

## The Links Between Nutrition and Agriculture In South Asia

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A literature review was conducted using both Web of Science and Google Scholar. Both search engines have the ability to return results listing “times cited.” NGO and governmental websites were also searched, including IFPRI, USAID, FAO, World Bank, and USDA. A number of keywords were searched, including but not limited to:

- Agriculture and Agricultural Productivity
- Nutrition
- Hunger
- South Asia (and specific countries)
- Growth and Economic Gains
- Women and Children

### **Literature Review Findings**

There is substantial evidence that the Green Revolution successfully raised agricultural productivity in South Asia. The introduction of new rice and wheat cropping systems in the 1970s significantly raised dietary energy supply. Prior to the Green Revolution, half of the Asian population did not get enough to eat; today the percentage has fallen to one fifth (Conway, 2003). However, the onset of the Green Revolution has also been accompanied by a transition in staple crops from micronutrient-rich crops (fruits, vegetables, pulses, etc.) to carbohydrate-rich cereals (Welch & Graham, 1999). Cereal production in South Asia has quadrupled since 1970 while the production of pulses (starchy legumes such as chick pea, lentil, and mung bean) has fallen nearly 20%.

Less is understood about how, or under what conditions, increased agricultural productivity translates into increased consumption and improved nutrition. In theory, increased productivity allows for more consumption (particularly for food insecure individuals) or income via an increase in the yields of existing crops, or from the opportunity to diversify with new crops or otherwise redirect “freed up” land and labor resources. But establishing the link between productivity gains and increased consumption (and income) is confounded by policies and pressures that change

relative prices across commodity markets. Haddad (2000) writes that the price of rice in Bangladesh fell 40% (inflation adjusted), due to production gains over a 25-year period. This led to greater consumption and should have allowed for a relative rise in incomes and more available household dollars to be spent on high-level goods (micronutrient-rich goods including dairy, vegetables, fish, etc.). However, production in high-level commodities did not keep pace with the other goods. One macro-level failure cited in South Asia was an ongoing focus on price support policies for cereals to increase output despite a market decline in the share of cereal consumption (Pingali & Stringer, 2005). This policy discouraged the production of micronutrient-rich goods. These supply-side responses, together with demand side pressures including continued rapid population growth and income gains, pushed up prices for high-level commodities.

Linking increased consumption from agricultural productivity to nutrition is likewise complicated. Academics and others have pointed out the problem of “hidden hunger,” referring to the lack of nutrient quality in food. Hidden hunger can be caused by agricultural policies, exogenous price changes, or low household purchasing power that affects food and cropping choices; or by poor soil quality (particularly for iodine deficiencies), poor water quality or infectious diseases such as helminthes or malaria (particularly for iron deficiencies) that affect the nutritional value of foods or the body’s ability to use the nutrients (Ruel & Levin, 2000). Hidden hunger is often cited as contributing to health problems, lower labor productivity levels, and diminished well-being (Welch & Graham, 1999). In turn, lower labor productivity can diminish agricultural productivity (Deolalikar, 1988). Women, especially during pregnancy, and children, are particularly affected by hidden hunger.

Macroeconomic changes in the supply of, and demand for, food are not the only determinant of an individual’s nutritional status, and several microeconomic and intra-household factors also contribute. At the immediate level, nutritional status can be visualized as the result of dietary intake (including quantity and quality) and health status, as shown in the adaptation of the UNICEF Conceptual Framework for Nutrition shown in Appendix 1 (Smith and Haddad, 2000). Whether implicitly or explicitly, an increase in household agricultural productivity is normally theorized to improve nutrition through improving the amount and/or quality of food available to household members, or by increasing the household income available for food and health purchases (Bouis, 2007). Studies have shown that increases in household income affect both caloric and nutritional intake. Income effects show small positive increases in consumption for poor households in vitamin A rich vegetables and more significantly in high-level goods such as eggs, fish, meat, dairy, pulses, and fruits. Iron-rich foods (such as fish and meats) and Vitamin C rich-vegetables and goods are the most common consumption increases associated with rising income (Bouis & Novenario-Reese, 1997). Some of the most successful agricultural interventions in relation to nutritional status have been home gardening interventions in Bangladesh, which raised production of fruits and vegetables, allowed for year round availability of these goods and raised incomes (Ruel & Levin, 2000). As shown in these cases, increased productivity and diversity of food production, and rising income can have positive effects on individuals’ nutritional status.

