

## **Crystal Ball Gazing: Micronutrients for All by 2015**

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In ways that would be unrecognizable to history, we are living in the most exciting of times. Using intuition, imagination, and creative ideas over the millennia of human past, and scientific methodologies especially over the last two centuries, human beings have succeeded in developing methods of agricultural management, disease control among living beings, means of communication, transport, interconnecting the world, looking after the environment, and installing systems of diffusion of knowledge through experience, education and research to effect an overall improvement in the quality of life. Even more than effective improvement, the immense potential for it has been opened up for the future.

Given all of this progress it is tragic that we have allowed something as basic as malnutrition and micronutrient malnutrition to persist in many parts of the world – for at least half a century too long.

It is therefore appropriate that at the end of a symposium in which we have heard from some of the most eminent experts on the subjects of epidemiology, etiology, and the impacts of nutritional deficiency which should never have been allowed to persist for so long, that we reflect on some of the underlying issues and strategies that will enable us to quickly and effectively eliminate the scourge of micronutrient deficiency from the face of the earth.

We have heard that the vitamins and minerals that the human body needs have to be taken in microgram or milligram quantities in daily diets for human well being. In such minute quantities they are essential as constituents of vital enzymes and proteins for the normal processes of growth, development, maintenance and resistance to infection. To call them micronutrients could be in conformity with the minute quantities needed, but it is certainly not in consensus with the nature and extent of the damage. In their absence

individuals and families suffer serious consequences expressed as increased mortality, morbidity and disability rates; communities and nations suffer losses in human potential and unaffordable social and economic costs.

The physiological roles of micronutrients have been known for a considerable period of time and were prominent in the early history of nutritional science. Their deficiencies have long since been brought under control in the industrialized world, while they continue to persist in large parts of the developing world. The young, the poor and the female in some cultures are the worst affected, but micronutrient malnutrition is a pervasive phenomenon and its consequences are felt at all stages of the human life cycle [1].

As recently as the 1970s and 1980s in many countries micronutrient malnutrition was considered a symptom to be treated when clinical signs are evident, which was often too late. It was the key research during those decades that clearly exposed both the pervasiveness of the problem and its far-reaching consequences in terms of survival, health, social and economic impacts. It became increasingly evident that clinical signs were only the tip of the iceberg – they concealed a much larger and invisible problem that affected many more people. It was only in 1985 that Prof. Basil Hetzel coined the phrase ‘iodine deficiency disorders’ to replace the term ‘goiter’, and in the late 1990s the phrase ‘vitamin A deficiency disorders’ was proposed by IVACG to refer to the range of disabilities caused by insufficient intake.

The turning point really came at the World Summit for Children in 1990 when 69 heads of state met in New York and approved a plan [2] that included 7 major goals and 26 supporting/sectorial goals of which 3 related to micronutrient malnutrition. Although the micronutrient goals seemingly constituted only a fraction of all the goals, they were the cutting edge, they were amenable to fulfillment in the shortest possible time, and their cost-benefit ratio was highly favorable. They also underscored the unique opportunity we had to provide nutritional well-being as fundamental to sustainable human development on a scale not witnessed before. The summit goals became a mission for the entire UN family, for the aid agencies, for governments and non-governmental organizations. Policy makers realized that in the wider picture technological problems are not nearly as serious as operational ones related to making programs work in communities where deficient people live. Issues of supply and logistics, communications and community participation, partnership building across a wide spectrum of players – public and private – were recognized as equally important to ensure the success and sustainability of efforts to eliminate micronutrient deficiencies in large populations.

The 1990s witnessed a spectacular expansion of the world economy as the technological innovations and dismantling of trade barriers known as globalization gathered strength. These forces have brought tremendous new opportunities but also raised new or greater challenges in terms of economic or political instability. But the massive benefits and opportunities generated by globalization failed to eliminate the micronutrient malnutrition problem.

