The Impact of High Food Prices on Maternal and Child Nutrition

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Introduction

Food prices have surged in the last two years wiping out global gains in poverty and hunger reduction achieved over the last two decades. The Food and Agriculture Organization (FAO) index of food prices rose by 9% in 2006, 24% in 2007 and has surged by 51% in the last 12 months. FAO forecasts that the world will spend US$1,035 billion on food imports in 2008, US$215 billion more than in 2007. This will severely strain the budgets of low-income food-deficit countries (LIFDCs) that will see their import bills soar by more than 40% this year (1).

The food price crisis is likely to have pushed at least 100 million people back into poverty in 2008 and erase at least four years of progress towards the Millennium Development Goal (MDG) 1 target for the reduction of poverty (2). The household level consequences of this crisis are most acutely felt in LIFDCs where a 50% rise in staple food prices causes a 21% increase in total food expenditure, increasing these from 50 to 60% of income (3). In a high income country this rise in prices causes a 6% rise in retail food expenditure with income expenditure on food rising from 10 to 11%. FAO estimates that food price rises have resulted in at least 50 million more people becoming hungry in 2008 (4), going back to the 1970 figures.

In April 2008, the United Nations Secretary-General established a Task Force on the Global Food Security Crisis under his chairmanship, composed of the heads of the United Nations specialized agencies, funds and programmes, Bretton Woods institutions and relevant parts of the UN Secretariat.The primary aim of the Task Force is to promote a unified response to the global food price challenge, including by facilitating the creation of a prioritized plan of action and coordinating its implementation. The UN has organized since a series of high level events and consultations. The special session at the Human Rights Council in Geneva in May on "The negative impact on the realization of the right to food of the worsening of the world food crisis, caused inter alia by the soaring food prices" is of particular importance since this was the first time the Council met at a special session to discuss a social, economic and cultural right and on a substantive theme such as the right to food. The June High-Level Conference on World Food Security: the Challenges of Climate Change and Bioenergy organised by FAO in Rome allowed member-states to make financial commitments to address the crisis. The High-level Task force released a Comprehensive Framework for Action (CFA) (5) in July.

This paper looks at the nutrition consequences of the food price crisis, particularly among women and children who are biologically the most vulnerable members of households. The nutrition status of individual household members is a product of food security, access to health and environmental sanitation services, and maternal and child caring practices. The paper provides a perspective on what the appropriate responses are for ensuring food and nutrition security in the face of rapidly rising food prices, in the context of contributing to the achievement of the MDGs and progressively realizing the human right to adequate food.

The consequences of rapidly rising food prices

The nutritional consequences of the 2008 food price increases are likely to be considerable for poor people, especially for net food purchasers in both urban and rural areas (60-80% of rural people in sub-Saharan Africa and Asia) (6). In any crisis, the first reaction usually is to save on food costs and cut down on non-staple food consumption, affecting the quantity, diversity and safety of diets, or to cut down on other critical household expenditures which may affect nutrition status such as health care. Within the household, women are especially vulnerable as they are usually the first to make sacrifices when the financial situation deteriorates. This eventually results in increased undernutrition and morbidity, among current and future generations, as well as impaired human capital, reduced productivity, and reduced economic growth in time

Women and children who have special nutritional needs are particularly at risk, with implications in terms of maternal health and well being, as well as the survival, growth and development of children (7). Maternal undernutrition, poor foetal growth and stunting in the first two years of life lead to irreversible damage across the course of life, including shorter adult height, lower attained schooling, reduced adult income and decreased offspring birthweight (8). Such damage may occur quickly, even among previously well-nourished populations as was seen during the Dutch famine of 1944-1945. More recent evidence from developing country settings confirms that rapid increases in food prices cause maternal and child undernutrition levels to rise relatively rapidly, with first effects seen in the mother (9). Furthermore deterioration in the quality of the diet causes the damage even before food shortages become pronounced. Even small variations in the micronutrient content of diets during pregnancy are associated with significant differences in foetal and infant growth. These issues and other biological evidence for the nutritional consequences of rapidly rising food prices are explored more fully in Box 1.