However, as shown in Appendix 1, in addition to dietary intake a variety of other health and non-health indicators are important, and influences may intervene at any three levels of causality for child nutrition: immediate, underlying, and basic. Household decisions may, for example, be impacted by size and purchasing power of the family, the availability of healthful foods, food preferences, ethnic traditions, and homemakers' educational levels, as well as health-related variables such as whether or not a child has a disease that inhibits nutrient absorption. These influences may augment, dampen, or inhibit the impact of improved household agricultural productivity on an individual's nutritional status.

Intra-household dynamics are also important. In South Asia, the intra-household distribution of food has traditionally favored males, who receive the greatest share of high-level commodities such as meat, eggs, milk, and certain types of fruits and vegetables. Bouis (1997), in his analysis of dietary patterns in rural Bangladesh, found that only leafy vegetables were distributed more commonly to women, because they were considered a low-status food despite their nutritious qualities. Haddad (2000) also found that men and women have differing priorities about how to spend family income and men generally wield the most influence due to cultural norms and economic earning power, which continues to favor males in rural households. Household consumption patterns favoring the economic earning household member (primarily the male in South Asia) can reinforce multi-generational inequities, where maternal malnutrition leads to child malnutrition and lost future labor productivity. Unfavorable intra-household distributions and rising prices as a result of increasing demand are generally cited as two major reasons for maternal and child malnutrition (McGuire & Popkin 1990).

Because of these complex interactions, more immediate biomedical interventions may be more often proposed for nutritional interventions. A three-part *Lancet* series from this year summarized biomedical approaches to maternal and child under-nutrition in the developing world, and explored a variety of short-term strategies that were found to be successful in different contexts, including food supplementation, micronutrient interventions, and education about breastfeeding and complementary feeding (Bhutta et al., 2008). In the longer term, they recommended supplementing these strategies with improvements in the underlying determinants of poor nutrition, such as poverty, poor education (particularly of women), disease burden (including water/sanitation diseases), and lack of women's empowerment.

Agricultural interventions are also suggested, often driven by a sense that these interventions may be more likely to be sustainable over the long run (though data is not often collected for long enough to determine whether these interventions are, in fact, sustainable). A general consensus within the literature is that nutrition education is an important component of successful nutrition interventions, including agricultural interventions. Berti, Krusevec, and Fitzgerald's (2003) review of 30 agricultural interventions in developing countries found that most of the interventions increased agricultural production but did not generally improve nutritional status. Some, but not all, interventions improved intermediate indicators such as household consumption. Programs that invested in human capital (especially nutrition education and consideration of gender issues) were more likely to

be successful, as were those that invested in all five types of capital (natural, human, physical, social, and financial). Home gardening projects were also more likely to be successful, though since nearly all of these interventions included nutrition education and were gender-sensitive, it is impossible to tell whether home gardening projects are an intrinsically strong intervention. Talukder et al. (2000) cites education as one of the reasons for success in the Bangladesh home gardening program and cites counseling to change consumer behavior as a critical aspect to any food-based strategy. But as Berti (2003) notes, there are also examples of interventions that used education only (with no agricultural intervention) to successfully improve nutritional status.

A significant portion of the literature discusses a multi-pronged, sustainable approach to addressing the problem. In addition to improving access to health services and strengthening child feeding and caring practices, agricultural interventions include employing biotechnological solutions, plant breeding, and education. Included in these approaches are nutrition fortification programs for women to promote increased economic potential and maternal health (McGuire, 1990). Food-based agricultural interventions, often paired with nutrition education, have also been used as a strategy to address nutrient deficiencies (Ruel & Levin, 2000).

