



# MAKING GAINS

IN  
NUTRITION  
AND  
HEALTH



## Micronutrients LEAD THE WAY

A piece of mango rich in vitamin A, some iron-fortified bread, a sprinkling of iodized salt—it doesn't take much to give a child the essential nutrients he or she needs every day for healthy development and growth.

Yet, millions of children in developing countries lack these crucial micronutrients in their diet and suffer increased disability, illness, and even death as a result. Nearly one-third of the world's population is deficient in micronutrients with enormous implications for their own future, not to mention that of their communities and societies.

Relatively inexpensive and easy to supply through supplements and foods, micronutrients promise huge benefits in health and nutrition—if government, NGOs, donors, and others commit to reducing micronutrient deficiencies.

# Micronutrients Save Lives and Strengthen Societies

## Three Key Nutrients

**VITAMIN A** is important to a healthy immune system, vision, and reproduction. Vitamin A is found naturally in meat, breast milk, dairy products, eggs, and some fruits and vegetables.

**IRON** is important in blood cell formation and functioning and, therefore, to work productivity and mental development. Iron is found in red meat and breast milk, and, in a less easily absorbed form, in grains, legumes, and vegetables.

**IODINE** is important to the formation of thyroid hormones and mental development. Iodine is found naturally in some soils and in seawater. People consume it in seafood, crops grown in iodine-rich soils, and, most commonly, in iodized salt.

## How Deficiencies Impact Children and Mothers

Micronutrient deficiencies are most devastating for young children but also affect mothers in their child-bearing years:

**VITAMIN A:** Six of ten preschool children with severe vitamin A deficiency die, particularly from common childhood infectious illnesses.

**IRON:** Severe iron deficiency causes as many as one in five maternal deaths. Anemic mothers produce sickly children with low birth weight. Less severe deficiency in children harms mental development and learning capacity.

**IODINE:** Iodine deficiency increases fetal deaths and stillbirths, retards neurological development, and lowers mental performance.

## What Are Micronutrients?

Micronutrients are *vitamins and minerals* that all humans need to maintain strong bodies and mental sharpness, fight off disease, and bear healthy children.

## Why Are Micronutrients Important in the Developing World?

Micronutrients play a lifesaving role in developing countries, as well as affecting people's quality of life. Three of them—vitamin A, iron, and iodine—have been shown to profoundly affect child survival, women's health, educational achievement, adult productivity, and overall resistance to illness.

## Why Do People Lack Micronutrients?

Only certain foods contain significant amounts of micronutrients. People may have enough to eat, but still not consume enough micronutrients. Doing so depends on the availability and accessibility of nutrient-rich foods and the dietary practices related to their preparation and consumption. In addition, infections and parasites can lower levels of micronutrients in the body.

## How Serious Is the Problem in the Developing World?

**VITAMIN A.** According to WHO, about 250 million children under five years of age were suffering from vitamin A deficiency worldwide prior to the significant supplementation efforts now under way. Most children affected are in south/southeast Asia; there are many in Africa, the western Pacific, and Latin America, as well.

**IRON.** Recent estimates indicate that iron deficiency and anemia afflict more than 3.5 billion people in the developing world. Preschool children and pregnant women suffer high rates of anemia in sub-Saharan Africa, southeast Asia, the eastern Mediterranean, and some areas of Latin America.

**IODINE.** Iodine deficiency is a public health problem in nearly every country of Africa and southeast Asia, the eastern Mediterranean, and more than half the countries in Europe and in the Americas.

## How Do Micronutrient Programs Support Social and Economic Development?

When people are well nourished, healthy, and productive, they can take better advantage of education, health, and economic opportunities. A well-designed micronutrient program, therefore, contributes to social and economic development.

Government officials in developing countries may hesitate to invest in programs addressing poverty-related malnutrition because of their belief that only the alleviation of poverty will result, automatically, in a reduction of that malnutrition. Experience suggests, however, that the alleviation of poverty is many years away in much of the developing world. Despite persisting poverty, enormous strides can be made toward eliminating malnutrition through well-targeted public health interventions. And, experience suggests micronutrient programs can be an attractive first step toward developing the confidence of government officials that advancements in curbing malnutrition can be made even in the presence of poverty.

## How Do These Programs Deliver Micronutrients?

For immediate impact, micronutrient *supplements* are effective in preventing and treating deficiencies. Two food-based strategies—*diversifying diets* and *fortification of certain commonly consumed foods*—increase the amount of micronutrients that people get each day. A mix of supplementation and fortification can dramatically improve health for less than a dollar per person per year and reduce the costs of illness to families, communities, and nations.