As the soaring food prices reduce availability of food at household and individual level, nutritional adaption may

occur in several ways (10). First through social/behavioural mechanisms (i.e. coping strategies as described in the following section). If these are unsuccessful, individuals will adapt physiologically, through for example decreasing activity to reduce energy expenditure, which will impact on productivity and therefore household access to food. In the last instance, irreversible biological/genetic adaptations may take place, such as those caused by maternal undernutrition as described above and in Box 1, with dire consequences that will affect generations to come.

Appropriate responses: understanding local coping strategies

In the development of responses to mitigate the effects of rapid increases in food prices, and to ensure the appropriateness and effectiveness of any interventions, it is important to understand what the local coping strategies of different communities are for dealing with such events. Coping strategies are the means people employ to master, tolerate, reduce, or minimize the negative consequences of changes in their environment.

The social/behavioural mechanisms for adapting to, or coping with, food shortages and increased food prices vary enormously depending on the social group and whether they are in rural or urban environments. These coping behaviours, many of which are learnt from previous generations, can be divided into “food based” and “non food based”.

Food based coping behaviours are usually the first line of defence, with reductions in the variety of foods consumed, and especially of more expensive items such as fruit, vegetables, meat and dairy products. Staple food consumption remains largely unchanged, although a cheaper staple may be consumed. As the crisis gets worse meals are reduced in size and frequency, first among adults and especially the mother, and then among children, and eventually even items such as grass, hay or sawdust may be consumed. In rural areas more and different foods may be collected from the fields and/or the forests. People may eat seeds instead of planting them, meaning that the next crop will not be harvested, and rural incomes and food entitlements will collapse. For the urban poor, even these coping foods may go up in price, as has happened in Haiti.

Non-food coping mechanisms include taking loans, selling assets, decreasing expenditures on health, education and other non-food items, and taking children out of school so that they can work, collect food or even be traded.

Understanding local coping strategies and the way that the local community deal with rapid increases in food prices, requires a community oriented approach. This is consistent with people-centred and human-rights based approach which has a strong emphasis on participation and empowerment and is central to the provision of UN development assistance (11).

Human rights entail both rights and obligations. In ratifying a human rights convention, States assume obligations and duties under international law to respect, to protect and to fulfil human rights: respect, that is not undermine, the rights of individuals, adopting a “do no harm” principle; protect these rights against infractions by third parties; and fulfil these rights, which may entail either facilitating the individuals or household efforts to improve their resources and opportunities to feed themselves, or as a last resort for those who are completely unable to do so, providing adequate food directly.

The nutrition conceptual framework[1] originally developed by UNICEF (12) was proposed as a tool to help orient problem solving discussions at all levels, including the community level, and in so doing to help to elucidate what the local coping strategies are. The conceptual framework includes three levels of causality. The immediate causes of malnutrition in are inadequate dietary intake and disease, operating a in a synergistic fashion with infections being more common in those with undernutrition and also contributing to the development of poor nutritional status. The underlying causes at household and community level concern access to food, health and environmental sanitation services, and maternal and child caring practices. Each of these three clusters of factors is an essential but alone insufficient condition for achieving nutrition security. The basic causes operating at the societal level include availability of natural resources, national income, education, and the adequacy of national infrastructure and governance mechanisms. In other words, the distribution of wealth, income, and political power is the ultimate cause of nutrition outcomes.

Appropriate responses: protecting and promoting nutrition security

Nutrition security means to be free from hunger and malnutrition. The nutrition security of a society is a reflection of the universal, indivisible, interrelated and interdependent nature of human rights. Nutrition security encompasses many rights, especially the right to adequate food, the highest attainable standard of health as in Arts. 11 and 12 of the International Covenant on Economic, Social and Cultural Rights (ICESCR), and the children's right to food, health, care as well as survival and development as defined in Arts. 6, 24 and 27 of the Convention on the Rights of the Child (CRC). Nutrition security also encompasses the right of mothers to appropriate services in connection with pregnancy, confinement and the post-natal period, granting free services where necessary, as well as adequate nutrition during pregnancy and lactation, as defined in Art. 12.2 of the

1. See illustration in Nishida et al on p.8 in this SCN News

Convention on the Elimination of all forms of Discrimination Against Women (CEDAW).