Bouis (2007) advocates for a sizeable investment in plant breeding research to create staple crops that are more nutritious (especially Vitamin A-enriched rice). While the investment is long term and will not immediately solve the hidden hunger issue, supplementation/fortification programs are equally costly and have no long-term return. Fully supplementing just one of the four major nutrients (Vitamin A) in South Asia would cost \$50 million per year. Haddad (2000) advocates for significantly increasing investment in efforts to raise the productivity of non-staple micronutrient-rich crops. Specifically, he suggests investment in crops whose relative price has increased over time. This theory is consistent with Welch's analysis that demand and rising prices for micronutrient-rich goods are significant obstacles for the rural South Asian population. Haddad also posits that there are continued gains to be made in plant breeding, and that a targeted investment could pay dividends within a ten-year period.

There is relatively little rigorous empirical work to inform the policy debate and resolve disagreements. There is scant literature that can empirically attribute household level nutritional and distributional impacts (among women and children) to particular policy changes, such as land titling, agricultural infrastructure development, or education. On a household level, there are relatively few evaluations of specific agricultural interventions that assess nutritional impacts, the distribution of food and nutrients among households, or the relationship of nutritional benefits via agriculture to clean water and sanitation access. The evaluations and data reviewed by Berti (2003) generally report success in improving dietary intake, but also suggest the agricultural interventions lack the structure needed to assess their impact on nutrition.

In South Asia, undernutrition and malnutrition continue to disproportionately affect women and children, despite improvements. The percentage of stunted, wasted, and underweight children (58% of all South Asian children in 1996) is significantly higher in South Asia than other developing

countries, including Sub-Saharan Africa. The high prevalence of these conditions are associated with maternal malnutrition, early labor, and low birth weight, with low birth weight generally considered the best single predictor of maternal malnutrition (Nandi, 1998). Analysis suggests that there are multiple causes for this, including women's lower status relative to men, a very high poverty rate, and "black box" country-specific factors which they suggest could include the monsoon climate, recurrent flooding in some countries, overcrowding due to high population density, and cultural beliefs and traditions that hinder optimal breastfeeding and the timing of introduction of complementary foods (Smith & Haddad, 2000).

In a more recent analysis of the "South Asian enigma" using multi-level modeling, Harttgen and Misselhorn (2006) confirm the role of income poverty, and suggest that characteristics such as educational and nutritional characteristics of mothers are also very important. Using different data sets, Klasen (2006) and Nube (2008) each suggest that the enigma can be explained by the fact that the single reference standard recommended by WHO and used to calculate Z-scores is inappropriate for the South Asian population.

The next section has some of the most relevant academic articles and literature which are listed with their citations and full abstracts. A table below the abstracts includes the citations for articles/studies that are relevant to the topic. This is broad topic for a literature review and there is an opportunity for more in depth analysis on a wide range of topics. In addition, some bodies of literature which may be of interest (such as those on land titling in agriculture) did not come up through searches which included health and nutrition. Many of the authors cited the issue of nutrition as a complex and multifaceted arena, which is evident in the numerous research strains that examine the issue.

## **Articles with Full Abstracts**

### **Subtopic #1 – Sustained economic growth versus lack of progress in nutrition rates and hunger in South Asia**

- 1) Welch R.M., & Graham, R.D. (1998). A new paradigm for world agriculture: meeting human needs productive, sustainable, nutritious. *Field Crops Research*, 60, 1-10.

Times Cited: 111

#### Abstract

Micronutrient malnutrition ('Hidden Hunger') now afflicts over two billion people worldwide, resulting in poor health, low worker productivity, high rates of mortality and morbidity, increased rates of chronic diseases (coronary heart disease, cancer, stroke, and diabetes), and permanent impairment of cognitive abilities of infants born to micronutrient-deficient mothers. The

consequences of food system failures include lethargic national development efforts, continued high population growth rates, and a vicious cycle of poverty for massive numbers of underprivileged people in all nations. Our food systems are failing us globally by not providing enough balanced nutrient output to meet all the nutritional needs of every person, especially resource-poor women, infants and children in developing countries. Agriculture is partly responsible because it has never held nutrient output as an explicit goal of its production systems. Indeed, many agricultural policies have fostered a decline in nutrition and diet diversity for the poor in many countries. Nutrition and health communities are also partly responsible because they have never considered using agriculture as a primary tool in their programs directed at alleviating poor nutrition and ill health globally. Now is the time for a new paradigm for agriculture and nutrition. We must consider ways in which agriculture can contribute to finding sustainable solutions to food system failures through holistic food-based system approaches, thereby closely linking agricultural production to improving human health, livelihood and well being. Such action will stimulate support for agricultural research in many developed countries because it addresses consumer issues as well as agricultural production issues and is, therefore, politically supportable.

