Micronutrient Malnutrition and Poverty

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Introduction

In September 2000, the world’s leaders adopted the UN Millennium Declaration committing their nations to stronger global efforts to reduce poverty, improve health and promote peace, human rights and environmental sustainability [1]. The Millennium Development Goals, enshrined in the Declaration, consist of 7 specific goals: (1) eradicate extreme poverty and hunger; (2) achieve universal primary education; (3) promote gender equality and empower women; (4) reduce child mortality; (5) improve maternal health; (6) combat HIV/AIDS, malaria and other diseases, and (7) ensure environmental sustainability. The last goal also reflects the commitment of the richer countries to the success of these goals by developing a global partnership for development.

The recognition that each country must pursue a development strategy that meets its specific needs should be the starting point of every attempt to reach the Millennium Goals. The national strategies should be based on good data from proper monitoring and evaluation. Helen Keller International (HKI) has always put a lot of emphasis on monitoring and evaluation; since 1990 it has developed surveillance and data-collection systems in Bangladesh, Vietnam, Cambodia and Indonesia [2, 3]. These surveillance systems have led to a much greater understanding of the interdependence of the various causes of undernutrition.

This article will discuss the importance of defining the indicators of undernutrition in a very specific way and determine the best possible strategies to combat the various forms of undernutrition. It will also highlight the importance of micronutrient undernutrition both as an important cause of childhood and maternal mortality as well as a very sensitive indicator of changes in poverty.
Famine

It has long been recognized that inadequate food intake leads to weight loss and growth retardation and, when severe and long lasting, proceeds to wasting and emaciation. Famines are among the most dramatic causes of inadequate food intake on a large scale and have been reported since the 4th millennium BC in ancient Egypt. Throughout history, famine has struck at least one area of the world every few years.

The causes of famine are many, but they are usually divided into human and natural categories. Natural causes destroy crops and food supplies and include: (1) drought (prolonged lack of rain); (2) too much rainfall and flooding, and (3) plant diseases and pests. Human causes of famine are primarily political in nature, e.g., war, economic boycotts, etc. Although this division between man-made and natural causes has widely been accepted, a recent discussion questioned whether natural causes for a lack of crop production necessarily lead to famine, or that governments were responsible for not taking the right actions during those times. Sen [4], the winner of the 1998 Nobel Memorial Prize in Economic Science, stated ‘no famine has ever taken place in the history of the world in a functioning democracy’. He explained this by stating that democratic governments have strong incentives to undertake measures to avert famines and other catastrophes in order to gain public popularity and be re-elected into government [4].

Undernutrition

We can say that famines are responsible for major fluctuations in the prevalence of undernutrition throughout the world. However, millions of people, including 6 million children, die each year as a result of hunger. Of these millions, only a few are victims of famine but far more die from chronic hunger [5].

Although undernutrition has been known for centuries, it was only since the early 1900s that more scientific research has been carried out on this topic. In the beginning, most of the physicians were studying the phenomenon, and health workers in Latin America identified a clinical syndrome ‘distrofia pluricarential’ [6]. In the mid 1930s in Africa, Williams [7, 8] identified two diseases: kwashiorkor and marasmus. Kwashiorkor literally meant ‘deposed from the mother’s breast by a newborn sibling’ and turned out to be caused by a lack of protein [7, 8]. Marasmus was a classic form of undernutrition mainly caused by a lack of energy and therefore all other nutrients. These diseases were clinical entities and the public health people were struggling when they wanted to have a better insight on the magnitude of undernutrition in various countries and regions in the world. Therefore, anthropometry was developed, based on measuring weight and height and
assessing age. Data from a reference population were used to construct tables to which data from individual children were compared in order to assess whether they were undernourished, based on how much they deviated from the norm. Undernutrition was divided into three forms: stunting (low height-for-age); underweight (low weight-for-age), and wasting (low weight-for-height) [9].

The next question was how anthropometry was associated with the clinical signs of undernutrition. Various studies in the 1960s and 1970s examined this. Then, various studies assessed the relationship between anthropometric indicators of undernutrition and the risk of morbidity and mortality. Those studies were fascinating as they found that the various indicators (weight-for-age, height-for-age, and weight-for-height) had their own specific relationships with mortality and morbidity. Undernutrition was no longer defined by clinical signs but by anthropometry. Each indicator had its specific use and, although this was very useful for the nutritional scientists, it became more and more complicated to understand what undernutrition really meant [10, 11].