While there was progress on the nutrition and micronutrient front, it still fell far short of the expectations. Today 70% of the world has access to iodized salt. 50% of the world's under-5 children receive at least one high-dose of vitamin A. But the problem of iron deficiency persists unabated. It affects several billion people and is one of the top 10 preventable risks for disease, disability and death in the world today.

In 2002 world leaders reconvened at the UNGA Special Summit for Children. They reaffirmed their commitment to ‘... achieve sustainable elimination of iodine deficiency disorders by 2005 and vitamin A deficiency by 2010; reduce by one third the prevalence of anemia, including iron deficiency, by 2010; and accelerate progress towards reduction of other micronutrient deficiencies, through dietary diversification, food fortification and supplementation ...’ [3].

Today it has become clear that our goal is beyond simply food security, based on per capita calorie availability. Rather, it is a comprehensive nutrition security, based on an affordable diet of high nutritional quality – a diet whose outcome is judged by mental acuity and economic productivity rather than simple physical survival. This amounts to a dietary quality revolution every bit as profound as the green revolution of the 1960s.

As we look forward, what dramatic action could we take that would really make a difference? How could we move the world towards eliminating the problem within, say, the next decade – within the broader development framework of globalization (in trade, capital flows and environmental issues) and localization (in terms of decentralization of political power to sub-national levels of government and growing urbanization) [4]?

Let us gaze at the crystal ball and see what the future has in store for us in order to eliminate micronutrient malnutrition in terms of: (1) technology; (2) delivery; (3) policy, and (4) social mobilization.

## **Technology**

The task at hand is relatively simple on one level. We need to give all essential micronutrients to everyone on this planet in one form or the other on a permanent, continuous and self-sustaining basis. Strategies have to be appropriate to the need and the use of existing delivery systems and available technologies where they serve the need. In addressing micronutrient malnutrition a combination of interventions 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 will need to be emphasized and implemented in a complementary manner.

They need to go well beyond traditional health and nutrition systems and based upon enabling people and communities so that they will be capable of

arranging for and sustaining an adequate intake of micronutrients, independent of external support. Strategies are necessarily to be multi-sectorial and integrated interventions with strong social communications, evaluation and surveillance components.

In the best of worlds the nutrients should come through the food we eat. Perhaps we will get there one day, but we are not there yet. For several reasons – economic, geographic, social, cultural – this has not been a practical solution, and even if this were possible there are issues related to the lack of bioavailable minerals and vitamins from staple diets. This is exacerbated by the fact that commonly consumed foods and beverages (rice, wheat, corn, legumes, tea and coffee) are high in inhibitors and low in enhancers of micronutrient absorption.

Let us look at some of the opportunities that could help eliminate the stealthy scourge of micronutrient malnutrition.

*Multiple Micronutrient Interventions.* Increasingly the thrust will be in the direction of multiple micronutrient interventions. Addressing more than one deficiency through a single intervention is more effective and efficient than isolated and potentially competitive control of each micronutrient individually. Multiple micronutrient deficiencies, the required technical skills, facilities and information resources frequently overlap and interventions to address several deficiencies could often be delivered through the same system.

*Fortified Foods for All.* A significant proportion of cereal flours can be fortified with essential vitamins and minerals: wheat flour in the Americas, Europe and Asia, corn flour in Sub-Saharan Africa and Central America, cooking oils and fats, sugar, milk and condiments can become important vehicles through innovative technologies that permit fortification both on a large and a small scale. Salt, the ubiquitous part of our diets, can carry a range of nutrients including iodine, iron, zinc and vitamins as well.

*Where Fortified Foods Don't Reach.* Here we could use multiple ways to deliver micronutrients to homes to enable mothers to either add them to the cooking pot or to mix them into the food they feed their infants. These are labeled as complementary food supplements [5], are available as water-dispersible or crushable tablets, Sprinkles or spreads that can be added to complementary foods just before feeding infants and young children. They are designed to provide 1–2 recommended daily allowances of vitamins and minerals in a small volume, at a low cost and are easily integrated into existing food practices.