# Taking Action on Micronutrients



In many developing countries, half or more of the population do not get enough micronutrients, particularly vitamin A, iron, and iodine. Low-income families and children are at the greatest risk.

## Confirming That a Micronutrient Problem Exists

Population-based surveys may provide evidence of the magnitude and severity of micronutrient deficiency in a country. The technology exists to determine the extent of deficiencies from biological measures or from information collected about what people are eating.

The most frequently used indicators of micronutrient deficiency as a public health problem are:

### VITAMIN A DEFICIENCY

- More than 10 percent of children six months to five years of age have low levels of vitamin A in their blood (less than 20  $\mu\text{g}/\text{dl}$  plasma).
- Dietary intake of vitamin A is less than 50 percent of the recommended level among 75 percent of children under six years of age.
- In the absence of biochemical or dietary information, a mortality rate for children under five that is greater than 100 per 1,000 individuals indicates that a vitamin A deficiency problem is likely.

### IRON DEFICIENCY

- Anemia in more than 20 percent of women or children indicates a significant health problem.

### IODINE DEFICIENCY

- Urinary iodine excretion of less than 100  $\mu\text{g}/\text{l}$  in 50 percent of schoolchildren indicates a significant iodine deficiency in the population.
- Goiter prevalence in schoolchildren greater than 5 percent indicates a severe iodine deficiency problem.

## Research Shows. . .

Vitamin A supplementation has been shown to reduce child deaths by at least 23 percent because it strengthens immune systems, lowering the risk of children dying from common infections, especially from measles and diarrhea.

Studies in India, Thailand, and Indonesia show that iron supplementation of iron-deficient children can lead to dramatic improvements in mental and motor skills.

Iodized salt contributes to improved mental development and learning capacity, reduced school failure rates, and increased productivity.

## Taking Steps toward Micronutrient Health

Among the first steps in addressing micronutrient deficiency in a country is to raise awareness and rally support among health and nutrition experts, national and local governments, NGOs, civic organizations, and the private sector. Then, identify and sensitize any government ministry or cross-sectoral body that is already active in health and nutrition in the country. In many countries, it has proven extremely useful to form a national task force representing all stakeholders in a micronutrient program. The process involves the following steps:

- Establish the magnitude of the problem.
- Identify approaches already used successfully in the country to reduce micronutrient deficiencies and look to other countries for new ideas and models.
- Develop the best mix of supplementation and food-based approaches, taking advantage of existing programs and policies, such as national immunization days.
- If needed, seek national and international technical and financial support. Sources include local governments, domestic or international agencies/donors (e.g., UNICEF, WHO, the World Bank), specific bilateral government aid programs (e.g., USAID missions, the Canadian International Development Agency, the Nordic Development Fund, Department for International Development, and programs in Belgium, Denmark, and the Netherlands), NGOs, and PVOs.
- Establish a system for monitoring and improving the performance of the program as it is implemented.

# Options for Improving Micronutrient Health

## Determine the Best Approaches

Each country is unique, with its own history, culture, and social organization. Micronutrient programs should be customized to this context. They should ideally represent a mix of supplementation and food-based interventions, coupled with public health measures to reduce infections. They should also be consistent with national policies and integrated into existing nutrition and health programs.

## Safety of Vitamin A Supplements

Vitamin A supplements have been shown to be safe and effective. Side effects in children rarely occur and are short term and mild if they do occur. For example, a temporary rash or redness may develop with excessive intake of vitamin A but this would dissipate with disuse. Age-appropriate doses are completely safe for children when given at least a month apart. Safe low doses have been established for pregnant women, while a high dose is safe during the eight weeks immediately following childbirth.

## SUPPLEMENTATION

Vitamin A supplementation entails distributing high doses of the vitamin twice a year to children aged 6–60 months and once to women immediately after childbirth. Vitamin A supplements are also recommended for treating children whose eyes show signs of severe deficiency or who have measles, severe malnutrition, or prolonged diarrhea.

High-dose supplements rapidly replenish body stores of vitamin A that last for several months and temporarily correct deficiency. The supplement itself costs only about US\$0.02 per dose. Adding the costs of logistics and distribution raises the cost of two doses per person per year to approximately \$0.50.

Universal vitamin A supplementation for preschool children has been widely implemented. High coverage (at least 80 percent) should be maintained until food-based interventions are in place. Even so, targeted supplementation may continue to protect high-risk groups not sufficiently covered by other interventions, for example, children 6–24 months of age.

