ALLEVIATING

Hidden Hunger

Approaches that work

by Eileen Kennedy, Venkatesh Mannar & Venkatesh Iyengar

Despite abundant global food supplies, widespread malnutrition persists in many developing countries. Micronutrient malnutrition is particularly damaging but it can, with relative ease, be eradicated.

The world has come a long way in understanding the nature, magnitude and range of solutions to micronutrient malnutrition – often called "hidden hunger". The most sustainable solutions – that is those that are likely to be maintained in the long term – almost surely will include food-based approaches including diet diversity, food fortification and biofortification. Food fortification and biofortification could be some of the most cost-effective of all public health interventions and thus within the economic reach of even the world's poorest. In order to implement them in a sustainable manner, a combination of technical, operational, economic, behavioural and political factors need to be addressed. In some ways the technological issues are the easiest. Because of attention to research, we now have a variety of ways for both single and multiple micronutrients to reach the target population. We also know what is needed in order to ensure delivery systems. The key factor for continued success in reducing micronutrient malnutrition through fortification is a political commitment at the national and international level and creating effective public-private partnerships at the national level. The payoff for eliminating hidden hunger through nutrient fortification is enormous and few other public health interventions offer such a promising health, nutrition and economic success story.

Nuclear and isotopic techniques are valuable tools in helping to meet the multifaceted challenges posed by nutritional disorders affecting the entire human life span (embryonic to elderly). Among the numerous applications available, isotopic techniques are uniquely well suited for targeting and tracking progress in food and nutrition development programmes *(See box: How Nutrients are Tracked)*. These include: use of the stable isotopes of iron (Fe) and zinc (Zn) as a kind of gold standard in studies of their bioavailability from foods; trace element bioavailability and pool sizes for measuring the effectiveness of nutrition supplementation or fortification trials; isotope dilution methods used in the assessment of vitamin A status tracing through carbon-13 (^{13}C) carotenoids. Further, specialized applications – namely neutron activation analysis and inductively coupled plasma mass spectrometry – permit simultaneous analysis of a range of minor and trace elements in foods and beverages.

Hunger pains

In the early 1990s the problem of "hidden hunger" commanded worldwide attention. Through a series of high-level conferences, including the 1992 international conference on nutrition in Rome, it became apparent that large parts of the developing world were plagued by micronutrient malnutrition which could not be seen but which had devastating health and nutritional consequences. The problem not only is an impediment to health but also compromises socioeconomic development, learning ability and productivity.

The numbers of affected people worldwide are staggering. Globally some 250 million children are at risk of vitamin A deficiency – a leading cause of childhood blindness. And, in countries where immunization programs are not widespread and vitamin A deficiency is common, millions of children die each year from complications of infectious diseases such as measles with 2.8 million showing frank signs of xerophthalmia; two billion people suffer from anemia or iron deficiency which the World Health Organization (WHO) cites as the most widespread nutritional disorder in the world and 1.5 billion people live in areas where iodine deficiency disorders continue to be a threat. Insufficient iodine in the diet is the most common – yet also most preventable – cause of brain damage throughout the world. While the numbers are staggering based on deficiencies of iron, iodine and vitamin A, it has become apparent that a range of other micronutrients are also lacking in the diets of low-income households such as zinc and folic acid. Particularly vulnerable within the low-income population are infants, children, pregnant women and the elderly given their special nutritional and health needs.

Alleviating "hidden hunger"

The basic objective of all national micronutrient programs is to ensure that needed micronutrients are available and consumed by vulnerable populations. Programmes directed towards the sustained elimination of micronutrient deficiencies need to be broadly based so that interventions become accepted community practices. Hence, program strategies need to go well beyond conventional health and nutrition systems and be based upon empowering people and communities to be capable of arranging for and sustaining an adequate intake of micronutrients, independent of external support. Such strategies must be multi-sectoral and integrate interventions with social communications, evaluation and surveillance components.