*Special Needs.* 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. However, where dietary intake is unable to meet the women's requirements, multiple vitamin and mineral supplements should be considered as an intervention to improve safe motherhood, pregnancy outcome and the health of breast-fed infants and their mothers.

*Biofortified Foods.* Breakthroughs in plant breeding and nutritional genomics could simplify and hasten the development of nutrient-rich varieties and improve nutrient availability in staple crops such as rice, maize, sweet potato, cassava, common beans and wheat. Advanced biotechnology tools, such as genome mapping and marker-assisted selection could enable us to identify, select, and transfer desirable traits, including those linked to high micronutrient content (iron, zinc and  $\beta$ -carotene), from one variety to another with or without transfer of genes across species [6]. By producing plants that are dense in minerals and vitamins, a process referred to 'biofortification', we could have crop varieties with improved nutritional content in the staple foods people already eat. This can be a feasible means of reaching malnourished populations in relatively remote rural areas, with limited access to health programs through which supplements are channeled or to commercially marketed fortified foods.

The key issue that is yet to be fully resolved is whether we limit our efforts to biofortification through conventional plant breeding or extend it to provide novel traits for breeding that are not available in the existing germplasm ( $\beta$ -carotene in rice endosperm as an example). The expanding ability to manipulate provitamin A carotenoid synthesis (e.g. Golden Rice), vitamin E synthesis and mineral composition in plants can be directly traced to advancements in nutritional genomics and exemplifies the power and potential benefits of the approach.

The argument for genetically modified crops is that breeding is limited to the variations that are generally present in the germplasm but not anything beyond the breeder's germplasm. Furthermore breeding could be time consuming. With biotechnology, it is possible not only to increase the level of the micronutrient but also ensure its bioavailability. For example, the bioavailability of  $\beta$ -carotene could be enhanced by its being engineered into an oil seed like canola, soybean, germ of corn and wheat thus providing the appropriate matrix for absorption of a lipophilic molecule.

We have the two strong positions on this issue. Anti-biotechnology activists have tapped into a powerful rhetoric as old as Dr. Frankenstein – add to this modern scientific and regulatory disasters like thalidomide and mad cow disease, plus actors in laboratory coats hawking everything from soap to diet supplements, and you have a profoundly skeptical public. So on one side, we have children in monarch butterfly costumes accompanied by activists with a shaky premise; on the other, a scientist with charts, graphs and a compelling body of evidence. In the age of the 10-second sound bite, who wins? While the public may be unsophisticated in their knowledge, they are extremely sensitive to attempts to manipulate their opinion. The ultimate aim is not propaganda, or even persuasion. It is making sure the correct information is heard, so people can make informed decisions.

*Rapid Assessment Techniques.* These can enable micronutrient status (iron, vitamin A, zinc, iodine) to be determined from a blood spot sample collected on a filter paper.

*Supplement Assimilation.* Where people have side effects or difficulties in absorption we have slow release tablets or patches that could be taken weekly or twice a week. We could probably develop a tablet to be taken once every month or once every 6 months.

## **Delivery**

For several decades in the past the primary responsibility for the health and nutritional well-being of the people was viewed as that of the government or the public sector. For too long, nutrition issues were dealt with in isolation by different sectors and organizations. This lack of communication and collaboration across sectors to address problems in a unified manner was in part responsible for the poor nutritional outcomes in many countries.