## FOOD-BASED APPROACHES

*Fortification* involves adding specific micronutrients to processed staple foods, such as vitamin A to sugar and margarine, iron and B vitamins to wheat and corn flour, and iodine to salt. Successful food fortification requires appropriate regulatory instruments, effective public-private partnerships, and a functioning quality assurance and monitoring system. The United States has been fortifying its milk with vitamins A and D since the 1930s.

Fortification of foods can greatly contribute to reducing micronutrient deficiencies because it is generally socially acceptable, may not require changes in food habits, and can be introduced quickly.

The cost of fortifying foods is relatively small (usually 0.5 to 2 percent of the product's retail price) and can be passed on to the consumer. Government usually pays for inspection, monitoring, and surveillance, or about 3 percent of the total cost of a fortification program. This makes fortification an attractive option for developing countries, compared with other interventions that are more costly to the public sector.

Experiments now under way to test the efficacy and commercial viability of a micronutrient additive to be sprinkled on prepared foods at home may lead to an attractive alternative to the more traditional fortification of centrally processed staple foods.

*Dietary diversification* involves increasing production and availability of foods rich in micronutrients, promoting food production and consumption at the community level (e.g., through home gardening programs), and encouraging a diet diversified to include natural and fortified micronutrient-rich foods.

Key to this strategy is changing people's dietary choices and practices. Program planners need to choose the most feasible and acceptable behaviors to promote, overcome identified barriers to new ideas, and support positive practices. The new practices can be disseminated and popularized through national campaigns, the media, and community workers, mothers' groups, extension agents, religious leaders, and teachers.

Often used to address general nutrition problems, dietary diversification can improve household food security and the overall quality of the diet, as well as address multiple nutrient deficiencies. Although few examples exist of its use for micronutrient deficiencies, it remains a potentially effective approach to address the problem.





## Learn from Others . . .

A wealth of experience on micronutrient programs has been gained in the past few decades. Developing countries can benefit from the lessons learned as they develop their own programs.

### ON VITAMIN A . . .

#### **Community Participation Aids Distribution of Vitamin A Supplements to Remote Areas.**

This has been demonstrated in Nepal, which has one of the most difficult environments for development activities: poverty is widespread and indicators on infant, child, and maternal mortality are among the worst in the world. Much of the population lives in remote areas with difficult terrain. USAID helped the Government of Nepal set up a cost-effective program of routine vitamin A supplementation using an indigenous network of volunteers.

In 1993, in an innovative partnership with USAID, collaborating agencies, and the Nepal Technical Assistance Group (a local NGO), the government set up a distribution system using female community health volunteers, who were supported and trained by the NGO. The program has reached 86 percent of targeted children in 64 of 75 districts. In 1995, after covering 23 districts, USAID estimated that 18,000 child deaths a year had been averted. By the end of 2002, the program will cover all 75 districts.

#### **Distributing Vitamin A at National Immunization Days Can Reach Large Numbers of Young Children.**

At 320 deaths per 1,000 live births, Niger has the highest documented rate of child mortality in the world. Improving levels of vitamin A in children could save more than 23,000 lives a year. Yet, 68 percent of the population live farther than 5 kilometers from a fixed health facility, too distant to be used for universal distribution or supplements.

National immunization days for polio eradication, however, are highly visible events and provide an opportunity to supplement many children with vitamin A at one time. USAID successfully integrated distribution of vitamin A capsules into national immunization days in Niger. The 1997 National Immunization Day, which distributed vitamin A capsules to children 6–59 months old, was estimated to have reached more than 90 percent of all children in the country.

The feasibility of combining vitamin A supplementation with national immunization days has been demonstrated in other coun-

tries as well. In Zambia, vitamin A was distributed during national immunization days, and, six months later, during a national child health promotion week. As a result, coverage of children under six years old was increased from 28 to 80 percent. Comparable improvements occurred in the Philippines, Bangladesh, and Mali using similar approaches.

#### **Health Rallies Prove Useful in Supplementing High Numbers of People with Vitamin A.**

In Nicaragua, since 1994 twice-a-year national comprehensive health rallies have distributed vitamin A and iron supplements, usually reaching more than 75 percent of the nation's children. These multi-day events provide a battery of preventive health services to the population, including immunizations, de-worming, family planning, and health and nutrition education. Nicaragua's decentralized health system, in which health districts have major responsibility for planning and implementing the rallies, has facilitated the supplementation. Local community participation has also been critical.

An important advantage of using health rallies for supplementation is that they provide twice-yearly contacts with children older than one year of age, who are difficult to reach through immunization programs. When effective and universal sugar fortification eventually becomes established, only those population groups not covered sufficiently by fortification will need to be targeted for vitamin A supplements.