In addressing micronutrient malnutrition in a country, a combination of strategies involving the promotion of breast feeding, dietary modification (e.g., improving food availability and micronutrient bioavailability, and increasing food consumption), food fortification and pharmaceutical supplementation needs to be emphasized and implemented. The different complementary approaches are often implemented in three phases: a) to ensure relief to vulnerable groups through supplementation, b) to improve micronutrient intakes across the population in the medium-term through food fortification and c) to ensure sustained, long-term outcome through dietary diversity coupled with biofortification of staple crops.

Supplements provide immediate relief to vulnerable populations and age groups with special micronutrient needs, e.g. pregnant and lactating mothers and pre-school age children. In some cases supplementation for women during adolescence through the entire child bearing age (especially during pregnancy) needs to be continued indefinitely. A clear "success story" is the improvement in the vitamin A status of preschool-aged children using high dose supplementation.

At least 90 countries routinely provide vitamin A supplements to young children in developing countries. Using the National Immunization Day's (NID) infra-structure, countries have been able to provide vitamin A supplements in efficient and cost effective ways. More than 75% of all young children in countries where vitamin A deficiency is known to be common received high-dose vitamin A capsules in 2002, compared to only about one-third in 1994. However, with the virtual elimination of polio in many developing countries, NID's are being phased out over time. Governments and international institutions are turning to alternative supplement delivery channels as a means of sustaining these gains. However, in the medium to long term, the objective should be to increase daily intake of all micronutrients through food either in natural forms or through fortification.

Food fortification is not a new nutritional intervention. Post World War II, fortification with a range of nutrients became common in the United States and some parts of Europe. Food fortification was a key factor in eliminating rickets (vitamin D in milk), goitre (iodine in salt) and pellagra (niacin fortification of cereals and other grains) and has also been effective in reducing the incidence of iron deficiency. Worldwide, fortification of salt with iodine has produced major reductions in iodine deficiency disorders. However, with the exception of iodine in salt, food fortification has not yet been used


Credit: Photodisc

How are Nutrients Tracked?

The major cause of micronutrient deficiencies is a lack of adequate intake of bioavailable minerals and vitamins from the staple diets. This is exacerbated by the fact that commonly consumed foods and beverages (such as rice, wheat, corn, legumes, tea and coffee) are high in inhibitors and low in enhancers of micronutrient absorption. Thus, these staple foods such as cereals and legumes are not only poor sources of bioavailable micronutrients but also interfere with the absorption of the micronutrients added during the process of fortifying foods.

Biochemical processes influencing the bioavailability (or the fraction of a nutrient our body's metabolism absorbs) are inherently complex. That is why the choice of the compound to be used as a fortificant is critical. This depends in part on its solubility in the gastric juice, besides its impact on sensorial characteristics of the food itself. Ultimately, both of these parameters can affect the outcome of a nutritional intervention strategy and therefore, it is necessary to understand the factors involved.

Iron compounds used as fortifying agents provide the best examples. From a practical point of view, many types of iron compounds exist and have been classified. They include: compounds soluble to some degree in water and/or in acidic solutions such as gastric juice. Similar factors are at play for the relative bioavailability of zinc from two potential sources, zinc oxide and zinc sulphate, among others.

To track nutritional processes, conventional chemical techniques measure the difference between the amount of mineral ingested and the amount in the faeces. But these methods have limited accuracy and validity besides being laborious. By contrast, isotope techniques directly and accurately measure iron and other mineral bioavailability found in the human body. This is the case whether the minerals derive from either single foods or total diets. Isotopic techniques also facilitate reliable evaluations of numerous factors such as the presence of excess phytates and fibres that influence mineral absorption.

Importantly, such techniques also help to identify those foods or fortificant-based interventions most likely to succeed in target populations. Stable isotopes are safe for use in children and pregnant women, feasible for field application and assess changes within reasonable time and cost. In the food fortification area the use of isotopic techniques is now well established for enhancing sensitivity of nutrition intervention trials.

Using the isotopic approach (*in vivo and in vitro*), determinations of bioavailability can be carried out. Laboratory assessment of bioavailability (*in vitro*) – by simulating the human stomach – measures the percentage of iron that is potentially available. It is the only rapid tool using radioactive isotopes to compare bioavailability from different foods and diets. It can also be used to investigate different promoters and inhibitors and the effect of food processing methods on iron bioavailability.

