



**USAGE REPORT OF “GUIDELINES FOR IRON
FORTIFICATION OF CEREAL FOOD STAPLES”**

*Based on Informal Survey of Private and Public Sector
Representatives*

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Summary

In May 2001, SUSTAIN published a set of “*Guidelines for Iron Fortification of Cereal Food Staples*”¹ to help program planners select and utilize iron fortificants in public health programs. The *Iron Guidelines* have been widely disseminated among international agencies, NGOs, donors and the private sector. A limited survey with respondents from public and private sectors working in North America, Europe, Central and Latin America, Africa and Asia indicates that the interim Iron Guidelines are being widely used. The following summarizes feedback from this survey.

The “*Iron Guidelines*” have been:

- Disseminated by UNICEF to its national country offices and included on a CD-ROM based training tool prepared by the U.S. Centers for Disease Control for public health officials worldwide
- Featured in international newsletters and on the websites of several international organizations concerned with nutrition. The document is reportedly one of the most popular on the Micronutrient Initiative’s website, with over 100 hits/downloads per month
- Consulted by organizations and governments worldwide in the development of iron fortification legislation, regional initiatives and recommendations for optimal fortificants
- Used by industry suppliers of fortificants in the development and refinement of premix specifications; and by planners working with local milling industries on iron fortification of their flours. Industries have expressed considerable appreciation for the “*Iron Guidelines*”, even on their interim basis, as a clear reference on a complex issue

Background

Elemental iron powders are the iron fortificants in widest use around the world today because they cause the fewest problems in food products and are relatively inexpensive. But research over the last 45 years has yielded highly variable results with respect to the bioavailability of elemental iron powders (from 5% to 145% bioavailability relative to ferrous sulfate, the standard against which most iron fortificants are compared). These vast discrepancies in bioavailability data undermine confidence in enrichment programs.

¹ SUSTAIN Task Force, May 2001. Guidelines for Iron Fortification of Cereal Food Staples. Nutriview 2001/3: 2-3, www.micronutrient.org, www.sustaintech.org

In September 2000, SUSTAIN convened a workshop in Monterrey, Mexico, to help resolve long-standing concerns about the bioavailability of elemental iron powders used in cereal fortification^{2,3}. Based in part on recommendations made at the workshop, SUSTAIN prepared a set of guidelines to help program planners to select and use iron fortificants. The *Iron Guidelines* reflect the consensus of public and private sector experts and are based on over fifty years experience with iron enrichment of cereals, and the best available knowledge on iron fortificants. They have been written with the goal of optimizing bioavailability, cost-effectiveness and consumer acceptance of the fortified product. While they represent the best information currently available, these guidelines should be considered interim and may change as more information becomes available.

The guidelines recommend the use of ferrous sulfate where possible, due to its relatively high bioavailability and low cost. When ferrous sulfate or other iron salts that are readily soluble in water or dilute acid cannot be used (due primarily to organoleptic problems), electrolytic iron is suggested as the best choice among elemental iron powders. Because electrolytic iron appears to be only about half as well absorbed as ferrous sulfate, twice as much is recommended per unit of product. Not enough is known about the bioavailability of the other elemental iron powders to offer specific recommendations. Foods with high levels of inhibitory factors (such as phytic acid or polyphenols) significantly reduce iron absorption, limiting the impact of fortification. In such cases, it may be necessary to add an iron-absorption enhancer to reduce the amount of inhibitor in the food. In planning a fortification strategy, the optimal level of iron fortification will depend on a number of factors, including the prevalence of iron deficiency in the population, the nature of the diet, the distribution of cereal foods, and the bioavailability of the added iron.

Iron Guidelines Dissemination

- **UNICEF Headquarters:** www.unicef.org

Copies of the *Iron Guidelines* have been distributed from UNICEF's New York office to all national UNICEF country offices to be utilized by the Nutrition or Health Program Officer.

- **U.S. Centers for Disease Control & Prevention (CDC):** www.cdc.gov

The *Iron Guidelines* will be included on a CD-ROM based training tool that the U.S. CDC is preparing for public health personnel and other interested parties. The CD-ROM will provide an overview of programmatic approaches to alleviate micronutrient malnutrition, as well as a library of resource materials.

- **Micronutrient Initiative:** www.micronutrient.org

Posted on the website of this international organization, which supports micronutrient nutrition programs worldwide, the *Iron Guidelines* have generated significant interest.

²Hurrell, R., Bothwell, T., Lynch, S., et al. The Usefulness of Elemental Iron for Cereal Flour Fortification: A SUSTAIN Task Force Report. (submitted for publication - 2001).

³ SUSTAIN Task Force, September 2000. Findings & Recommendations from Monterrey Workshop: Evaluating the Usefulness of Elemental Iron in Fortification, www.sustaintech.org.

According to MI's communication staff, "The document is one of the most popular on MI's website. It receives about 110-120 hits/downloads per month. It has been one of the top 15 downloaded documents on MI's website since the end of August 2001."

- **Nutriview:** www.nutrivit.org/vic/staple/index.htm

Featured in the 2001/3 issue of *Nutriview*, a quarterly newsletter on the role of micronutrients in nutrition and health, the *Iron Guidelines* were widely distributed in the United States, Europe, Asia, Africa and Latin America. *Nutriview* is published by Roche Vitamins Europe Ltd. as a service to health-care professionals and science communicators

- **Iron Deficiency Program Advisory Service (IDPAS):**
www.micronutrient.org/idpas/index.html

The Iron Deficiency Project Advisory Service (IDPAS) posted the Iron Guidelines on its website as well as distributed the document on CD-ROM to more than 800 professionals in the field. The IDPAS is a project of the International Nutrition Foundation and United Nations University, and is dedicated to supporting those working to improve iron nutrition in developing countries and countries in transition. The IDPAS Iron World web pages are located on the website of the Micronutrient Initiative.

