Forging Effective Strategies to Combat Iron Deficiency

Panel Discussion: Regional Action Priorities1,2,3

Reynaldo Martorell4

Rollins School of Public Health, Emory University, Atlanta, GA 30322

ABSTRACT Action priorities for reducing iron deficiency vary across regions. Some regions have limited experience with national programs, such as in the republics of Central Asia, where the focus since independence has been on assessment, advocacy and scaling up of interventions. In more developed regions the priorities are improving established programs and addressing the needs of the remaining subpopulations with high rates of iron deficiency. The etiology of anemia, whether multi-factorial as in Sub-Saharan Africa or mostly due to iron deficiency as in the Middle East and North Africa, is an important factor shaping the choice of strategies. Some interventions are particularly feasible in some settings and are being promoted aggressively, such as flour fortification in Latin America and the Middle East and North Africa, or the fortification of condiments in Asia. The quality of the health infrastructure and resources in general also determine the mix and scale of interventions implemented. A lesson for all regions is that countries in North America and Europe, where diets are varied and abundant and infections nearly absent, generally support multiple strategies that include nutrition education, supplementation and fortification of a variety of staples consumed by toddlers and the general population. Monitoring and evaluation efforts have proven necessary for improving quality and for advocacy.


KEY WORDS: • iron deficiency • anemia • action priorities • policy

Six panelists, representing major, diverse regions of the world, discussed action priorities for combating iron deficiency. A major theme bought forth is that the characteristics of the region, including the epidemiology of iron deficiency as well as economic, political and environmental conditions, are powerful determinants of what can and should be done.

Africa

Background. Africa presents special challenges in the development of strategies to combat iron deficiency. The continent straddles the equator and has a vast range of climate, vegetation and economic development. Many of the world’s poorest countries are in Africa. In many countries, political instability seriously hampers advocacy programs and distorts national priorities.

Assessment. Information on the prevalence of iron deficiency in much of Africa is very patchy. Efforts to gather this information are frustrated by the high prevalence of inflammatory disorders and other non-nutritional causes of anemia. In addition, a lack of resources precludes the use of sophisticated diagnostic measurements. Virtually all of the information on anemia in African countries is derived from small studies usually involving single villages or small districts and simple methodology. Accepting the patchy nature of the data, there is evidence that anemia is more common in coastal regions, where the prevalence may reach 80%, and becomes less common in the interior and in countries further south (20–30%). This geographic variation probably reflects factors such as the prevalence of malaria and hookworm and socioeconomic factors. However, the fact that anemia is most common in preschool children and pregnant women suggests that iron deficiency remains a major underlying cause of anemia in Africa. Evidence from individual studies indicates that approximately one-half of the cases of anemia, even in pregnant women, can be attributed to iron deficiency. As the acquired immunodeficiency syndrome epidemic continues to gain momentum in Africa, particularly in southern Africa, the prevalence of anemia is likely to rise. Whether preexisting iron deficiency anemia affects the morbidity or pathogenesis of acquired immunodeficiency syndrome related anemia remains to be determined.

Strategies. In Africa, traditional strategies aimed at combating iron deficiency anemia (supplementation and fortification) are likely to have less impact on prevalence because of the multi-factorial etiology of anemia. A holistic approach is
needed with attention being given simultaneously to other micronutrients, particularly vitamin A, and to the control of diseases, such as human immunodeficiency virus infection, malaria and hookworm in appropriate areas. Dietary modification is unlikely to work on its own but should be attempted through effective communication and education. Supplementation should be targeted to vulnerable groups, but this option is limited by the poor development of health services. Fortification is a cost effective option in some settings, such as urban areas, but the logistics of implementation are difficult.

Poverty is a major contributing factor, and probably the most important factor, separating the iron replete developed world from the iron deficient developing world. For this reason, none of these strategies for addressing iron deficiency will be truly effective without the elimination of poverty. At the same time, it is likely that combating iron deficiency can, itself, assist in overcoming poverty. This effect should not be underestimated.

**Middle East**

**Background and assessment.** The Middle Eastern region, composed of 23 countries containing 455 million people, offers a unique opportunity for fortification. First, iron deficiency is a serious problem, with one-third to one-half of women and children suffering from anemia. Second, it is well-established that most of the anemia is due to iron deficiency. Third, the conditions for fortification are highly favorable. Wheat consumption is among the highest in the world, with an average of 150 kg per person per year. Flour production is mostly by large modern mills and delivery to urban (approximately one-half of the population) and most rural areas is efficient. Fourth, support for advocacy for fortification of flour has been facilitated by the widely recognized, successful experience with salt iodization.