The most common method is to directly assess the human body's nutritional status (*in vivo*). It is based on incorporation of radioactive (^{55}Fe and ^{59}Fe) and stable iron isotopes (^{54}Fe, ^{57}Fe and ^{58}Fe) into red blood cells following extrinsic labelling (mixing the isotope directly with the food) and feeding to test subjects. Since newly absorbed iron is primarily used for haemoglobin synthesis, iron bioavailability from a specific diet can be determined simply by measuring the incorporation of an iron isotope into the red blood cell haemoglobin 14 days after the ingestion of the test meal.

In the case of zinc, zinc sulphate and zinc oxide are commonly used and are both absorbed quite well and isotopic techniques (e.g. ^{67}Zn) are applicable. However, in most food fortification programs when multi-nutrients are involved, inter-nutrient interactions have to be anticipated. For example, in the case of iron and zinc, using zinc in the sulphate form significantly reduces iron absorption in contrast to fortification with zinc as oxide.

more extensively in developing countries. Fortification as a nutrition intervention offers clear advantages in that foods commonly consumed can be fortified without requiring changes in consumption behaviour on the part of the consumer. The costs of fortification are modest and a variety of technologies now exist.

Dietary diversity is accomplished by promoting consumption of foods that are naturally rich in micronutrients or are enriched through fortification. The 1992 International Conference on Nutrition, jointly run by the UN Food and Agriculture Organization (FAO) and WHO, stressed food-based diet diversity strategies be given first priority for alleviating micronutrient deficiencies because these dietary approaches were seen as the most sustainable in the long term. Diet diversity has been overlooked by many governments and public health groups, in part, because they are viewed as more difficult to implement and thus not likely to produce quick, short-term results. However, varied diets are a key reason why most of the world's population are free from micronutrient malnutrition. Therefore, diet diversity should be seen as an essential part of an integrated strategy relying on a menu of interventions to improve micronutrient status.

The *biofortification* approach aims at enhancing the nutrient content of staple foods by conventional plant breeding. This opens a feasible means of reaching malnourished populations even in relatively remote rural areas, and delivering naturally fortified foods to people with limited access to supplements or to commercially marketed fortified foods. Thus, the breeding strategy will complement other successful ongoing interventions to reduce micronutrient malnutrition.

In order to provide immediate relief and at the same time ensure long-term impact and sustainability of interventions, a combination of interventions need to be planned. Certain vulnerable groups may need supplements for an indefinite period of time. "Safe Motherhood" programs need to address the multiple deficiencies that women face through improvements in intake, preferably through optimal diets *(see box: A Good Start)*. However where dietary intake is unable to meet women's requirements, multiple vitamin and mineral supplements should be considered as an intervention to improve safe motherhood, pregnancy outcome and the health of breastfed infants and their mothers.

In parallel, an overall strategy that includes dietary improvement, food fortification and supportive public health measures should be developed to improve and sustain the overall micronutrient status of the entire population.

Fortification: one part of a whole

Among the different interventions, food fortification plays an important role in meeting a demonstrable need for particular nutrients in a population perceived to be suffering from deficiency. Fortification involves identifying commonly eaten foods that can act as vehicles for one or more micronutrients and lend themselves to centralized processing on an economical scale. Fortification, when imposed on existing food patterns, may not necessitate changes in the customary diet of the population and does not call for individual compliance. Frequently, it could be dovetailed into existing food production and distribution systems. For these reasons, fortification can often be implemented and yield quick results and be sustained over long periods of time. It can thus be the most cost-effective means of overcoming micronutrient malnutrition.