Initially, protein deficiency was recognized as a cause of undernutrition, but it became clear in the following years that a lack of energy was the main cause of undernutrition defined by anthropometric indicators. Based on these findings, Jelliffe introduced the term ‘protein-calorie malnutrition’, which evolved into ‘protein-energy malnutrition’ [11]. The green revolution, however, increased the global production of staple foods, and this is one of the reasons why the level of protein-energy malnutrition has decreased dramatically in the past two decades, specifically in Asia and Latin America.

**Micronutrient Undernutrition**

Since the beginning of the 20th century, many researchers developed knowledge about the importance of vitamins and minerals. Diseases like beri beri, pellagra, xerophthalmia and other deficiency diseases had been known for centuries, and careful laboratory and epidemiological studies revealed the causes of these diseases. The role of these ‘micronutrients’ in preventing infectious diseases was elucidated, and large-scale prevention programs were developed [12]. These programs ranged from large-scale home gardening programs to intervention with cod-liver oil in households and factories [13]. After the Second World War, antibiotics were developed and many of these preventive nutrition programs collapsed.

However, since the work of Sommer and West [14] on the effect of vitamin A on mortality, many researchers have re-searched the role of micronutrients in morbidity and mortality [15]. There is more and more evidence that micronutrients may play a critical role as one of the strategies to reach the millennium goal of reducing childhood and maternal mortality.
Definitions of Undernutrition

So undernutrition is defined in various ways, which sometimes leads to the notion that nutritionists do not have clear ideas about the problem of undernutrition. A report from the World Bank entitled ‘Does undernutrition respond to incomes and prices?’ stated in its introduction the following: ‘The attainment of adequate nutrition is an important criterion for evaluating the success of development policies. However, such evaluations have often been hampered by the fact that the measurement of undernutrition is fraught with both conceptual and technical problems. Most importantly, the nutritional requirements needed for good health vary across individuals and over time in generally unknown ways, and their intakes are typically also measured with error’ [16]. Although many nutritionists will disagree with this statement, it is absolutely true that it is very important for nutritionists to define its various indicators for undernutrition specifically so that there is no confusion among other professions who have to work with these definitions.

The problem of definitions goes further than clinical signs and anthropometric indicators; the Food and Agriculture Organization is using the term ‘undernourishment’ for its definition of world hunger. The percentage of a population that is undernourished provides information on the number of people within a population whose dietary energy intake lies below their minimum requirements. Although this indicator is a valuable indicator, it confuses the discussion about undernutrition even more [5].

Causes of Undernutrition

The discussion about the causes of undernutrition has always been and is a difficult one. The first and most important question is, what indicators are we using to define undernutrition? Then, it also depends on the profession dealing with the analysis. To tackle this problem, UNICEF developed a model, which includes many of the various causes that contribute to undernutrition [17]. It distinguishes the following levels of causes: the immediate causes; the underlying causes, and the basic causes of undernutrition. The immediate causes are lack of food intake and diseases. The underlying causes are fourfold: access to food; caring practices; access to health services, and the environment. The basic causes are the political and economic circumstances.

This model has contributed much to the understanding of the interdependence of the various causes of undernutrition. Traditionally, the nutritionists have always put a lot of emphasis on the caring practice component, which includes ‘lack of knowledge’ as one of the causes of undernutrition; the economists have put much more emphasis on food prices and the
availability of staple food; the public health authorities and experts on the primary health care services, and the social scientists on the socio-political background.