**Strategies.** A 1995 regional consultation recognized the potential for flour fortification but also called for a multi-pronged strategy, including improved innovative supplementation programs, effective dietary approaches and appropriate public health measures. The World Health Organization, United Nations Children’s Fund and the Micronutrient Initiative (MI) held regional workshops in 1996 and 1998 to build partnerships for fortification with all key actors. This included Ministry of Health program managers, policy makers; regulatory/food control authorities, standard setters and quality controllers; academia, for the necessary research and development; and flour millers, the producers. These meetings confirmed the high feasibility of fortifying wheat flour, permitted the sharing of fortification experiences in the region, led to agreement on regional fortification levels, and resulted in regional and country action plans for flour fortification.

The MI established a $1 million fund in June 1999 in an effort to accelerate the implementation of the country plans. Proposals for funding were received from 12 countries and support is being provided for a variety of purposes, including the purchase of fortification hardware and of premix, development of fortification technology, testing fortified products after baking, baseline and impact assessments and advocacy efforts. Much progress has already been achieved. Two countries fortify their flour and one major importing country has decreed that all imported flour must be fortified. Eight countries are implementing flour fortification at the national level and are solving logistic bottlenecks in implementation. Three other countries are conducting pilot projects with fortification and eight others are poised to begin similar efforts.

Several critical issues and needs have been raised that require effective solutions:

- Although the basic decisions to fortify flour at a certain level of fortification is made by the Ministry of Health, the implementation and financing must be agreed to and carried out by other agencies. The question is how to ensure national consensus on iron deficiency and related anemia as a major public health issue needing fortification as a strategy in sectors outside the health sector.
- In most countries of the region, flour is considered a strategic commodity and the price of bread is a very political issue. The cost of fortification, even if <1% of the retail price, is difficult to pass on to consumers. The issue is how to deal with the cost issue under these circumstances.
- How to foster consumer demand of fortified flour?
- How to develop channels to advocate fortification directly to the private sector in countries where this sector is an important actor?
- How to ensure sustainability of flour fortification?
- How to develop regional standards for flour fortification to facilitate trade?
- How to establish quality assurance and control, and how to imbed these in the existing structures?
- How to deal with changes in governments?

Several actions are being taken or are planned to address the above-mentioned issues. A communication component is in place to create demand by the public; a regional logo, a seal of quality and other measures are being developed. Continued dialogue between program managers and milling associations is being facilitated to strengthen the private/public partnership. Mechanisms are being developed for the procurement of premix, which should enhance sustainability. The establishment of quality assurance/control is being addressed in consort with both millers and food control authorities and relevant training manuals are being developed. The capacity to monitor and evaluate programs is being addressed through workshops, the development of training tools and through technical assistance.

**Asia**

**Background.** Asia is a huge, diverse region and efforts to combat iron deficiency and anemia have to be tailored to varying conditions across countries. Examples of innovative strategies being pursued in the region include multiple micro-nutrient supplementation; fortification of flours, complementary foods and condiments; and plant breeding.

**Strategies.** Multiple micronutrient supplement trials are being carried out in Bangladesh and Indonesia and results should be available soon assessing the effectiveness of these multiple supplements on anemia prevention and control when compared to iron alone.

The widespread use of condiments in Asia presents an opportunity for fortification. Two experiences are particularly promising. Research in Vietnam has demonstrated that fish sauce fortified with NaFeEDTA is efficacious in improving hemoglobin levels of women of reproductive age. Soy sauce, similarly fortified, has also proven to be efficacious in improving hemoglobin status in school children. Future steps are to scale up to national level and to expand into other countries where similar condiments are consumed. Regulations and standards need to be developed, production of fortified prod-
ucts needs to be undertaken and launched to market, and the demand for such products needs to be created through promotional and educational efforts.

A regional partnership for fortifying staples is in development with strong support from the Asian Development Bank and in collaboration with governments, the International Life Sciences Institute (ILSI), MI and bilateral and multilateral organizations. Six themes support the creation of market-based solutions: strengthening the public sector’s role as regulator and enabler, developing and disseminating fortification technology, creating a demand for fortified foods on the part of the poor, increasing the availability of affordable, fortified complementary foods, supporting public policies that promote competitiveness and lower the price of fortified foods, and creating country investment plans in support of market-based solutions that have defined public and private roles. Efforts to improve regional dialogue are also being undertaken. Recent examples include a workshop on flour and cooking oil fortification held in Singapore, a meeting held in Thailand on food regulation, trade and surveillance and a forthcoming investor’s roundtable to support implementation at the country level.