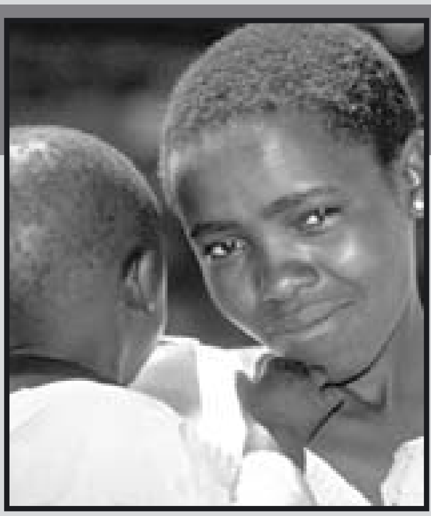
Fortification is obviously one part of a range of measures that influence the quality of food that include improved agricultural practices, enhanced food processing and storage, and consumer education leading to adopting good food preparation practices. Fortification efforts need to be integrated within the context of a country's public health and nutrition situation and as part of an overall micronutrient strategy that takes advantage of other interventions as well – specifically providing adequate nutrition to children under the age of two years. Fortification calls for a multi-sectoral partnership between industry, national governments, international agencies, expert groups and other players. They need to work closely on specific issues relating to technology development, food processing and marketing, free-market approaches with minimum price support mechanisms, standards, quality assurance, product certification, social communications and demand creation, monitoring and evaluation.

New efforts to enhance the micronutrient content of staple foods that are predominantly consumed by poor people in developing countries through plant breeding are showing promise. Research so far has focused on five crops (rice, wheat, maize, cassava, and common beans) and three nutrients (iron, zinc, and beta-carotene). For all of these crops, there is adequate genetic variation in concentrations of beta-carotene, other functional carotenoids, iron, zinc, and other trace minerals. Varieties are available in germplasm banks to increase micronutrient densities through conventional breeding by a multiple of two for trace minerals and by higher multiples for vitamin A. Under a new 10-year challenge program of the Consultative Group on International Agricultural Research (CGIAR) it is proposed to further increase the micronutrient content of these crops through conventional breeding, have their nutritional efficacy tested and then widely disseminate them in developing countries for adoption by farmers.

Making the right food choice

The success of fortification in improving micronutrient status and/or in eliminating a micronutrient deficiency depends on three key factors:

- There must be a specific food or foods consumed by the target population in great enough quantities to affect the intake of the target nutrient;
- The fortification process should not affect the organoleptic characteristics



A Good Start:

IAEA Contributes to Safe Motherhood

Many victims of malnutrition start life already hungry in the womb – before their first cries. And for countless pregnant women in developing countries, their growing belly belies the fact that they are severely malnourished. When a pregnant woman is malnourished, she runs the very real risk of giving birth to a low-birth weight baby – a prime cause of infant mortality in developing countries – and jeopardizes her own health. Furthermore, lactation increases maternal nutrient needs and chronic nutrient deficiencies place mothers at increased risk for cancer and degenerative diseases later in life.

In countries plagued by malnutrition, the most critically vulnerable groups are developing fetuses, children up to the age of three and women before, during and after pregnancy while they are breastfeeding. The IAEA, in collaboration with governments and donor agencies, is developing and transferring tools, based on nuclear science and technology, that can be used to evaluate nutritional status and nutrients in foods around the world aimed at eliminating this hidden hunger — starting with the very young.

One such project focuses attention on the increased energy needs of pregnant and lactating mothers. Dietary energy requirements increase markedly during pregnancy and lactation. Normally, a pregnant woman or nursing mother either increases food energy intake or reduces physical activity, or both. But when resources are limited and the demands on women's labour are great, unmet energy needs result in low birth weight infants and reduced maternal work capacity and fat stores, which limits the success of breastfeeding.

Until the advent of isotopic methods, it was impossible to accurately assess energy needs and nutrient stores in pregnant or lactating women. The doubly-labelled water method is the only technique that can accurately determine energy needs of people in their own environments. The method is non-intrusive and non-invasive and employs stable isotopes of oxygen and hydrogen that pose no risk to the woman or the unborn baby.

The IAEA has already helped in two important ways to improve the global information-base on maternal energy requirements. First, a report on the theoretical and practical aspects of the doubly-labelled water method for measuring energy expenditure was published in collaboration with The International Dietary Energy Consultancy Group (IDECG). This report has been distributed to researchers in more than 40 countries and has served widely as a central reference for studies utilizing the 2H218O method.