Analysis of the problem has consequences for the proposed intervention programs. A good lesson can be learned from the evolution of the education programs to reduce vitamin A deficiency. Vitamin A deficiency is considered to be one of the major public health problems in the world, specifically in the countries where rice is the main staple food. While xerophthalmia has been known since the time of the ancient Egyptians, the fact that vitamin A deficiency leads to increased mortality has only been established and accepted since the 1980s, after the important work of Sommer and West [14]. However, one of the first public health scientists in the field of vitamin A deficiency control, Oomen et al. [18] stated in one of their publications that it was very peculiar that vitamin A deficiency was endemic in those areas where vegetables, considered as major source of vitamin A, were abundant. The lack of knowledge among mothers was considered the major cause of vitamin A deficiency, because they did not feed their children the right amount of vegetables. Many campaigns were set up in the 1980s to improve the intake of vegetables by children and women in areas where vitamin A deficiency was endemic. Some of them have claimed to be successful in reducing vitamin A deficiency among its target group. In 1995, de Pee et al. [19] published an interesting paper, which has been confirmed since then by other studies that found that vegetables are a much less good source of vitamin A than previously thought. In fact it is impossible to provide children aged 6–23 months with enough vitamin A by giving them mainly vegetables as a source of vitamin A [20, 21]. Because of the much lower bioavailability of vitamin A from vegetables and fruits, animal products have become more essential as a dietary source of vitamin A than was thought before [20, 22]. This also explains the early observations from Oomen et al. [18]. These findings had consequences for the strategies to combat vitamin A deficiency throughout the world. Animal products are expensive and poor people can hardly afford any of these products. Vitamin A deficiency became a problem of poverty and not of ignorance. Home gardening programs are still considered effective strategies because they also increase the income of women of poor households, but more emphasis is now being put on animal husbandry components of these home gardens. Supplementation and fortification programs are now seen as the most cost-effective strategies to combat vitamin A deficiency in the short and medium term [23].

Therefore, the bioavailability of vitamin A in vegetables is a problem at the immediate cause level, and had consequences for the shift in emphasis on causes from ‘caring practices’ to ‘access to food’. The role of home gardening in reducing vitamin A deficiency has shifted from addressing the underlying cause to addressing a basic cause by providing more income. However, despite the fact that vitamin A deficiency and other micronutrient deficiencies are
clearly a poverty problem, many agencies still carry out programs that have behavior change as its key strategy [24].

**Rice Prices and Undernutrition**

In 1994, Bloem et al. [25] showed in an early analysis, using the Helen Keller International (HKI) nutrition surveillance data of Bangladesh, that there was a strong association between rice prices and undernutrition defined by weight-for-age. A follow-up analysis by Torlesse et al. [26] showed similar results after 10 years of data collection. The intake of rice during the period 1992–2000 did not change and the main fluctuations in the prevalence of low weight-for-age could be explained by the changes in the expenditure and consumption of non-grain food items. Expenditure on these items was higher when rice prices were lower and the prevalence of low weight-for-age during such periods was found to be lower. These reports thus describe the relationship between the basic (economic) causes of undernutrition and the outcome (underweight), and have hypothesized the following mechanism of the relationship. The immediate cause of undernutrition, measured by a low weight-for-age, is a lack of intake and/or diseases, e.g. diarrhea, respiratory diseases, etc. In countries where seasonal food shortages exist as in Bangladesh, women and children have a chronic or periodic lack of energy in their diet. When the total food intake lacks in quantity it also lacks in quality, which means a shortage of micronutrients. The main cause of this is that these women and children have limited access to food mainly because they cannot afford it for economic reasons or because of natural or man-made disasters. It is very interesting to observe that households always try to maintain their energy intake in the sense that they try to maintain the same intake of their staple food. When there is economic distress, they will reduce consumption of all other products so that they can consume the same amount of their staple food in order to maintain the most optimal energy intake. However, this still results in a lower energy intake as well as in a lower micronutrient intake, which results in a lower weight-for-age among children. This lower weight-for-age can thus be due both to a lower weight gain due to the lower energy intake, mainly from non-staple foods, as well as to less linear growth because of the poorer quality of the diet.

There are, however, also countries and regions where there is nearly no chronic or regular periodic lack of energy in the diet and where the quality of the food is the main bottleneck to further reducing undernutrition. Indonesia, Thailand, and many Latin American countries are good examples. Under the circumstances in these countries, undernutrition defined by low weight-for-age is mainly determined by lack of linear growth, also called stunting. Linear growth is much more dependent on the right mix of micronutrients and it is interesting to see that the progress in the reduction of stunting has stagnated.
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in those countries where animal products are still not consumed by all strata in the society. The immediate cause is a lack of quality food, such as animal products and fortified foods, in the diet of women and children. However, the role of ‘caring’ practices becomes more important because households can now make decisions about the best mix of quality foods within reach of their budgets. While people have a good feel for maintaining energy intake as long it is possible, it is a much more difficult task for people to achieve or maintain consumption of an adequate mix of quality foods. Furthermore, food taboos and foods forbidden because of religious reasons make these choices even more complicated and limit the possibilities of further increasing the quality of the diet. While a right mix of micronutrients is important for linear growth and a stagnation in the reduction of stunting indicates a lack of micronutrients, such trends only become visible after a while because linear growth does not respond quickly to changes in diet. A more sensitive indicator to a sudden lack of micronutrients in the diet is the hemoglobin concentration, or the prevalence of anemia, especially among children.