In order to minimize the nutritional consequences of rapid food price increases, short term priority measures are required to assist the most vulnerable households in order to both protect their diet, and prevent further de-capitalisation. Such measures should focus on net food purchasers, such as the urban poor, small subsistence farmers and the landless in rural areas, who are the most acutely affected by food price increases. Efforts should be made to enable them to access the food they need, if needed through social safety net programmes. An appropriate response to the food crisis should include both preventive and curative interventions as mutually reinforcing elements of an effective strategy, integrated in a comprehensive approach aimed at ensuring food and nutrition security. Short term food based approaches to ensure locally-appropriate diversification of household diets as well as increased availability of safe and affordable foods on local markets are an essential component of such a strategy.

Specific attention and support should be provided to people living with HIV and their families, as high food prices will put them at further risk of food insecurity. HIV and AIDS affected families experience a drop in household food consumption, whereas an adult living with HIV has a 10-30% higher energy requirement and a child living with HIV has a 50-100% higher energy requirement. A recent study in Botswana and Swaziland found that food insecure women were 50% more likely to engage in intergenerational sex; 70% more likely to engage in uncontrolled and unprotected sex; and 80% more likely to engage in transactional sex, thereby accelerating the propagation of the epidemic. Food insecurity was found to be a significant predictor of risk-taking behaviour among women, even after controlling for income, education and HIV knowledge (13). Good nutrition on the other hand reduces the risks of vertical transmission to an infant and reduces the body's susceptibility to sexually transmitted infections, further reducing HIV susceptibility when exposed.

Urgent attention should be given to support food and nutrition policy making at global and national level and the necessary dialogue needs to be initiated immediately. The present crisis requires, and provides an opportunity for, advocacy and awareness-raising on the need for synergies and urgent action. This should be based on a review of existing institutional arrangements an understanding of their implications in terms of priority setting, and an assessment of the strength of the political coalition for better nutrition (as compared to the constituencies for setting up other policy priorities). Also, as rights holders, poor and food insecure people must be given a voice and empowered to advocate for their rights.

It is particularly important to ensure the mothers right to adequate food and to health, as well as the right of infants to grow and develop. Where epidemiological evidence shows that food and nutrition security problems already exists and levels of maternal and child undernutrition are already high, then nations states should take extraordinary action to provide food and nutrients as appropriate, directly to pregnant and lactating mothers and/or their young children. Such "immediate level" interventions are aimed at the individual level as illustrated in the UNICEF framework, especially at the "window of opportunity" from conception to 24 months of age, the most vulnerable phase of the life course where growth failure is concentrated (14). These "short route" measures (15) to improving food and nutrition security are to be implemented on top of and not instead of the "long route" measures aimed at the underlying level of causality to improve the situation of the general population as a whole.

The interventions that should be considered for implementation in order to protect food and nutrition security, especially in response to a rapid rise in food prices are listed in Table 1. The appropriateness of the interventions will depend on the local situation, including current levels of maternal and child undernutrition, maternal and child caring practices, and the presence of diseases. The "triggers for action" are the prevalence levels of the condition that are considered either "severe" or "moderately severe", and that from a public health perspective require action to ensure that rights to adequate food and health are not being violated. This list of interventions draws on the recommendations agreed at the SCN 35th Session (16), which are largely based on the Lancet Nutrition Series set of essential nutrition actions (17) that if taken to scale would help accelerate the rate of reduction of maternal and child undernutrition. Evidently, these interventions are needed on the top of actions that address the basic causes of malnutrition concerning the distribution of wealth, income, and political power.

Food supplements should be provided to women during pregnancy and lactation, in food insecure areas, or where low birth weight rates are greater than 15%, which is already the case for about a quarter of the 82 Low-Income Food-Deficit Countries (LIFDC) identified by FAO (18), (19). In populations where more than 40% of women of reproductive age are anaemic, iron and folic acid supplements should be given to all women during pregnancy and lactation (20). A quarter of the 82 LIFDC have rates of anaemia among non-pregnant women of more than 40% (21), and with the food price crisis this will get worse. Iron deficiency anaemia accounted for 20% of maternal mortality even before the food price crisis (22). Anaemic mothers are rarely just iron deficient, but instead have multiple micronutrient deficiencies. For these reasons a multiple micronutrient supplement (MMS) that could potentially replace the iron-folic acid supplement has been developed for trial purposes (23). Although a joint statement has been issued on the use of MMS in populations affected by an emergency (24), there are no

recommendations yet on their use in non-emergency situations. The control of anaemia should also consider the control of infections such as malaria and intestinal parasites (25).