Second, the IAEA has supported several multi-centre analyses of energy expenditure during pregnancy and lactation. Results have been used in a new evaluation of dietary energy requirements which is being conducted by the Food and Agricultural Organization (FAO), the World Health Organization (WHO), the United Nations University (UNU) and the IDECG.

Together with its partners, the IAEA can help the world's most precious resource – our children.

—Staff Report

More information on the Agency's programs in nutrition is available at: *http://www.iaea.org/worldatom/Programmes*

of the food, i.e. taste, colour, odour and should not decrease its shelf life;

- The process of fortifying should not significantly raise the price of the fortified food. The fortified food(s) must be affordable.

The first condition – that the target population consume a food in sufficient quantity – should be easier to achieve than it has been. Historically the diets of low-income populations have been heavily based on staple grains, which are easy food carriers for the fortificant in the milled form. However, until recently, low-income populations lived in rural areas with much of the basic staple consumed by households home-produced, making the fortification process implausible. Now, with the global demographic trend from rural to urban areas, a larger proportion of the low-income population can now be easily reached via commercially processed foods. This has raised the prospect of fortification as an effective and crucial strategy for improving nutrition and health. Unlike dietary diversity that may take years to evolve as a reasonable intervention, fortification techniques can be implemented as both a short and medium term strategy to improve diets.

There are a number of countries that have been successful in fortifying sugar with vitamin A, including Guatemala, Nicaragua, Honduras, Vietnam and Zambia. Other countries are fortifying oils, fats and condiments. As the macronutrient content of the diets of low-income households shift, some public health officials argue that more attention needs to be given to the type of foods that are to be fortified. They argue that it is no longer sufficient to ascertain whether the food is consumed in sufficient quantity but, in addition, they caution that other characteristics such as the macronutrient composition of the food must be considered. The issue of which foods to fortify is not a scientific one but rather a policy decision.

Public awareness

Even when there is little or no cost differential between a fortified and an unfortified food, consumer awareness may still be an important issue in the overall acceptance of a newly fortified product. Consumers must be made aware of the benefits of fortified foods and this information needs to come from a source that is viewed as credible. Effective communication to consumers is an often overlooked but an essential part of effective fortification interventions. This is where public-private and government partnerships can be particularly valuable.

Hand-in-hand with interventions to improve micronutrient intake is working to eliminate other underlying causes of the deficiency. For example, improvements in sanitation, which result in decreasing hookworm infection, may lead to improvements in iron uptake (through reduced iron losses). Malaria control may lead to improved folic acid status. Vaccinations against measles may protect against infection caused by reduced resistance due to vitamin A deficiency. Birth control will ultimately improve the standard of living of a family making food more available and help to prevent iron and iodine deficiency in both women and children.

Regulatory framework

Surveillance and evaluation

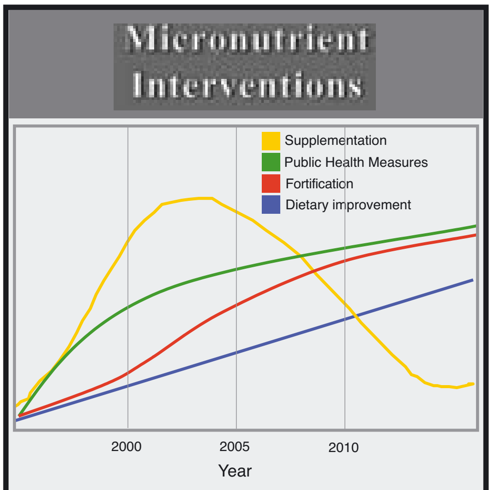
A key to controlling micronutrient deficiency is to establish effective assessment and surveillance able to identify populations at risk and monitor progress over time. To develop effective surveillance, program managers must define the target groups, the indicators to be used to assess micronutrient status, and the strategies by which surveillance will be organized and co-ordinated. Epidemiological surveillance includes monitoring and evaluation of micronutrient status of the population to identify the impact of the intervention strategy. Since food fortification is a medium- to long-term strategy, epidemiological surveillance should be conducted every two years. For example, a specified system of quality assurance and complementary epidemiological surveillance activities are necessary in every program or process of iron fortification.