Asian Economic Crisis

In September 1997, the Thai Baht was devaluated and it was the beginning of the Asian Economic crisis and the fall of the Asian Tigers. Although many economic indicators in the region have shown improvement since then, the effects of September 11, 2001, and the global recession have not helped the region either. In 1998, HKI reacted in Indonesia by setting up a continuation of a surveillance system which had been in place between 1995 and 1996. Using these data, HKI was able to compare health and economic household indicators before and during the crisis in one province, Central Java in Indonesia. Central Java is a province with about 50 million inhabitants.

Bloem and Darnton-Hill [27] reported the early results and showed similar results to those found in Bangladesh. The rice prices increased as a result of the crisis and the effect was that the expenditure on non-grain food items decreased, resulting in an increase in micronutrient deficiencies, indicated by an increase in the prevalence of anemia [27]. They showed an increase in maternal malnutrition but did not observe an increase in undernutrition measured by weight-for-age [28]. The urban poor were more affected than the rural poor but later analysis showed that the rural poor were also suffering but to a lesser extent [29]. Despite these results there were many debates in 1999 on whether the Asian economic crisis had an impact on health and nutritional status among the poor populations.

The HKI Health and Nutrition Surveillance System in Indonesia expanded to 12 sites in 1999, and is still in operation. The follow-up data between 1999 and 2003 showed that both childhood anemia and maternal malnutrition are very sensitive indicators of economic change.
Conclusions

Undernutrition is a major problem in the world, independent of the indicator that is used to define it. Millions of children, women, and men are affected by a lack of food resulting in many forms of undernutrition, including micronutrient malnutrition. The problem of micronutrient malnutrition is not only restricted to the developing countries but is also prevalent among the poor in the richer countries including the USA [30].

While child anthropometry has traditionally been used as the most sensitive indicator for food distress, micronutrient deficiencies such as iron deficiency anemia and vitamin A deficiency, seem to be more sensitive indicators during economic distress, specifically in those countries where energy deficiency is no longer the bottleneck of the food problem.

It is therefore recommended that hemoglobin levels should be routinely measured in surveillance systems in both developing as well as developed countries to measure the potential impact of economic changes on health and nutrition.

References

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Discussion

Dr. Abrams: You mentioned child mortality as a marker of the overall situation. How does it follow the same trends as in Indonesia and in Bangladesh? It is one of the things that public policy makers always look to as an end point because it is very easy. It doesn't follow these trends as closely, is that true?

Dr. Bloem: In Bangladesh child mortality has reduced quite dramatically. The Banks have said that the progress Bangladesh made is great, though still far from enough. Actually that is the message, both for child mortality as well as looking at the malnutrition rates. In Indonesia we didn't have data on mortality at this particular time, and I think this is a pity but we didn't collect the data. What we have seen in Indonesia besides these data is that there was an increase in severe malnutrition in pockets – not like Bangladesh – which we hadn't seen. So suddenly we saw these children who were severely malnourished, and if that is the tip of the iceberg, there may have been increased mortality during that particular time, but I don't have the data.
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Dr. Pettifor: You made a throwaway line very early on in your statements saying that these effects seen with the crisis had no relationship to all the UNICEF-type programs of immunization and growth monitoring and all those programs which are built into the health systems. What you are saying is that we have to fix food prices because that is the major determinant of the things that you were looking at, and then we get into the system of saying fixing food prices is an untargeted global sort of event that should be taken within a country, which in fact costs or could cost governments considerable amounts of money. They eventually get to the stage where food prices are being kept so low that when they lift these fixed food prices there are suddenly major calamities within a country. Would you comment on that?