### Summary

Article Type: Evidence based review of the reasons for hidden hunger with an analysis of steps to construct policy going forward on the issue.

Area Covered: Covers entire world but has focused examples from South Asia (India, Bangladesh), particularly with production and nutrition rates.

Conclusions: Due to the population explosion, we will have to embark on a new Green Revolution. In this revolution there should be target to produce the big four (iron, iodine, vitamin A, and Zinc) nutrients and integrate the nutrition approach with the sustainability/productivity approach.

2) Haddad, L.J. (2000). A conceptual framework for assessing agricultural-nutrition linkages. *Food and Nutrition Bulletin*, 21(4), 367-373

Times Cited: 11

### Abstract

The pathways through which agriculture affects nutrition are outlined. New evidence from the International Food Policy Research Institute (IFPRI) and the Consultative Group on International Agricultural Research (CGIAR) on specific linkages is reported. Two groupings of impacts of agriculture on nutrition are identified: specific (because food per se is being produced) and generic. Specific effects include declines in food prices (to what extent do increases in food productivity lead to declines in food prices and better diets?), own-consumption (to what extent does the production of certain foods influence their consumption within the grower households and communities?),

processing and preparation (how can nutrient losses be minimized?), and plant-breeding (what can be done to make specific foods more nutritious?). Generic effects include income generation for those engaged in agriculture and those linked to it, time allocation effects (how compatible are work activities with time investments in nutrition?), impacts on household decision-making (does innovation in the sector draw influence away from nutrition decision makers?), energy and nutrient expenditures (for certain individuals, are more additional nutrients expended than generated?), and health environment effects of agricultural production.

The time is right for international agricultural research to review its potential for increasing its impact on malnutrition. First, micronutrient malnutrition cannot be overcome by food fortification and supplements alone. Second, international agricultural research is being put under increased pressure to demonstrate poverty reduction; improving nutrition reduces poverty. Third, agricultural policy makers and scientists will be placed under increased pressure to be more nutrition sensitive in the context of increasing over nutrition.

### Summary

Article Type: The article is a review of current research being done on the connection between agriculture and nutrition.

Area Covered: General overview with references to evidence from Bangladesh

Conclusions: Conclusions are that raises in income can have an effect on nutrition, plant breeding and other innovations can improve micronutrient intake. Increased agricultural productivity should affect rural income and rising income should see a greater intake of nutritious goods.

### **Subtopic #2 – Primary determinants of improved nutrition at the household level**

- 3) Ruel M., & Levin C. (2000). Food-based approaches for alleviating micronutrient malnutrition: An overview. In P.K. Kataki & S. C. Babu (Eds.), *Food systems for improved human nutrition: Linking agriculture, nutrition, and productivity* (pp. 31-44). Philadelphia, PA: Haworth Press.

Times Cited: 31

### Abstract

This paper reviews current knowledge and experience with food-based approaches to reduce vitamin A and iron deficiencies. It presents a review of recently published literature, highlights some of the lessons learned, and identifies knowledge gaps and research priorities. The main strategies reviewed are food-based interventions that aim at (1) increasing the production, availability and