In the recent past we have seen the roles of government and private industry change dramatically. Food production and consumption patterns are shifting to more centrally processed and packaged food products with increasing attention to food safety, hygiene and quality. The food business is becoming more global with new trade agreements accelerating the worldwide movement of food technology, products and capital. Markets in developing countries are providing unprecedented opportunities to attract private investment and entrepreneurial energy. Publicly funded food and nutrition programs are gaining from past experience and improving in effectiveness. In this new environment governments, food companies, scientific establishments and development agencies are beginning to work together on ensuring adequate nutrition status for all. The public sector is recognizing the need to engage and stimulate the private sector to contribute to the public good and motivate it to do more. In turn the private sector is seeing value in expanding its market through penetration of lower-income groups that are much larger in size but offer slimmer profit margins. The world is going to increasingly see such collaboration in several sectors of human development, and nutrition could be at the forefront of that movement.

The challenge therefore for all of us is to consider how we can channel the capacities of the private sector – and the huge potential for good – in a constructive and responsible manner. Clearly adequate regulations by both governments and international bodies – and public–private partnerships – must be in place to prevent any actions that might in any way detract from the goal of reducing malnutrition. Along with such checks and balances, both government and industry need to devote more energy and ingenuity to build such an alliance that could exploit the potential for common good and ensure a significant corporate contribution to improve the condition of malnourished people.

Governments, businesses and the nonprofit sector can engage in several types of collaborative arrangements for public good. For ease of understanding

I will categorize these [7] as (1) core business engagement (a public private partnership); (2) supportive partnerships, and (3) philanthropy (public private not-for-profit arrangements).

#### *Core Business Engagement*

In core business engagement the private sector contributes to the public good through the redesign and marketing of its products and services.

(1) Fortification of staple foods with nutrients is a good example of a collaboration that should be led by the public sector in active consultation with the private sector. It would identify the deficiencies to be addressed, the foods to be fortified, levels of nutrient addition and standards to which they should be fortified. The initiative should also set clear norms for quality assurance, product certification, product promotion, social marketing, monitoring and evaluation.

(2) The production and marketing of industrially produced fortified complementary foods targeted at 6- to 24-month-old infants is another example. Such foods could ensure higher energy density, protein quality and micro-nutrient bioavailability, not to mention the safety and convenience. Government encouragement and guidance could encourage the food-processing sector to produce a nutrient-dense, low-bulk complementary food at affordable prices and a fraction of the price of branded infant foods.

(3) Food companies can also work with governments to produce processed foods for distribution in public institutional feeding programs.

(4) Experience in several South-East Asian countries like Vietnam, Thailand and Indonesia has shown that more and more people are able and willing to purchase nutritional supplements if they are properly developed, fairly priced and encouraged by the government.

(5) Public and private sectors can collaborate to lower the prices of conventional foods such a fish, dairy products and land-based crops of nutritional significance. For instance, corporate experience can be helpful in designing and carrying out projects for more effective processing, storage, transport and distribution.

(6) There is significant potential for donation of genetic information patents held by private corporations to the public domain. This could support the improvement of nutritional quality of a range of cereal and tuber crops.

#### *Supportive Partnerships*

In supportive partnerships, the private sector offers services not necessarily central to its business actions: (1) corporate distribution facilities can be used to market low cost foods produced under government programs; (2) skills of private industry can be marshalled to devise education programs that create greater nutrition awareness, and (3) industrial research capabilities and facilities can be made available for government programs.

### *Philanthropy*

In addition to private sector involvement in products from which they expect to benefit financially, there are growing instances of private philanthropic support for nutrition where the donors do not have a direct connection or interest in the food and pharmaceutical industry. Recent examples include support from the UN Foundation created by Ted Turner for a range of preventative health and population programs, support from the Bill and Melinda Gates Foundation for the establishment of the Global Alliance for Improved Nutrition.

Private voluntary organizations such as the Rotary have been key partners in the Universal Child Immunization effort. Lions Clubs have done yeomen service to deliver eye care. More recently at the global level Kiwanis International has adopted the elimination of insulin-dependent diabetes as its worldwide service project and raised in excess of USD 75 million to support the effort. Can we draw these and other organizations to expand their support to nutrition programs?