The Asian Development Bank has collaborated with the International Rice Research Institute and the International Food Policy Research Institute in exploring the potential for breeding rice varieties richer in iron and zinc. This work is also being extended to other grains and to beans. Iron-rich germplasm has been identified, cultivated and tested in rats with promising results. Future steps include testing bioavailability and impact on iron status in humans, disseminating promising varieties throughout the region, testing consumer acceptability, and economic research for breeding iron-rich rice varieties, particularly concerning feasibility and cost effectiveness.

In summary, considerable efforts are being undertaken to combat iron deficiency and anemia using proven as well as promising strategies. It remains uncertain how these efforts can best be coordinated, results validated, and potential expansion into programs positioned within the donor community in key Asian countries.

Europe and North America: The United States as a case study

Background and assessment. In industrialized European and North American countries with strong economies, diverse diets and low infection rates, iron deficiency is now uncommon among men but remains the most common known form of nutritional deficiency among infants, young children and women of childbearing age. In the United States, significant reductions in the prevalence of iron deficiency and anemia among infants and young children occurred over the last three decades, likely related to improvements in iron nutrition with the Supplemental Nutrition Program for Women, Infants and Children (WIC). Among low-income American children, for example, the prevalence of iron deficiency declined from 21% in 1976–1980 to 13% in 1988–1994. In contrast, among non-pregnant women of childbearing age the prevalence of iron deficiency did not decline from 1976–1980 to 1988–1994. The prevalence of anemia among low-income pregnant women in their third trimester has remained close to 30% since 1979. The prevalence of iron deficiency is highest among Mexican Americans, more than two times as high as among non-Hispanic white Americans.

Strategies. The two main strategies to prevent iron deficiency include primary prevention through increasing iron intake and secondary prevention through screening and treatment with iron supplements.

In infants and young children in the United States, the major approach to increasing iron intake is the promotion of breastfeeding, iron fortified formula when not breastfeeding, and the consumption of age-appropriate iron containing and enhancing foods at weaning and beyond. From 1971 to 1991, the proportion of infants fed with cow’s milk or with unfortified formula at 6 mo of age declined, whereas the proportion of infants’ breastfed or fed with iron-fortified infant formula increased from 13% to 84%. This change in patterns of milk intake is likely a factor in the decline in iron deficiency in this age group.

In women of reproductive age, the major approach to increasing iron intake is promotion of iron containing foods, including iron enriched and iron fortified foods, and iron supplementation during pregnancy. Data are limited on consumption of iron from supplements during pregnancy. Data are also limited on the health effects of iron fortification for women of reproductive age. Beginning in the 1940s, the United States set enrichment standards to restore the iron in wheat flour to the same level as whole wheat in an effort to improve the nutritional quality of the food supply and the nutritional status of the population. Currently, the United States requires iron fortification of cereal grain products labeled as enriched with standards of identity. Canada requires iron fortification of flour, enriched pasta, cornmeal, and rice, for the purpose of restoration, and also permits fortification of breakfast cereals. From 1977 to 1978, enrichment and fortification of grain products in the United States provided 19% of the total dietary intake of iron for people 2 y of age and older and 15% of the total dietary intake of iron for women 23 to 50 y of age. More recent estimates are unavailable. Changes in consumption and fortification may have changed the contribution of enriched and fortified products to iron intake over time. From 1977 to 1978 and from 1994 to 1995, for example, the average daily amount of grain products consumed by U. S. women 20 y of age and older increased by 44%. Total meat, poultry and fish consumption remained about the same, but the average amount of beef consumed declined by more than one-half. The quantity of iron intake has changed little over this period, but the bioavailability may have decreased due to changes in dietary patterns.

Iron overload. Concerns about the effects of excess iron for people with hemochromatosis have led some European countries to eliminate iron fortification or to recommend selective iron supplementation during pregnancy. Hemochromatosis, the most common cause of iron overload, occurs in 0.2% to 0.5% of people of Northern European descent. Prevention of the clinical manifestations of hemochromatosis involves early case detection and phlebotomy.

The evidence that iron fortification of foods leads to rapid iron overload in susceptible individuals is limited mainly to absorption studies and theoretical modeling. The exception is a recent study in Sweden that suggested that the withdrawal of iron fortification (the highest in the world) from flour in 1995 resulted in an average reduction in the amount of iron absorbed of 0.7 mg/d in 16 men with hemochromatosis. The interval between phlebotomy was also extended by an average of 10 d. Iron overload is clearly a concern but this involves only a small portion of the population.