access to vitamin A and iron-rich foods through the promotion of home production; (2) increasing the intake of vitamin A and iron-rich foods through nutrition education, communication, social marketing and behavior change programs to improve dietary quality among vulnerable groups; and (3) increasing the bioavailability of vitamin A and iron in the diet either through home processing techniques or food-to-food fortification strategies. Plant breeding strategies are also discussed because of their potential to increase the content of vitamin A and iron in the diet as well as their bioavailability. The review highlights two contrasting facts. On the one hand, it is clear that the technologies and strategies reviewed have the potential to address many of the concerns about both the intake and the bioavailability of vitamin A and iron among impoverished populations. On the other hand, enormous information gaps still exist in relation to both the efficacy and the effectiveness of most of the strategies reviewed, even for approaches as popular as home gardening. Significant progress has been achieved in the past 10 years in the design and implementation of food-based approaches, particularly with respect to the new generation of projects integrating production and nutrition education and behavior change strategies. Yet, little has been done to evaluate their efficacy, effectiveness, feasibility, sustainability and their impact on the diets and nutritional status of at-risk populations. The same question as that posed in previous reviews decades ago remains at the end of the present review: what really can be achieved with food-based interventions to control vitamin A and iron deficiency? Food based approaches could be an essential part of the long-term global strategy to alleviate micronutrient deficiencies but their real potential is still to be explored.

### Summary

Article Type: Analysis and review of recently published literature on food based strategies to address nutrient deficiencies in the developing world

Area Covered: General focus on the developing world with extensive examples of Bangladesh and also some examples of India and Nepal.

Conclusions: The introduction of food-based interventions has been successful and the design of the programs has improved. The agricultural research and donor organizations have neglected these approaches, which has hindered further progress.

- 4) Bouis, H.E. (1997). The determinants of demand for micronutrients: An analysis of rural households in Bangladesh. *International Food Policy Research Institute, FCND Discussion Paper, Number 32.*

Times Cited: 21

### Abstract



Micronutrient deficiencies are particularly severe in Bangladesh. Understanding how household income, food prices, parental education and nutritional knowledge, and culturally based customs and food preferences interact to determine food consumption patterns (particularly for nonstaple foods), and so micronutrient intake, can provide crucial information for designing policies and intervention programs to improve human nutrition. Within the typical dietary patterns of the Bangladeshi survey population, the key food group with respect to micronutrient consumption is vegetables, providing nearly 95 percent of vitamin A intake, 75 percent of vitamin C intake, and 25 percent of iron intake. Vegetables are the least expensive sources of all of these nutrients. Vegetables are sufficiently inexpensive sources of vitamin A and vitamin C that they could provide the RDA within normal dietary patterns and the budgets of low-income groups. There is no corresponding inexpensive source of iron. Programs to educate consumers about the importance of meeting recommended daily allowances of vitamin A and vitamin C and about commonly eaten sources of these nutrients has the potential for improving intake. Because a high proportion of vitamin A and vitamin C intake apparently comes from own-production, extension programs to promote growing specific vitamin A and vitamin C rich foods not only would provide households with a ready supply of these nutrients, but increased production could bring the local price down. In contrast, it is much more difficult to see how these types of education and extension programs could be effective in increasing iron intake, because sources of bioavailable iron are expensive. Fortification or supplementation may be the best policies for solving the low iron intake problem in the short to medium run, depending on the costs and feasibility of successful implementation in specific circumstances. There is clear evidence that adult males are given preference in the intra-household distribution of certain micronutrient-dense foods (milk, eggs, and meat) while other micronutrient-dense foods (e.g., fish and vegetables) are more equitably distributed. *Ceteris paribus*, agricultural production programs aimed at more equitably distributed foods (e.g., fish and vegetables) will have a greater impact on the nutrient intake of women and children who are at greatest risk for micronutrient deficiencies.

### Summary

Article Type: Analysis of dietary patterns of eight Bangladeshi villages and their demands for micronutrients.

Area Covered: Rural Bangladesh villages

Conclusions: Higher income groups consume more micronutrients from a greater diversification in their diet. Males are heavily favored in receiving micronutrients before women and children and these goods rise with income. Agricultural extension programs to promote growing vitamin-rich foods would provide more sources or nutrients and keep local prices down.

### Subtopic #3 – Agricultural productivity/reform and interventions in nutritional status

- 5) Bouis, H.E. (2007). The potential of genetically modified food crops to improve human nutrition in developing countries. *Journal of Development Studies*, 43, 79-96.