In order to ensure food and nutrition security for the infant and young child a first priority is the universal promotion of exclusive breastfeeding for the first six months of life, and continued breastfeeding and adequate complementary feeding through the second year (26). Three quarters of the 82 LIFDC have less than 50% exclusive breastfeeding among 0-6 month old infants, and the food price crisis will exacerbate the risks related to sub-optimal breastfeeding, for example if mothers start diluting substitutes. Suboptimal breastfeeding, especially non-exclusive breastfeeding in the first six months of life, already results in 1.4 million deaths each year and 10% of the disease burden in children younger than 5 years (22). In addition to facilitating community based efforts to promote breastfeeding, a nation state should also take steps to ensure that breastfeeding is respected by government procedures and throughout state facilities, as well as protected from the activities of third parties. The most important strategies for respecting, protecting, promoting and supporting breastfeeding are the Baby Friendly Hospital Initiative (BFHI) based on the WHO/UNICEF Ten Steps to Successful Breastfeeding (27) and the International Code of Marketing of Breast-milk Substitutes and subsequent World Health Assembly resolutions (28), (29).

In food secure areas or where wasting levels in children are less than 5%, behaviour change communication alone can improve complementary feeding and continued breastfeeding rates, as well as reduce stunting levels (17). The role of the state in such food secure areas is mainly one of facilitation and provision to disabled people and social cases. But only one third of the LIFDC have a wasting prevalence of less than 5%, which means that in the other two thirds of LIFDC the role of the state is, while continuing facilitate livelihoods, to also provide as necessary. In areas with food insecurity or where wasting is greater than 15% blanket provision of appropriate food supplements is needed. In addition, all children with severe acute malnutrition need to be treated with ready to use therapeutic foods (RUTF) that can be provided in the community in conjunction with facility based treatment, with much reduced case fatality. Even before the food price crisis there were some 20 million children with severe acute malnutrition globally, with one million dying annually (22). Clearly much more needs doing to deal with the problem of wasted children in non-emergency settings (30).

It is difficult to meet the recommended intakes of certain key nutrients (particularly iron, zinc and calcium) of children aged 6-24 months through complementary food mixtures without the inclusion of animal food sources. As these increase the cost and/or may not be culturally appropriate, the use of either fortified complementary foods or vitamin-mineral supplements is needed in most settings (31), and can help to mitigate the effects of the rapidly rising food prices. Even in developed country settings the prevention of anaemia in children has largely been achieved by fortifying complementary foods Around half of the LIFDC already had rates of anaemia in preschool children above 40% before the crisis.

Strong community participation is essential to ensure full coverage of the preventive and curative “short route” interventions described above that can help mitigate the impact of rapid increases in food prices and protect nutrition security. These interventions are best delivered by local community based mobilizers that extend selective preventive health service delivery to all mothers in their neighbourhood during pregnancy, lactation and early childhood (32). This outreach is best facilitated by health service staff such that training and supply with supplements is part of regular supportive supervision, and the reference for health facility treatments is ensured. Community based growth monitoring promotion provides a useful platform, that has been successfully used in many countries to mobilize community resources in favour of improved maternal and child survival growth and development (33).

Appropriate responses: protecting and promoting food security

A household is food secure when all of its members have access at all times to food of adequate quantity and quality, consistent with leading an active and healthy life. Access to food is an underlying determinate of undernutrition, and as such one that requires both short term and long term interventions in order to achieve food and nutrition security (34). Such approaches will clearly differ according to the local context given that constraints and opportunities will differ according to ecosystem, livelihood and economic characteristics.

In urban areas social protection policies and programmes are needed to provide safety nets that can cushion and mitigate the effects of poverty, especially when faced with rapid increases in food prices for example. Conditional cash transfer programmes link the transfer of cash to poor households with a commitment of the family head to keep children in school and/or for the mother and child to receive/make health service visits, i.e. the short route interventions described above. Cash transfer schemes can be targeted to poor women who are heads of households, and or to areas where the prevalence of women with low Body Mass Index (BMI) is greater than 20% (moderate and severe population risk).