A network of certified laboratories (public/private) should be established, within the context of compliance with food safety regulations, to certify the quality of both the premix and the final product. For evaluating a nutritional monitoring program in the context of micronutrients, factors affecting efficacy *(can the intervention lead to the expected results under chosen conditions?*), effectiveness (*does the intervention provide the expected result under real conditions?*) and efficiency (*is the intervention able to generate expected outcome with a reasonable cost-benefit ratio?*) should be scrutinized. Multiple methods should be considered to provide greater evidence that results found are due to intervention.

Analytical quality control

As regulatory monitoring and other surveillance activities increase, the demands for generating reliable analytical data will increase further. Importantly, the regulatory monitoring practices have instilled a quantitative dimension to the nutrient profile of processed and other foods. This has resulted in impressive developments in the area of food standards. For example, following the regulatory directives of the U.S. Infant Formula Act of 1981 and the Nutrition Labelling and Education act of 1990, a variety of reference materials representing food matrices such as frozen food composite (for fatty acids), infant formula (nutrients) and typical diet and milk powder (for a both organic and inorganic constituents) among many others, have been introduced. In order for this to happen, several U.S. government agencies, university laboratories and private industry laboratories (industrial laboratories associated with infant formula council) pooled their analytical resources collaboratively, led by the National Institute of Standards and Technology. The impact is that these standards are being used as primary validation sources in several developing countries preparing their own secondary food reference materials to meet their specific needs.

For the many developing countries that do not yet have the resources to develop their own fortification standards, the Codex Alimentarius (Codex) has been very helpful. FAO and WHO took the lead in establishing Codex to address concerns over food additives and pesticide use and differing country and regional food standards. Codex provides a sound basis for food standards for promoting consumer health and encourages global food trade.



The graph shows the relative contributions of different interventions to eliminate micronutrient deficiencies.

Cross-border food movements

As governments intensify and expand fortification efforts, it is time to be aware of the trade requirements that may affect fortification policies and standards. The rules under the World Trade Agreement (WTA) offer both benefits and pitfalls when it comes to food fortification. Generally, the WTA requires that imported goods receive no less favourable treatment than domestic products, that domestic measures not restrict trade unnecessarily, and that only the least trade-restrictive measures be adopted. The resulting reduction in unnecessary differences in standards, bureaucratic red tape, and associated costs offers benefits that should promote the export of fortified foods.

On the other hand, even neutral requirements that have the effect of restricting trade may be found to violate the WTA. Although governments are given specific authorization to deviate from the above principles when necessary to protect the health and safety of their populations, many technical regulations have the potential to restrict trade. As a result, governments may find themselves relieved of some of their discretion to set their own food fortification policies and standards. In turn, this may make administration of their fortification programs more burdensome.

The food and food-processing sector is rapidly expanding in the developing world and will play an increasingly important role in influencing consumer diets. Food enrichment offers a unique opportunity for the industry to simultaneously expand its market and profitability while playing a key role in improving the physical, social and economic well being of the nation.

Public-private partnerships

Food fortification efforts need to be integrated within the context of a country's public health and nutrition situation and as part of an overall micronutrient strategy that uses other interventions as well. Effective and sustainable fortification will be possible only if the public sector (that has the mandate and responsibility to improve the health of population), the private sector (that has experience and expertise in food production and marketing) and the social sector (that has the grass-roots contact with the consumer) collaborate to develop, produce and promote micronutrient-fortified foods.

What is urgently needed is to identify a set of priority actions and initiate a continuous dialogue between the public and private sectors and other key stakeholders. They should be encouraged to move quickly towards the implementation of schemes that will permanently eliminate micronutrient malnutrition. Specifically, a multi-sectoral partnership needs to be built between industry, national governments, international agencies, expert groups and other players, to work closely on specific issues relating to technology development, food processing and marketing, free-market approaches with minimum price support mechanisms, standards, quality assurance, product certification, social communications and demand creation, monitoring and evaluation. Guidelines on these issues should then gain acceptance and be implemented at the country level. A multi-sectoral group within each country should define a feasible and affordable fortification strategy designed for the target population, identify opportunities for the involvement of the food industry and assist in promotional and educational efforts to reach the target population.