#### **Sugar Fortification Can Contribute Significantly to Reducing Vitamin A Deficiency in a Country.**

The effectiveness of sugar fortification as an intervention to reduce vitamin A deficiency and enhance child survival was demonstrated in Guatemala in the mid-1970s. The Institute of Nutrition of Central America and Panama (INCAP), with significant support from USAID, advocated for sugar fortification by developing appropriate technology, promoting legislation, and assisting policy and program development and implementation in the region. Sugar fortification is now universal in El Salvador, Guatemala, Honduras, and Nicaragua, three of which have documented a dramatic reduction in vitamin A deficiency in children. In Honduras alone, the baseline prevalence of 40 percent deficiency dropped to 14 percent in children under five with fortification of sugar. Guatemala has served as a model for fortification in other countries in Central America and around the world.

## **Analyses Help Determine the Most Cost-Effective Mix of Interventions in a Country.**

Cost-effectiveness analyses help to determine the best use of scarce resources in developing countries. USAID supported economic analysis of vitamin A interventions in the Philippines and Guatemala to discover the most cost-effective mix of supplementation and food-based programs.

**Philippines.** Food fortification was found to be more than twice as cost-effective as the national vitamin A supplementation program in increasing adequate intake of vitamin A. Complementing food fortification with targeted supplementation programs in the poorest rural areas will reduce total vitamin A program costs, while providing an optimum mix of interventions for the country.

**Guatemala.** The fortification of sugar with vitamin A was shown to be the most cost-effective approach when compared to both supplementation through capsules and food production/education programs. The analysis, however, did conclude that in geographic locations where sugar is not consumed and vitamin A deficiency is highly prevalent, targeted supplementation improves overall cost-effectiveness rather than relying on fortification alone.

ON IRON . . .

## **Multifaceted Micronutrient Programs Have Been Found Effective in Channeling Supplements to Populations at Risk.**

In Indonesia, where more than half of pregnant women suffer from anemia, the Ministry of Health and USAID's MotherCare project combined social marketing, training of midwives, and sensitization of community leaders to (a) raise families' awareness of anemia as a problem, (b) increase demand for iron supplements, and (c) expand the distribution and availability of low-cost iron supplements at the community level.

Results have been modest, but encouraging. The percentage of pregnant women taking any iron pills during pregnancy increased from 65 to 73 percent during 1996–99, and the percentage in their third trimester who consumed at least sixty iron supplements doubled from 15 to 30 percent. South Kalimantan experienced no increase in

maternal anemia, despite the hardship imposed by the 1997 economic crisis and increased prices for the supplements.

## **Approaching a Region as a Whole Can Be Effective in Promoting Food Fortification.**

USAID has been a key player in promoting the fortification of wheat flour in Latin America. Enriching wheat flour with iron and B vitamins began in the 1960s in a number of Latin American countries and, in the 1990s, several countries modified their legislation to increase the levels of iron added to flour.

To a large extent, this resulted from concerted advocacy by international agencies at regional and local meetings, including those of the Latin American Millers Association (ALIM). As a result, wheat flour fortification was established in the region during the 1990s. Currently, at least eighteen countries in the region are fortifying wheat flour with iron and B vitamins. At the 1997 ALIM annual meeting in Lima, Peru, ALIM members committed to fortify wheat flour whether or not governments require it.

ON IODINE . . .

## **Government Commitment and Support to Salt Producers Moves Iodization Forward.**

In the mid-1990s, an estimated 82 percent of Eritrea's school-aged children suffered from iodine deficiency. In December 1996, with USAID and UNICEF support, two major salt plants began to iodize salt. USAID then supported installation of a monitoring system, an education program for consumers on iodized salt, and adequate quality control of salt iodization. USAID also worked with Eritrea's small salt producers to improve the quality of iodized salt destined for the lower end of the market. In 1998 the Eritrean Parliament passed legislation requiring all salt producers to iodize salt with the goal of eliminating iodine deficiency by 2000. High-level government commitment and support to salt producers was key to turning the situation around. Eritrea has provided a model for salt iodization programs elsewhere.

Universal salt iodization in Eritrea has had an impact on iodine deficiency far beyond its borders. Tanzania and Uganda import substantial amounts of their salt from Eritrea, and Eritrea's salt is marketed throughout Africa and the Middle East.