Home gardens and distribution of plots for urban and periurban agriculture can also improve diets and strengthen livelihoods of poor urban consumers. According to the cities, such gardens can increase availability of, and access

to micro-nutrient rich foods, such as fresh vegetables and fruits, roots and tubers and meat and dairy products from small livestock, Community gardens also allow sharing of knowledge and constitute a good entry point for food and nutrition education.

In rural areas, it is essential to promote more resilient food systems. Agricultural policies should provide specific attention to homestead food production and best use of local biodiversity for both healthy diets and economic development. They should ensure year round availability on the local market of the variety of safe and affordable foods required, including staple foods and micronutrient rich foods such as fruits and vegetables and meat and dairy products. They should also protect and strengthen the livelihoods of the poorest of the poor. Women should be given priority both as actors and recipients of programmes aimed at increasing access to food, as they have a leading role in achieving nutrition security. For net-food buyers, direct transfers for income support can increase access to adequate food and stimulate the local economy

Part of the reason for the present crisis has been the increasing gap between agriculture policies and food policies, and the insufficient attention given to rural-urban linkages, in particular in terms of food practices, preferences and exchanges. This should be systematically incorporated into food and agriculture policy and planning with a view to more resilient, sustainable and acceptable food systems. In a context when the increase in food prices is due in part to increasing transport costs, sourcing foods from local agro-biodiversity can reduce dependence on the limited range of staple foods that are transported over long distances

In the face of food price crisis and food shortages school meals are important both for keeping children in school, as well as protecting school children from the effects of food shortages. School meals are especially important for keeping the girl child in school, as it is she who is most likely to be removed from school in the event of a financial crisis and/or to help increase food collection and/or harvest (research shows that investment in girls education helps improve child nutrition over the next generation). Schools can also provide a route for reaching the most vulnerable members of the community with food assistance, such as those that are orphans or that have HIV/AIDS and/or tuberculosis. School gardens can be used to cultivate foods and small animals. The fresh garden produce can contribute to the quality of the regular school meals. Gardening techniques and healthy eating habits can be transferred from the school child to the home, benefiting the entire family.

It is essential to increase resilience of vulnerable households and reverse the spiral of decapitalisation that each additional shock generates. A sustainable livelihoods approach providing integrated support to poor families can alone ensure both good nutrition and sound environmental management and prevent social disintegration. With increasing food prices and demand for land for bio fuel production, it is essential to secure people's access to natural resources and prevent property grabbing, in particular for women. rights as a pre-condition for food security, taking into consideration these emerging issues. This is particularly important for households with chronically sick or disabled members who require both livelihoods and psychosocial support,

There is a need to achieve a balance between investments in export oriented agriculture to earn revenues, and local oriented agriculture to guarantee production not just of grains, but of a diversity of foods for local consumption. It is increasingly recognized that poverty reduction strategies in the least developed countries, especially those with more than 60% of the population on less than a dollar a day, should first concentrate on engaging the poor in the production of foods for sale in the local market before investing in more intensive export oriented agriculture (35).The former will not only create localized income, but also contribute to assuring the quality of the diet available for local consumption. Improving the productivity of small farmers has a ripple effect that spreads benefits throughout poor rural communities, and stimulate urban economic activity as well. When small farmers have more money to spend, they tend to spend it locally on labour-intensive goods and services that come from the rural non-farm sector, boosting the incomes of the rural population as a whole, including landless labourers who make up a large proportion of the hungry and poor in many countries (36).

Conclusions

Rapid increases in food prices will cause maternal and child undernutrition levels to rise relatively rapidly, with the first effects more likely to be seen in the pregnant mother, leading to irreversible damage to the fetus that will persist across the course of life. Furthermore deterioration in the quality of the diet is likely to cause such damages even before food shortages become pronounced. Efforts to mitigate the effects of the food price crisis must therefore ensure that the right to food, that is adequate in quality not just quantity, is respected, protected and fulfilled. While such efforts are needed urgently, they should be placed in a development rather than only an emergency or humanitarian context, since this is not a new problem just the worsening of the existing situation, which was already serious.