### **Policy**

We have also realized that addressing micronutrient malnutrition cannot be through stand-alone vertical programs. Also we became much more effective in inserting nutrition into broader health and social development goals rather than waiting for them to be addressed in order to serve the cause of nutrition. We must focus increasingly on 'intersecting' micronutrient programs with major development challenges. These include: HIV/AIDS, malaria, hookworm and reproductive health, and emergency programs. Additionally nutrition should be included on the agenda of important reproductive and child health initiatives; vitamin A deficiency on the agenda of the ophthalmologists, and iron deficiency a priority in early child development, school health and maternal health programs.

### **Social Mobilization**

An effective communications campaign supported by the government should necessarily accompany any major micronutrient effort in order to gain the understanding and support of key sectors from policy makers and legislators to medical professionals, health workers and consumer groups. The communications component should consist of the following.

(1) Presentations to the highest policy-making bodies to ensure continued national commitment and national effort.

(2) Communication with public health professionals, government officials at every level, and private industry and trade to obtain their understanding and support.

(3) Communication research among the consumers to understand the perceptions with respect to the micronutrient deficiency problems and the use of fortified foods.

(4) Dissemination of effective messages through appropriate channels to the target populations in order to educate, persuade and motivate them to accept the new product and to change their behavioral patterns. Subconscious consumer demand for micronutrients needs to be made conscious and directed to appropriate foods and pharmaceuticals. This demand will serve as a 'pull' factor to bring the target groups to distribution points for supplements, to overcome resistance and, if necessary, to induce consumers to pay a little more for a fortified diet [8].

The time is ripe for a rededicated initiative to eliminate the global micronutrient problem. We have new technologies, improved communications, and an expanded public infrastructure through supervised feeding programs. In parallel, by demanding the supplements and fortified foods that they need, consumers enable themselves to achieve their full social, physiological and economic potential. By eliminating micronutrient malnutrition through complementary public-private-civic sector initiatives we could make an enormous difference to the health and well-being of millions of people around the world.

## References

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## Discussion

*Mr. Parvanta:* As an example, I just wanted to give a kind of follow-up to a comment that Dr. Zlotkin made on the first day that these programs have to be continuous. In Scandinavia some people are thinking about eliminating fortification of

infant foods just because the problem has gone away. In the map that you showed of the world, the former members of the Russian Union and all of those eastern European countries are a big block which has a problem with salt iodization or lack of salt iodization. It is important to remember that apparently in the old days in those countries, in the 1960s and perhaps even in the early 1970s, those programs were in place. But for some reason, perhaps because the problem had been eliminated, the programs were stopped, and now they have just resurfaced again [1]. So this is important for policy makers to realize that it is not over, it will always be there and we have to deal with it.

*Dr. Mannar:* We have seen cases in countries which had developed good levels of iodization and then slipped, and the problem has recurred very quickly. Within 1 or 2 years cases of iodine deficiency and goiter recur.

*Dr. Zlotkin:* We have both raised the issue of advocacy, and having Bill Gates on our side certainly does help. This may be a tough question, but as pediatricians, and there are pediatricians here, we have many opportunities to interact with other like individuals. But at the individual level as opposed to a government or a UN level, is there anything that as individuals you think that we professionals can be doing to advocate this particular issue at the individual level?

*Dr. Mannar:* I think all of you are key advocates. I have just talked to Dr. Mayya and he said that he was going to give a talk at the next meeting of the Indian Pediatric Association in the nutrition section of the program. I said that he should be talking about micronutrients and he agreed that he will. So each of you can go back to your country and do that, and spread it even among your own pediatric and other medical communities, that would certainly be of great help to promote the cause.