Without fortification, the gains made in controlling iron deficiency among women of reproductive age may be eroded. In Sweden, the level of iron fortification of flour was increased from 30 mg/kg in 1943 to 50 mg/kg in 1963 and 65 mg/kg in 1970. A population study indicated that from 1963 to 1964,
25–30% of women of reproductive age were anemic primarily due to iron deficiency. Later population studies in the same area from 1968 to 1969 and 1974 to 1975 indicated that 5–7% of women were anemic. An analysis suggested that at least 25% of the decline (7–8 percentage points) was attributed to iron fortification. The remainder was attributed to greater prescription of iron tablets, use of ascorbic acid supplements, and use of oral contraceptive pills, highlighting the need for multiple strategies to prevent iron deficiency.

**Action priorities.** Action priorities for industrialized countries in Europe and North America include monitoring the prevalence of iron deficiency among women of reproductive age with changes in iron enrichment and fortification. Action priorities to prevent iron deficiency in the United States include continuing to promote adequate iron intake among infants, young children, and females of childbearing age. In the United States, a national health objective for the year 2010 is to reduce the ethnic and income disparities in the prevalence of iron deficiency. Participation of low-income women and children in WIC has increased since 1985 but could be expanded with additional funds. New approaches, including better screening and treatment, iron supplementation or targeted fortification of foods, may be warranted for population subgroups with high rates of iron deficiency. Finally, the lack of improvement in the prevalence of iron deficiency and anemia among women of childbearing age requires further investigation and action.

**Latin America**

**Background.** Most Latin American countries are already fortifying wheat flour, corn flour, or both with iron and often other nutrients. In addition, several countries are also producing and promoting the consumption of enriched foods targeted to specific population groups. This includes fortified complementary foods for young children (milk or cereal based) and fortificated drinks and biscuits for school children. Progress in fortification can be accelerated because of a series of favorable conditions: well-developed industry, available laboratory facilities, qualified personnel, urbanization accompanied by availability and consumer demand for processed foods, motivated industrial and health sectors, and appropriate legislation.

**Strategies.** Although the conditions for successful iron fortification programs are at hand, specific problems still prevail. First, arbitrary criteria have often been adopted in selecting the iron compounds to use and in setting fortification levels. Second, fortification programs lack quality assurance systems, and countries have not implemented monitoring and surveillance systems. Without such systems, target populations cannot be identified and counted, use of fortified products known or effectiveness measured. Third, communication strategies have not been used to promote fortified products. Fourth, legislation has not been updated in accordance with needed changes.

In light of these problems, we propose a set of actions to be implemented at regional and country levels. These actions should be adapted to each country taking into account the level of consumption of the food vehicle to be fortified, the type of iron compound to be used, climatic conditions, and technological capacity. In addition, legislation and regulations should be reviewed and updated to ensure that fortified products will have an impact in reducing iron deficiency anemia. These actions should be promoted through partnerships, involving private and public sectors, consumers, research institutions and the international community.

At the regional level, networks should be put into place for exchanging experiences related to the different stages of program implementation. In addition, training workshops should be implemented to standardize methodologies and procedures and to harmonize regulations taking into account the globalization of industrialized products. These networks should also be channels for promoting voluntary fortification of other food products.

**The Central Asian Republics and Kazakhstan**

**Background.** The Central Asian region includes several countries that gained independence after the breakup of the Soviet Union: Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan. These countries began with a limited knowledge of national health problems and an equally poor capacity to address them. Anemia is an example. In Kazakhstan, two Demographic Health Surveys, both nationally representative, showed that anemia affected over 50% of women and young children. Other countries are likely to have similarly high levels of anemia. None of the countries of the region, until recently, had national programs for dealing with this important nutritional deficiency.

**Strategies.** The efforts to deal with anemia prevention and control can be divided into three phases. The first, lasting from 1995 to 1997, was primarily one of research and advocacy. The second phase, from 1998 to 1999, saw the development of key interventions at the provincial level, namely nutrition education and weekly supplementation of all women of reproductive age, all pregnant women and all children 6 to 24 mo of age. Also, during the second phase, the groundwork for wheat flour fortification, including advocacy and research, was begun. The third phase, from 2001 to 2010, is anticipated to lead to the establishment of a national program of supplementation, universal fortification of wheat flour and the functioning of ongoing monitoring and evaluation systems to improve program functioning in all countries.

The fortification of flour with iron and other micronutrients will rely on nationally owned and nationally sustainable models. Close collaboration with millers is planned and a single fortificant mix formula will be used in the region, with possible production at the regional level. Tax incentives for producers of fortified products are anticipated.

Turkmenistan began flour fortification in 2000 and Kazakhstan, the Kyrgyz Republic and Tajikistan now have the regulations in place to begin flour fortification. The Asian Development Bank has a new grant of $6 million to support universal iodization of salt and fortification of wheat flour in the region and in Mongolia.