From a rights-based programming perspective, every effort should be made to empower individuals working together at the community level to try to resolve their own nutrition problems during the food price crisis. The

underlying causes of malnutrition related to food, health and care at the household level, are ideally suited to resolution through collective community action, such as the creation of community-based crèche facilities by mothers who have to work for example. For the success of such efforts, individuals and groups at the local level must also be empowered to demand and obtain adequate services and support from the government, from the local to the national level. Linking the "short route" interventions from Table 1 with the "long route" interventions for ensuring food health and care, as appropriate to local conditions is the challenge for local governments. Building food and nutrition policy and programme experience from the bottom up can help identify state obligations in the right to adequate food, since while it is first and foremost the responsibility of individual right-holders to find their own solutions to feeding themselves, the state has a duty to facilitate through strengthening their capacity (37). In addition, an enabling international environment with clearly defined obligations needs to be created, as proposed by the Rapporteur on the Right to Food (38).

Achieving food and nutrition security requires a multi-sectoral approach, often involving many ministries. Local coping strategies to increased food prices will most likely affect all of the underlying causes of malnutrition, namely food insecurity, poor utilisation of health services and inadequate maternal and child caring practices, with implications for Ministries of Health, Agriculture, Education and Social Security. Ensuring the successful implementation of integrated strategies of all of these ministries at local, national and regional level requires a close integration with efforts to decentralize social development programmes. Establishing food and nutrition surveillance systems that can inform decision making at all levels, not just by central policy makers, is a first priority for all nation states. Such information can provide the elements of predictability and accountability that are required in a human rights based approach to developing national government responses to crisis, such as those provoked by the increases in food prices.

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Table 1: Essential interventions to ensure food and nutrition security outcomes during the food prices crisis across the life course*

Stages in the Life Course	Target Groups	Indicators	Triggers for action[39]	Interventions	Other Considerations
Pregnancy, birth and lactation	Women during pregnancy and lactation	Anaemia	> 40%	Universal Iron-folate supplementation and/or multiple micronutrient supplementation	-Deworming -Malaria (bed nets and presumptive radical treatment during pregnancy) - Smoking and air pollution
		Low Birthweight	> 15%	Food supplementation	
Infant and toddler	Infants (0-6 months)		Universal	Promotion of exclusive breastfeeding	-Code of Marketing of Breast-milk Substitutes -Baby Friendly Hospital Initiative
	Young children (6-24 months)		Universal	Behaviour change communication for adequate complementary feeding and continued breastfeeding	-Zinc in diarrhoea -Deworming -Malaria (bed nets)
		Wasting	> 15%	Food supplements targeted to wasted children Ready to Use Therapeutic Food (RUTF)	
		Anaemia	> 40%	Iron (or multiple micronutrient) supplements	
			> 5%	Fortified complementary foods (sprinkles)	
Childhood and adolescence	Preschool (2-5 years)	Anaemia	> 40%	Iron (or multiple micronutrient) supplements	
			> 5%	Fortified foods (sprinkles)	
	Schoolchildren (5-16 years)		Universal	Nutrition education School meals	
		Anaemia	> 40%	Iron-folate supplementation	
Adulthood	Women of reproductive age (15-45years)	Low BMI	> 20%	Cash transfers	-Teenage pregnancy -Too many pregnancies - Deworming - Malaria (bed nets)
		Anaemia	> 40%	Iron-folate supplementation	
	Others	Anaemia	Universal	Food diversification and food fortification	- Sicknesses (HIV/AIDS, Tuberculosis)
		Iodine deficiency	NA	Universal Salt Iodization	

* This table builds on previous efforts to define priorities for nutrition intervention and to define prevalence cut-offs which indicate when action is required and what those actions are, developed by the Institute of Medicine as well as the Commission on Nutrition Challenges of the 21st Century

Box 1: Technical note on maternal and child undernutrition and the food price crisis

The nutritional consequences of the food price increases are likely to be considerable, especially in poor urban populations of low income food deficit countries. Although economic improvements only produce slow reductions in child undernutrition rates (40), this relationship doesn't seem to be the same in reverse. Whereas women are usually the last to benefit from increasing income, when the financial situation deteriorates they are first to make sacrifices. This has special consequences because of the critical importance of maternal nutrition both for her own health and well being, as well as for the survival, growth and development of her children (7).