*Dr. Tolboom:* That was a very stimulating presentation. You mentioned that the world leaders in 2002 were recommitting themselves. But if you look at the goals that were formulated in 1990 and those formulated last year (2002), the goals of 1990 were reformulated. That is one of the problems we are dealing with because goals are set and then they have to be reformulated. So if the world leaders commit themselves, at what price is it? How can we hold them to their promises? You showed that vitamin A deficiency is declining, subclinical vitamin A deficiency, but are these lines really linear curves or are they different? The lines look so nice and on the basis of this type of picture we make our global crystal ball gazing which you have been doing. But do you think they are really straight lines or do we have to formulate the goals again in 3 years time? What is your idea, when you look into the future?

*Dr. Mannar:* Certainly I agree with you that global commitment is only the first step and a lot of work has to follow that. We are doing that with UNICEF, each of these global leaders is going to get a score card next January, 2 years from the time they made the commitment. We (MI) are going to give them a score card on how their country is doing in terms of addressing each of these deficiencies, what is the current coverage and what are the consequences. We are translating that into the functional consequences saying that do you realize that 50,000 children are being born with intellectual impairment; do you realize that so many mothers are dying because of very low levels of iron, and so we want to hit them with that, and UNICEF is of course the major advocate of this approach. We know that some people won't like it because they will get a bad score card, but we believe that they need to know the facts. As you said they made the commitment 2 years ago, and they can easily be forgotten in the midst of competing priorities, and can easily slip off the agenda all together. It is very important to constantly keep renewing and reminding leaders regarding the commitments and progress being made. On the second question I agree with you that it is very simplistic to just draw straight lines, we need to do more precise work for each country and it will obviously not be linear and it could fluctuate both up and down. Each country has to be considered separately.

*Dr. Bhutta:* This was really inspiring and I agree with almost all the crystal ball gazing that you have done. I want to make two comments that I believe are key in the global quest for addressing micronutrient malnutrition. I think there is a global issue in terms of global advocacy, but perhaps equally if not more important is the issue of national investments. The problem at this point in time of micronutrient deficiency is not only restricted to parts of the world where there is a real link with poverty, but also with areas like south Asia where there is no shortage of resources but there is a tremendous policy gap in terms of main streaming micronutrient malnutrition within the national nutrition programs. I come from a region where there has been a recent investment of 600 million rupees in a liver transplant program. Yet the national micronutrient program is starved for funds. So the point that I would like to make is that a lot of the advocacy really needs to be at a local level with policy makers. In your design of how you will do this, please make sure that they are involved. The second comment is in terms of the challenges that we have. It is nice to see approaches such as agricultural-based approaches to micronutrient malnutrition, and I believe it is one of the global challenges that have come out of the recent call for proposals. But a much bigger challenge in terms of micronutrient malnutrition is really how you get these to deliver within health systems. Although we may have the best program, when it comes to delivering these right down to the grass roots through existing health systems there is a big gap between evidence, research and intervention programs. So one would have very much liked to see an equivalent investment in delivery systems for existing interventions. We may have the best formulation but we still don't know how to get it right down to the grass roots. So I just wanted to flag these as two possible areas of attention.

*Dr. Manmar:* Absolutely, the work and commitment have to be at the national level, and in terms of dealing with national planners we have to get the attention of not only the ministry of health but other ministries such as education, planning and finance. They have to realize that this is something that they are also responsible for. In many countries, ministries of health tend to be under-funded, the minister is a junior minister and doesn't have the clout to mobilize huge resources. As you said making the decision to invest in something like a health facility is probably important but will benefit only a few people. It needs to be compared with something that would benefit millions of people, and a decision based on costs and benefits needs to be made. We certainly need to integrate micronutrients into sectors outside the health system, e.g. the food sector needs to take an active part in the solution so that at least part of the problem in terms of nutrient intake is addressed outside the health sector. This will also enable the health sector to focus its limited resources on those who cannot afford micronutrient-rich foods or have no access to them. But I agree with you that we need to improve those systems to reach even those people.