Dr. Bloem: It is always good to put that in so that people will react. Talking about rice prices for example, I don't know what happens in Africa or in Latin America, but I know that rice prices, global rice prices, are lower than the rice prices in Indonesia. In most of the countries, the government puts a tariff on it, so they pay more to the farmers, they subsidize the farmers. They don't in fact subsidize the poor; they have subsidized programs to support the poor. So on one hand they put a tariff on it and on the other hand they have that system. Again, I am not a food economist, I don't want to go into that, but I know there is a big discussion in Indonesia. For example some people are saying lower the food tariff and another group for political reasons says no, we have to support the farmers. One argument about this is that, for example in Bangladesh, only 15% of these farmers are net producers of rice, so when I show you the data from Bangladesh, that makes a lot of sense because most of these people are landless. In Indonesia the percentage is a little bit higher, about 30%. So you support 30% but most of the poor are actually not net consumers of rice. The issue of our health programs is a little more complicated because in fact what I am saying is not true. The relationship that I show is the better one which you have to look at. Within the better relationship of course there are health programs and health interventions, so this relationship is based on economic situations. But at the same time you can make optimal use of what is available, if you are allowed. That is why the last part of my presentation is about whether the countries, the International Monetary Fund and the World Bank allow you to do that. Kerala, Sri Lanka and even China are great examples. The difference between India and China was during the time when economic development was not very great in both countries. India invested a lot of money in a very highly qualified, top level of schooling so they have great scientists and great top people. As a consequence of course there is a brain drain because people would move to the United States or to England or to Western Europe, where they are relatively cheap to hire. But they didn't invest much in the schooling of the poor. China did it differently. They invested in schooling at all the different levels, when the economy was not very great, but the moment they started to switch to an open economy they were ready for it, and that is why you can see that they have moved quite dramatically. In India they are improving a lot of course, but not in similar way as China. The Kerala situation shows clearly that in fact when you invest in education and in health care, despite the fact that your gross national product is relatively low, you can still have a very dramatic effect. One of the issues is the transfer money. If you look at the total income of a country, there is a certain amount which is funded back to the population. For example in Holland, we pay a lot of taxes and a lot of funding goes back into social policies. In other countries, where they believe much more in private decision making on welfare issues, the level is much lower. So that is a factor which influences outcome. Programs like those of UNICEF take part in this transfer money, and I think it is a philosophical difference between, for example, Europe and the Unites States, and of course that reflects in how we support certain countries in this policy.

Dr. Tolboom: I am impressed and confused because urbanization is a process we can’t stop and you said we get locked in cities, winners and losers, so everyone loses.
You showed that if populations are poor then the diversity of food is decreased and staple uses increase. So there is perhaps some promise if we fortify staple foods, because diversity is impossible for the poor who depend on staples. The food price must be guaranteed. We are not economists so perhaps we are not asking ourselves the right questions.

Dr. Bloem: As I showed in Bangladesh, it is the green revolution which increased the amount of rice produced per square meter. That is part of globalization if you follow the global market, and the next step in this is of course biotechnology. I am not going into that because there is a lot controversy about this issue, but at least it is something which people are discussing. So following an open market most probably helps the cost. It is not the lack of staple food in the whole world at this particular time, but the countries defend themselves by saying that they are in a situation in which they would like to support their own systems. So I don’t know the answer to that question. But I see the tension in Indonesia between people saying just open the market and see that will help and people saying no, it must be done in sequence. For example, the financial market is still closed, but the market for rice is open. So these are the issues which people are discussing and I don’t have the answer for that. To look at the solutions we have to offer, let’s go back to our field. We have food fortification, we have supplementation and we have horticulture to a certain extent because in urban areas that would be quite difficult. Those are great solutions. Fortification is one way to go. However, we have to think this through very carefully because it doesn’t fit all that is one of the main problems. In Bangladesh you can’t find the food. A lot of these experiments worked in Latin America because they have wheat as a main staple food; in Africa maybe that is possible, but rice fortification has not been successful yet so we must put a lot of effort into these technologies to do these kinds of things. I am not pessimistic, I am just saying that we should not forget what is the reality today and how can we fit our work into this reality. That is the message, the fact that we have only one economist in the world who tries to translate the work we are doing in micronutrients for the World Bank, that is actually not a very positive sign. When Dr. Semba and I were working on our book (Nutrition and Health in Developing Countries) we had to find someone doing this work. Dr. Horton was not able to do this part, but we could not find anyone else. That means we need more people who can translate what we are doing, not only to the Minister of Finance but at the top level. I think we have a moral obligation to do so because the work we are doing is in principle to support these kinds of activities. So I am not pessimistic, I am just saying don’t be unrealistic, don’t be like an ostrich.

Dr. Horton: There are a lot of very interesting data and big ideas in your presentation but I will ask you a question about a smaller topic. I was very struck by the data on anemia and the urban rural differences for Indonesia and I was actually very surprised, I wouldn’t have predicted that. I wanted to ask you if you have seen that same trend where the urban areas are worse in other countries during normal times, not in conditions of crisis, and secondly why do you think it is, is it primarily lack of dietary diversity in urban foods or is it health issues or what do you think causes this surprising finding?