Food shortages are known to impact most acutely on women during pregnancy. The Dutch famine of 1944-1945 showed that even in a previously well nourished population that were receiving food rations, food restriction during pregnancy produced significant reductions in birth weight, length and head circumference. Third trimester exposure accounted for the whole of the famine effects on birth weight, which were apparent only below a threshold value of official food rations (41). Although the effects of the Dutch famine on birth weight were small (about 100g), many negative consequences of constricted foetal growth appeared, but only later in life. These included increased obesity (42), increased risk of schizophrenia (43), increased behavioural problems (44), and increased blood pressure and coronary heart disease (45).

Recent evidence from developing country settings confirms that rapid increases in food prices cause maternal and child undernutrition levels to rise relatively rapidly. During the Indonesian financial crisis in 1997/8 wasting increased in Javanese women, although without increases in child undernutrition, suggesting that mothers buffered children's food intake. An increased prevalence of anaemia in mothers and children was associated with a reduction in consumption of high quality foods. The combined effects were particularly severe for cohorts conceived and weaned during the crisis (9). The currency devaluation in the Congo in 1994 increased the price of imported staple foods resulting in increased wasting among mothers, more low birth weight babies and greater levels of stunting and wasting among children (46). In Zambia during the drought of 2001-2002, mothers who experienced high maize prices while pregnant had reduced Vitamin E and Vitamin A status and stunting increased among infants (47).

Our understanding of the nutritional consequences of food price crisis is also informed by new evidence that quality not just the quantity of the diet during pregnancy is important for successful birth outcomes. The consumption of more expensive micronutrient rich food (milk, green leafy vegetables and fruits) during pregnancy and erythrocyte folate at 28 weeks of gestation were found to be independently and positively associated with the size of the infant at birth in rural India (48). Even in developed country settings increased intake and/or status during pregnancy of antioxidant nutrients (Vitamin C and E especially) which largely come from more expensive fruit and vegetables, positively influences foetal and infant growth (49),(50). Multiple micronutrient supplementation, in addition to iron folate supplementation, during the latter part of pregnancy in thin Indian women (BMI<18.5) significantly increased birth weight by 98 g, birth length by 0.80 cm, and reduced early neonatal morbidity by 50% as compared to a placebo group (51). This small increase in mean birth weight meant that the incidence of low birth weight was reduced from 43.1% to 16.2%. Randomized controlled trials of iron-folate supplementation versus a true placebo in non-anaemic women during the latter part of pregnancy in the USA increased mean birthweight by 200g in Cleveland Ohio (52) and 108 g in Raleigh North Carolina (53). All of these studies clearly demonstrate that small variations within the normal range in the micronutrient content of maternal diets and/or maternal micronutrient status during pregnancy are associated with small but significant differences in foetal and infant growth.

Rapidly increasing food prices are also likely to cause nutritional insults very early in pregnancy that will influence later foetal and infant growth and increase stunting among those children that survive. The risk of delivering a low-birth-weight baby seems to be set in the first 10 weeks after conception and related to the maternal circulating concentrations of a placental protein, pregnancy-associated plasma protein-A (PAPP-A) (54). Prospective studies during pregnancy in Guatemalan mothers has shown that whereas birthweight is more influenced by weight gain in the second half of pregnancy, birth length is most influenced by weight gain in the first half of pregnancy (55). A recent prospective cohort study in the US confirms that variation in birth weight is determined, at least in part, by foetal growth in the first 12 weeks after conception, probably through effects on timing of delivery and foetal growth velocity (56). Adult height is largely determined by height at two years of age (57) and length growth trajectory during infancy is largely set in uterus (14), (58).

Indeed it may well be that the relatively small impact of food and micronutrient supplements provided to mothers during pregnancy (about 100g) is in part because they are normally provided only in the latter half of pregnancy, which maybe too late for maximal effect. A diet that is adequate in quantity and quality that is available and accessible for the whole population will help to ensure peri-conceptual nutrient status of the mother to be, thus contributing to improved foetal and infant survival growth and development. Sustainable efforts should be made in this direction which needs a strong partnership between agriculture and health sector.