*Dr. Pettifor:* I refer to your comment that in fact we should perhaps do away with micronutrient deficiencies as a vertical program. I am worried about that because I have seen a number of countries trying to remove vertical programs. What happens is that you lose the advocacy, you lose the direction of that particular program that gets incorporated into general health care or whatever it happens to be; in fact the program dies. I would like to make the strong plea that in fact we don't remove the issues of micronutrient problems out of a vertical program, we need the advocacy, we need people who are going to be committed to try and address this problem. When we look at it on the ground and we may need to implement it, then sure we may need to use programs that are already there.

*Dr. Manmar:* I agree absolutely. I was talking of model integration at the community level in terms of the delivery and you are right, it still has to remain distinct in government policy and programs as well, not something buried under some other project.

*Dr. Abrams:* I want to make a comment about the gap between pediatricians and nutritionists. I think that they see the problem very differently and don't necessarily all agree on the ideas and approaches that need to be addressed. Pediatricians see a disease model, somebody is anemic and needs to be treated, and don't particularly think that global nutritionists have much to offer. I am certain that global nutritionists don't often think very much of what pediatricians do and their approach of the problem. So here we have a very biased group, pediatricians and nutritionists, which doesn't represent the busy pediatrician throughout the world who is occupied by taking care of lots of disease processes. I think a lot more needs to be done in terms of integrating the pediatrician as the advocate in understanding it, and also make the nutritionist a little bit more aware of what the pediatric world is about.

*Dr. Gebre-Medhin:* One thing that I would like to ask you about is the fact that within the next two decades the process of urbanization will continue. We are likely to be living more and more in towns, in urban settlement areas, with the result that food supply systems are going to be very different. What are your views on the micronutrient initiative that you have discussed vis-à-vis the classical issues of production of industrially produced breast milk substitutes and industrially produced complementary foods, I mean industrially produced foods for younger children and the rest. You did not link these two together. Are we going to abandon this classical approach that we have had, and how do we talk to governments about the continuation of these classical tested approaches vis-à-vis the micronutrient initiative?

*Dr. Mannar:* I think urbanization is something which we cannot avoid, it is something that is happening and it is something we have to live with. The question is how do we adapt our strategies in this rapidly changing environment, and I would say that the classical approaches have not been abandoned, and we should continue to push for both dietary promotion and of course expansion of food fortification and supplementation within the new health systems that are now coming up in urban centers, and work within that.

*Dr. Gebre-Medhin:* As was mentioned, my point is that we encourage governments and big organizations to take a stand. We push them to make declarations of different types. Earlier we talked about the necessity of supplying the increasing urban population with something for the first 6 months. Thereafter complementation issues are not being addressed adequately yet. Now we are shifting the emphasis in the area of micronutrients, perhaps partly to the detriment of other investments. This is really the problem.

*Dr. Mannar:* I hope not, I hope they can be complementary to all the other health nutritional interventions that we are doing, and I am hoping that micronutrients can in fact, through their quick impact and success, have an impact on addressing broader nutritional problems as well.

*Mr. Parvanta:* Just a comment, and I wonder if you might be able to share your thoughts on this? I refer to the importance of sharing the stories of special successes with the partners who may not know that they are part of the partnership. We forget that they are partners especially with the private sector for example. How can the surveillance information be shared, as you mentioned the idea of monitoring and surveillance? As scientists or academics we tend to publish the results of scientific research, monitoring it in scientific journals and that is where it stays. I don't know how much of that information gets passed into the sectors that we are working with. I want to ask the colleagues from Nestlé for example, if you have an idea about how we might go as a public agency? What do you think are options for us to share; in what format to share such information with the food industry such as yours, for example, in various parts of the world?

*Dr. Guesry:* Every morning our managers at the top level receive nutritional information coming from at least 20 scientific journals.

*Dr. Mannar:* I would add that in this era of high-speed communication we should be able to very rapidly synthesize information and then transmit it as widely as possible or make it available. This is perhaps the role of institutions like ours (MI) and CDC.