## **The Benefits of Harmonizing Standards for Fortification at the Regional Level**

In 1996–98, USAID supported the Central American Regional Micronutrient Initiative (CARMi), a concerted effort with the Institute of Nutrition of Central America and Panama (INCAP), to harmonize technical specifications for fortifying sugar with vitamin A, wheat flour with iron and B vitamins, and salt with iodine. The initiative succeeded in strengthening existing public and private sector partnerships and reached consensus on harmonizing regulations in the region for mandatory fortification of these commercially processed food staples, including universal labeling. Fortification of these foods is now well established throughout Central America.

## USAID Addresses Micronutrient Deficiencies

The 1990 World Summit Goals for Children endorsed by world leaders targeted the year 2000 to eliminate vitamin A and iodine deficiency and to achieve a one-third reduction in the numbers of women with iron deficiency anemia. In the past few decades, USAID has played a lead role in working toward these goals.

USAID has promoted and funded most of the basic and applied research on vitamin A that has demonstrated its role in child survival. USAID has also implemented a series of field-based programs to improve the micronutrient status of populations at risk throughout the world as a key element of its child and maternal health programs. In addition, USAID has promoted global consensus for micronutrients through cooperative agreements and management of the International Vitamin A Consultative Group (IVACG) and International Nutritional Anemia Consultative Group (INACG).

In 1999, USAID launched the Global Vitamin A Alliance, an enhanced effort to reduce vitamin A deficiency that is based on a multisectoral alliance among donors, the private sector, NGOs, PVOs, and civic organizations. Building on the combined efforts and expertise of its members, the Alliance is forging public-private partnerships to augment supplementation, fortification, and other food-based approaches for the elimination of vitamin A deficiency.



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# WHAT DOES THE Future HOLD?

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Efforts to improve levels of micronutrients in populations at risk in developing countries continue to evolve. Some major developments envisaged for the future include the following:

## **New Approaches to Vitamin A Supplementation**

In the next five to ten years as national immunization days are being phased out in many developing countries, other ways to reach high numbers of people with vitamin A supplements must be found. An alternative of choice is to set up health or child survival days or weeks, or comprehensive health rallies. This will entail periodic, routine, and institutionalized distribution of vitamin A capsules by local health services and communities.

## **Transition from Universal to Targeted Supplementation**

So far, capsule supplementation has been greatly emphasized as a key intervention to reducing vitamin A deficiency; relatively fewer efforts have been made to foster food-based approaches. A transition from universal to targeted supplementation is foreseen, as countries establish effective food-based approaches to address vitamin A deficiency, particularly food fortification. Prevention and control of iron deficiency anemia will continue to rely on improved, more-effective universal iron/folate supplementation to pregnant women and young children, as well as on iron fortification programs.

## **Addressing Multiple Micronutrient Deficiencies**

The international community and local governments have become increasingly aware that populations deficient in one vitamin or mineral are usually deficient in other micronutrients, too. Rather than approaching each micronutrient independently, governments, agencies, and others are expected in the future to document and address such multiple micronutrient deficiencies using more comprehensive strategies.

## **Increased Emphasis on Controlling Anemia**

As more is learned on effective approaches to addressing the multiple causes of anemia—especially iron deficiency anemia—programs controlling anemia are likely to gain increased priority on both international and governments' agendas.

## **Higher Priority for Monitoring and Evaluation Systems**

Substantial efforts and investments have been made in addressing micronutrient deficiencies in a number of countries, yet limited information exists on program performance and the ultimate biological impact on people. Documenting program effectiveness will be critical to maintaining the political commitment needed for these programs. Development of functional systems to monitor and evaluate programs and surveillance systems to track micronutrient problems are likely to receive high priority in the near future.

## **FOR MORE INFORMATION**

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### **WEB SITES:**

<http://www.mostproject.org>  
[http://www.info.usaid.gov/pop\\_health/cs/csvita.htm](http://www.info.usaid.gov/pop_health/cs/csvita.htm)  
<http://www.micronutrient.org>

### **CONTACTS:**

Roy Miller, Executive Project Director, MOST International Science and Technology Institute, Inc.  
1820 North Fort Myer Drive, Suite 600  
Arlington, VA 22209-1802  
Telephone: 703-807-0236  
Fax: 703-807-0278  
E-mail: [most@istiinc.com](mailto:most@istiinc.com)

Frances R. Davidson  
USAID Office of Health and Nutrition  
USAID/G/PHN//HN/CS  
3.07-O4OU, 3rd Floor, RRB  
Washington, DC 20523-3700  
Telephone: 202-712-0982  
Fax: 202-216-3702  
E-mail: [fdavidson@usaid.gov](mailto:fdavidson@usaid.gov)