- **Program Against Micronutrient Malnutrition:** www.sph.emory.edu/PAMM

Iron Guidelines are posted on the website of PAMM, at the Rollins School of Public Health of Emory University. PAMM is an organization dedicated to support national programs to eliminate micronutrient malnutrition.

Guidance for National/Regional Fortification Programs

- **South Africa: National Wheat Flour and Maize Meal Regulations**

Based on recommendations included in the *Iron Guidelines*, mandatory fortification regulations were amended by the South African Department of Health specifying that electrolytic iron be used as the iron fortificant.

- **Fiji: Proposed Flour Fortification Program in Fiji**

Premix specifications for national fortification trials in Fiji, as well as preliminary drafts for national mandatory wheat flour regulations have been based on recommendations from the *Iron Guidelines* with respect to electrolytic iron compounds, levels, mesh sizes and other characteristics.

- **WHO/EMRO (Eastern Mediterranean Regional Office):** www.who.int/regions/emro

WHO/EMRO amended regional guidelines for flour fortification to reflect the interim findings of the *Iron Guidelines*. WHO/EMRO currently recommends ferrous sulfate at 30ppm (mg of iron / kg of food vehicle) or electrolytic iron at 60ppm (mg of iron / kg of food vehicle). WHO/EMRO provides technical input for 13 countries ranging from North Africa to the Middle East and South Asia.

- **Pan American Health Organization (PAHO):** www.paho.org

In Latin America, flour fortification with elemental iron is widespread. Based in part on a review of the findings and recommendations from the Monterrey Workshop and the *Iron*

Guidelines, experts from PAHO, INCAP (Institute for Nutrition in Central America and Panama) and other Latin American organizations are preparing guidelines for selection of iron fortificants for optimal biological impact. The PAHO recommendations provide a customized regional application of the *Iron Guidelines*, as well as additional recommendations based on research conducted by INCAP.

- **Asian Development Bank (ADB)**

Two regional flour fortification initiatives of the Asian Development Bank, JAICA Fund for Poverty Reduction and a Regional Technical Assistance project, have specifically relied on the *Iron Guidelines* to clarify technical issues around selection of iron compound and level. These clarifications enabled parties to two recent regional consultations to issue clear consensus statements on flour fortification with iron, which specify iron levels and iron compounds. The fortification initiatives involve countries of Central Asia, South Asia, South East Asia and The People's Republic of China.

- **Indonesia: CIDA funded Flour Fortification**

Premix for the Indonesian National Flour Fortification Program is being supplied on an interim basis through the Canadian International Development Agency (CIDA). After discussions regarding specifications, the CIDA bids for premix relied on the *Iron Guidelines* for iron compound, level, mesh sizes and other product specifications.

- **Brazil Producer Guidelines**

In Brazil, during the development of the guidelines for iron fortification of corn and wheat flour, questions were raised whether mesh size of elemental iron fortificants was a significant concern. To help resolve this issue, the planners, working with Embrapa (the research arm of the Ministry of Agriculture in Brazil), turned to the *Iron Guidelines* for technical recommendations. According to an Embrapa official, "the Iron Guidelines, for sure, was used as the ultimate word in iron fortification, and was used to set the recommendation of the Manuals written for the corn and wheat milling industries, for iron fortification of their flours."

Views from Industry Suppliers of Fortificants

Even on an interim basis, premix suppliers appreciate a clear standard to communicate to their customers. "The report from SUSTAIN is very useful... Despite some still controversial issues, it is the only thing we have got. I think there is still a long way to go, but at least there is a document that has the necessary "clout." One supplier noted that "electrolytic iron is 25 to 30% costlier than other compounds but if the bio-availability is as reported 50 to 65% better [than other forms of elemental iron] then this becomes a good investment."

Premix companies are doing research and making changes needed to "comply" with the *Iron Guidelines* and are looking into supply issues. "We are now evaluating a supplier of electrolytic iron and plan to switch a portion of our business to this iron source." Company executives are researching technical and marketing implications of *the Iron Guidelines*. "We have confirmed that there is not enough of this material available to

come close to meeting our needs on a global scale (maybe 1/3) but there does appear to be enough to meet the needs of current projects.”

Conclusions & Next Steps

As a temporary measure, the *Iron Guidelines* have provided the basis for the selection of iron compound, level and other product characteristics in national fortification legislation and regulations as well as voluntary fortification guidelines worldwide. The *Iron Guidelines* have also served as dialogue and marketing tools, simplifying communication on iron fortification among governments and donors as well as food processors and premix suppliers. Finally, the *Iron Guidelines* offer a baseline of information from which to identify research needs.

To resolve unanswered questions about the bioavailability of elemental iron powders, SUSTAIN has launched a comprehensive evaluation of each of the iron powder fortificants in use today. Initially, each of the iron powders will be evaluated through a series of screening tests. The most promising iron powders will then be evaluated in a human trial to be carried out in mildly iron deficient volunteers. Results from the complete series of studies will be released as they are completed. Initial results from the screening studies will be available in 2002 and results from the human study are expected in 2003. The outcome from these studies will provide the basis for making more informed recommendations on the use of elemental iron powders in food fortification to reduce iron deficiency anemia. This work is being conducted with broad participation from industry and the scientific community.

The interim nature of the *Iron Guidelines* is recognized. Thus research and development is critical. According to one respondent to the survey, “the world is waiting for the results of the experiments by SUSTAIN.” Another volunteered that “I would truly like to see some real results pertaining [to] the bioavailability differences between the various iron sources. At this time it is extremely confusing for anyone in this business.”