Dr. Bloem: Many different urban areas have been analyzed and in fact the stunting levels are always lower than in the rural areas in most places. Only in Bangladesh the opposite was found. So Indonesia is not an exception to that rule. The only point is that, what I showed are the anemia levels which are still very high. We know that they consumed a lot of fortified food. Before the crisis, there were fortified noodles. They used processed food for the children. Suddenly because of the crisis they couldn’t afford it anymore so they went back to some traditional food like rice, and didn’t use fortified or processed products anymore. In urban areas the food is not the same as in rural areas; more processed food is eaten in urban areas. I think most of the time it is
better than the food they eat in rural areas. So that is the explanation for why you see such an increase. There is still not much investment in Indonesia since the crisis, hardly any. Because it is a big country there is a kind of internal economy coming up, but of course it is a different form of economy. So there is an improvement but the improvement is not as dramatic as what we have seen in the past 10 years.

**Dr. Guesry:** In your presentation you spoke about rice price and availability and vitamin A deficiency, but you did not mention even a word about the golden rice project. In your answer to Dr. Tolboom you very briefly alluded to genetically modified organisms (GMO) and said that you didn't want to discuss it. Everybody knows that GMO would be a way to improve productivity, to decrease cost, to improve the nutritional value of these products, and many countries like China, India, Brazil have understood this. I do not understand why are you so shy, what is taboo about genetic engineering. If we can't discuss it in this type of setting where we are all open and scientists, then how can we discuss this issue?

**Dr. Bloem:** First of all, I am not an expert in this field but I believe that if you are realistic, there is no other way to go. However, I know there is a lot of discussion about it and since I am not an expert in this field I don't want to touch it because I would then have to defend or attack a certain policy on this. But I know it is a big topic. At the last INS meeting in Austria, it was a topic and thousands of people are discussing it. When I look at the data I think we have hardly any other way to go. I don't see any other solution than improve the quality of our products because, as we said yesterday, supplementation at this scale is almost impossible, so you have to do it through food and then we have this solution.

**Mr. Parvanta:** I suppose in any economic situation it is a matter of making choices, and you showed that obviously there was a difference. During the crisis there was a change in dietary patterns or at least in the selection of foods that people consumed. Do you know if there are any data on non-food products such as cigarettes or what I would consider non-essential consumer goods that people would still use in many ways, whether there are any patterns on that? I feel that there is some work to be done on making consumer choices, influencing consumer choice with regard to food and nutrition.

**Dr. Bloem:** That is a good question. We have looked at all these issues because one of the principles is, when you use the UNICEF conceptual framework, you look at food access, caring practices, health infrastructure, and socioeconomic issues. In Indonesia there is an incredible tobacco industry. It is one of the places where you can still see the most beautiful advertisements and you would love to smoke at the end when you see all those advertisements. So we looked at that and in fact after the crisis it was very interesting. Among the poor, the people who normally would buy a pack of cigarettes moved away from that. Ten years ago in Indonesia, you didn't have to buy a whole pack, you could buy 1 cigarette, and you pay for the cigarette and you smoke, or you buy 2 cigarettes. And that happened again. So people didn't stop smoking but they didn't buy whole packs. So it is true that even that had its effect. But we looked at this for policy reasons, and we said if you don't smoke at all and you spend that on the consumption of health products, you would save your child. But realistically people also like to enjoy life; even when they are poor they make choices not only based on the fact that they want to survive. There are a lot of other things in life.

**Dr. Zlotkin:** Thank you for taking on a difficult topic, quite related to what we were talking about in terms of the implications in ideology of micronutrient deficiencies. If I understood you correctly a lot of what you were saying had to do with food security, and the four components which influence food security to a large extent are economy, war, the weather and political instability. No matter how much we want stability in terms of those four conditions, we can't influence them very much and I think that no matter what we want, these things are going to continue in our lifetime. But with regard
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to micronutrients, at least we do have the opportunity to invest, if I can use that analogy, and possibly put some of the investment in a bank, and for some of the micronutrients like the fat-soluble vitamins, iron, vitamin A, we can in fact increase our stores and put it into the bank. The only way that we can increase our stores, recognizing that there is going to be a time of food insecurity, is in fact by either a major emphasis on food fortification during times of stability and maybe in fact thinking more about increasing the value of our plant crops possibly through GMO. Can you make any further comments and perhaps mention something about GAIN or the other international initiatives to bank some of the micronutrients in light of the food insecurity that is likely going to occur.