*Dr. Hurrell:* I would like to talk about biofortification, you mentioned that it is a strategy of the future, but your crystal ball was only gazing to the next 10–15 years. I would argue that it is going to take a lot longer than 10–15 years to get into biofortification. Plant breeding can only perhaps double or triple the level of iron or zinc in some of the staple crops, and this isn't really high enough, so we have to go to genetically modified organisms (GMOs), and we have to convince people that they have to accept GMOs. So how would you propose that we go about this?

*Dr. Mannar:* That relates to the broader issue of the safety and acceptance of GMOs. This is an ongoing debate which is reaching some kind of resolution. People tell me that the nutritional enrichment of crops could be one way in which you can demonstrate the necessity and the importance of GMOs, and it could in some way take off the negative perception that people have of genetically modified foods. But I agree with you, this is going to take anywhere from 10 to 20 years for us to see commercial products with significantly higher iron and zinc. I think you are going to see a marginally high iron and zinc content fairly soon in the next 5–8 years, but in order to meet the full requirement you are right, probably 20 years.

*Dr. Barclay:* Coming back to what industry could do, perhaps you could describe the program that was set up in the Philippines to encourage the food industry to move towards voluntary fortification?

*Dr. Mannar:* The Philippine Government has a fairly innovative program which is a seal of approval for any food that contains micronutrients at a specific level which they defined [2]. It is a way to get foods fortified as much as possible. But I don't know if it really addresses the problem of reaching the most vulnerable groups. There were cases of even hot dogs being fortified just to get the seal. I think the idea is good but the government has to aggressively promote it to reach some of the widely consumed lower priced staple foods as well.

*Dr. Barclay:* In this context, one of the projects we had in this program in the Philippines was the fortification of instant noodles, quite an inexpensive and widely consumed food product. We fortified instant noodles with calcium, iron, zinc and some vitamins; these products began to lose market share and this was thought to be due to fortification. In fact when we compared the competitors' product versus our own, we discovered that our product was inferior in terms of taste and consumer preference; it had nothing to do with the fortification. So coming back to what we are saying about quality, the products have to deliver a certain overall quality and the nutritional message alone will never be enough to ensure that the products are consumed by the target population. I would also like to ask Mr. Parvanta, what sort of information sharing do you have in mind in terms of collaboration between private and public sectors?

*Mr. Parvanta:* One of the ideas I had was more along the lines of a lot of national flour millers in that kind of sector, but I suppose it could even be national food processors or complementary food producers, a kind of the smaller operation that may not have as sophisticated scientists and people like that who receive scientific information as they would in Nestlé. So I was thinking that there might be some options whether they have newsletters or other kinds of simple information, whether it could be E-mails, I don't know if that is an option, but some way of summarizing some of the key pieces of information. But as far as I am concerned from the CDC perspective in United States, if we were to share that information within the United State companies, I would like to acknowledge the fact that not only the situation changed but also the role of the industry in that. So it is a way to acknowledge their

participation and collaboration and contribution, and to keep them motivated like that. Do you think that is even sensible to do?

*Dr. Guesry:* I am really sorry but honestly I don't believe that the solution of food fortification and the solution of these micronutrient deficiencies is a scientific issue. I think we know everything we need to solve it. The problem is political and financial, and we have very little influence on this aspect. So it is not because instead of 20, 30 people receive pieces of information that it will change anything. They know what they need to know. We were speaking of the commitment of the opinion leaders and politicians, and since the half-life of politicians is about 4 years, they don't care about their commitments. So I am not as optimistic as you are. In spite of knowing for 20 years or more what we have to do, we still do not progress very rapidly.

## References

- 1 Partnership for Sustained Elimination of Iodine Deficiency. US Update, Nov 2000.
- 2 Sangkap Pinoy Information Brochure. Department of Health, Government of Philippines, Manila.