Such collaboration could benefit all sectors: national governments could reap national health, economic and political benefits; food companies could gain a competitive advantage in an expanding consumer marketplace; the scientific, development and donor community could gain impact and recognition for achieving global goals to eliminate micronutrient malnutrition.

With adequate awareness to balanced nutrition and by choosing foods fortified at appropriate nutrient levels, consumers empower themselves to achieve their full social, physiological and economic potential.

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For a full listing of references, please contact the authors.

Cuba's Nutrition Mission

Researchers are on the Trail of Key Health Links

Cuba's nutrition studies focus on the young and old alike. (Credit: Wedekind/IAEA)

Havana — Dr. Manuel Hernandez-Triana is a man on a mission, striving to help Cubans live longer and healthier lives. He's fortunately in good company. Cuba's longstanding emphasis on health care, he says, surrounds him with people looking to build on a pretty strong record. Rankings for just two measures – the rates for life expectancy and infant mortality – place the developing country among far richer nations. Cubans can expect to reach 76, rivaling Sweden's 79-plus, and fewer babies are lost at birth than in most neighboring countries, including the United States.

"We're a poor country facing rich country problems when it comes to health," says Dr. Santa Jimenez, Dr. Hernandez-Triana's boss and Vice-Director of Nutrition at Cuba's Institute of Nutrition and Food Hygiene in Havana. Problems related to nutrition – including obesity, hypertension, and diabetes – are commanding increasing attention, she notes.

Over the past several years, Cuba has learned more about the connections between nutrition and health. Through IAEA projects, the country's researchers are using sensitive techniques, including isotopes (forms of chemical elements such as oxygen and hydrogen) and nuclear analytical techniques to track and evaluate the body's energy expenditure in children and adults, including the elderly, as part of overall nutrition studies.

As head of the Institute's biochemistry and physiology arm, Dr. Hernandez-Triana knows the work can pay big dividends. Together with project partners, Cuba already is gaining key analytical support for its subsidized feeding programme. It provides daily food baskets of fortified milk, fruit puree, and other foods to more than 1.7 million children, including nearly 150,000 pre-schoolers.

Several field studies – involving counterparts at Cuba's ministries of education and health, and the atomic energy commission – are adding to the knowledge base.

Studies of preschool children, for example, show that those living in the country expend far more energy than youngsters in cities because they're more physically active. "It's an important finding," says Dr. Hernandez-Triana. "Cuba's feeding programme is more geared toward supplementing the diets of highly active children. We now know adjustments are needed for less active city children, to prevent problems of overweight and obesity. We already see the tendency."

Studies of the elderly in urban and rural settings also detect trouble spots, with one in five men and about half of all women found to be overweight. Excess weight is a leading factor in diet-related chronic diseases such as hypertension and diabetes, which stand among Cuba's major health problems. Nutrition programmes are being directed accordingly as part of preventive efforts, particularly targeting children in time to reverse course. Worldwide, obesity trends are alarming, the World Health Organization (WHO) reports, with an estimated 300 million adults now considered clinically obese, about a third of them in developing countries.

Cuba's results are critical to the success of school nutrition programmes in which it invests more than $80 million annually. The data are contributing to reviews of national policies and — for the first time — to set baseline nutritional guidelines tailored to local conditions and needs. The results of the children field studies also are being used by the Expert Committee of the UN Food and Agriculture Organization (FAO), WHO, and United Nations University to set new recommended standards for the region.

"The big contribution of the IAEA projects is that we're obtaining the concrete data we need," says Dr. Hernandez-Triana, "so we can decide on changes helping our own people live longer and healthier lives."

—Lothar Wedekind, IAEA Division of Public Information, whose report first appeared on the IAEA's web site.

Dr. Santa Jimenez (center front) and Dr. Hernandez-Triana (left top) with colleagues at Cuba's Institute of Nutrition and Food Hygiene in Havana. (Credit: Wedekind/IAEA)