Dr. Bloem: When I was preparing this presentation, I looked through one of the text books of nutrition and there was a chapter by Carp, from Columbia University in New York, and he presented a very interesting story about micronutrient deficiencies among the urban poor in the US. I thought that was very interesting because in the countries we live in, for example the Netherlands or the States, although we have fortified products, supplementation, all the support of the health care system, we still find micronutrient deficiencies among the poor. Coming back to your question, yes, GAIN is a fantastic initiative. I think GAIN is the exception and it is really interested in making a difference in the lives of poor people. Whether GAIN is the most optimal group, I think it is a great initiative and I think it is good something has started. The danger of this initiative is that we always work only with governments. What we need to do is also to involve the private sectors in countries. It is very important. For example, there are two fortification projects we do with Heinz and a Western university, and the counterpart in the country itself is a non-government organization (NGO) involving technicians. So all these people have been brought together and that is actually very important. So I think GAIN is a great initiative and I hope they will involve all the different parties in it.

Dr. Gebre-Medhin: I am quite sure you are aware that these issues of food supply assistance, nutrition, etc., have been very eloquently discussed by Sen in his monumental work. He has also taken up the issue of urban rural dichotomy. In fact I very strongly believe that one of the interesting things with these analyses is that the increases in food price are very insignificant. These nations are nearly all net exporters of food. I think in this presentation governments are getting off very easily; I think we must get back to this issue very strongly. You mentioned Ethiopia and the World Bank. The main reason for the World Bank not giving Ethiopia the money was not because they didn’t believe in their program but because nearly all of the NGO work and international support were used for very destructive wars, extremely destructive wars. Your main message was that in crisis micronutrient intake goes down. You also said food intake generally goes down in special groups. Is the solution fortification with micronutrients?

Dr. Bloem: I personally believe that we have to explore this further. Biotechnology is extremely important and I don’t think that fortification itself is the solution alone. I don’t believe in a single solution. All these activities are important. Let me give you one example about iodization of salt which is a success story. Looking at the data from Indonesia, you can see that even before the crisis – I am not talking about after the crisis because it is collapsing now – but before the crisis, we had an extremely successful program which almost went to 95% coverage in certain places; of course not in every place but a lot of places. But then if you analyze who is not receiving iodized salt, we are talking about the 5–10% of the poorest in that population. In a place like Indonesia, where you have over 200 million people, it is quite a dramatically large group. So the Indonesian government also thought we need to do something else, we also need another form, injections or capsules or whatever, to supplement this activity. But because all the driving forces were only looking at iodization of salt and there was

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hardly any interest in supporting any other type of activity. That is one of the dangers when you say fortification is the solution. I think fortification is a major strategy, however supplementation has a role to play and also all the other potential strategies. We have to be open minded to really solve a problem with many differences in different places, even in different ecological situations. A solution that fits all doesn’t work in the world, but it doesn’t mean that we should neglect these important global strategies and those are very important to support.

*Dr. Villalpando-Carrión:* In Mexico we also have very long periods of instability, but if we don’t look at the nutritional problem as a stepwise problem, if you cannot try or make an attempt to modify the micronutrient status, if you haven’t solved a first issue like severe malnutrition, it would be naïve at some point to try to do both things, both steps at one time. I don’t know what you think about having different programs or different offers to different organizations, having a government subsidizing staple foods and NGO doing micronutrient fortification, could this happen?

*Dr. Bloem:* Let me state again, I am not supporting subsidized staple food. In fact it is the opposite, I believe that we need to open up so I am not for that at all. I don’t think that you can say let’s first solve severe malnutrition and then we will go to micronutrient malnutrition. They are happening at the same time. The data I showed you in Bangladesh, there is more severe malnutrition because there is an energy problem on top of the micronutrient problem; while in Indonesia the energy problem is much less than the micronutrient problem because there already is a different economic status level. But these problems are happening at the same time. I believe that we have to have comprehensive strategies, and the talk I gave today is actually to hopefully open the mind of the medical field, saying you have to communicate with other fields, bankers, economists, because if you don’t we are working in isolation. It is nice because by still publishing papers we can still have a career in our field, but it doesn’t solve the problems which we are facing. That is actually the message.