Times Cited: 5

#### Abstract

Because of poor dietary quality and consequent widespread micronutrient malnutrition in low income countries, children and their mothers, who have higher requirements for vitamins and minerals due to rapid growth and reproduction respectively, have higher mortality, become sick more often, have their cognitive abilities compromised for a lifetime, and are less productive members of the workforce. Their quality of life and aggregate economic growth are unnecessarily compromised. One way that biotechnology can help to improve the nutrition and health of consumers in developing countries is by increasing the vitamin and mineral content and their bioavailability in staple foods.

#### Summary

Article Type: Overview of the role biotechnology can play in improving nutrition, including a cost benefit analysis of biotechnology and fortification interventions.

Area Covered: Targeted to developing countries, explicit cost benefit analysis of simulated interventions in South Asia.

Conclusions: A relatively small investment on research could benefit millions of poor throughout the world as well as increase agricultural productivity on the least productive lands. Nutrient programs through biotech can be instituted for a fraction of the cost of supplement programs.

- 6) Bouis, H.E. (2000). Commercial vegetable and polyculture fish production in Bangladesh: Their impacts on income, and dietary quality. *Food and Nutrition Bulletin* 21, 482-487.

Times Cited: 10

#### Abstract

Given the low access that women in rural Bangladesh have to productive assets, their crucial role as caretakers, and their high vulnerability to micronutrient deficiencies, numerous non-governmental organizations target women for food-based income-generating activities.

Three such programmes were examined, which promote adoption of polyculture fish production (two sites) and commercial vegetable production (one site). The programmes evaluated had income generation—and not better nutrition—as their primary objective. The fish and vegetable technologies were found to be more profitable than rice production, although rice production provided a higher share of total income. On the basis of the evidence collected, there is little reason to believe that adoption of the two technologies has improved the micronutrient status of members of adopting households through better dietary quality. There was no finding of disproportionately high own-consumption of fish and vegetables by adopting households. The impacts on overall household income, although positive, were not strong. The effects of adoption on women's status and time allocation do not change this conclusion. It is consumers in general who benefit from research, extension, and credit programmes to increase the market supply of vegetables and fish. All other things being equal, increased market supply will lower prices for these foods. Although inflation-adjusted cereal prices in Bangladesh have fallen by 40% over the last 25 years (a remarkable achievement), real prices of lentils, vegetables, and animal products have increased by 25% to 50%. Real fish prices have perhaps doubled. Dietary quality for the poor may be declining over time due to these price effects.

### Summary

Article Type: Review of three NGO programs that promoted the adoption of technology to produce polyculture fish production and commercial vegetable production in Bangladesh.

Area Covered: Three districts in Bangladesh.

Conclusions: The study concludes that there is not substantial evidence that the introduction of this technology improves the micronutrient status of its users. The author also states that this is a difficult strategy in the short run, however the production of these non-staple goods are important in the long run. Again, education is still key as there is not a large demand for vegetables amongst the rural population.

7) Leroy J.L., & Frongillo, E.A. (2007). Can interventions to promote animal production ameliorate undernutrition?. *The Journal of Nutrition*, 137, 2311-2316.

Times Cited: 4

### Abstract

The potential of animal-source foods (ASF) to alleviate micronutrient deficiencies is well recognized. How the intake of ASF can be effectively increased is not known, but promoting animal production (AP) is one possible method. We reviewed the impact of interventions promoting AP on nutritional status and on 6 nutrition-related outcomes: production, household income and expenditure, caregiver income, caregiver time and workload, zoonosis, and dietary intake. Information about the effects on each of the possible outcomes is needed to be able to weigh trade-offs in the potential benefits and costs of promoting AP. The majority of the 14 identified studies found a positive effect of the promotion of AP on production. All studies evaluating the impact on household income or expenditure reported a positive effect on these outcomes. Evidence regarding impact on caregiver income and on caregiver time and workload is too limited to draw any conclusions. We found no studies that examined the impact of the promotion of AP on zoonosis. The studies generally reported a positive impact on dietary intake. Only 4 studies evaluated the impact on nutritional status and found a positive effect. It is unclear whether the improvements in dietary intake and nutritional status were a direct effect of increased production or an indirect effect of increased income. Future studies on the AP-nutrition link would benefit from stronger methodological designs. Available evidence is insufficient to answer whether the promotion of AP is an effective means to alleviate undernutrition.

### Summary

Article Type: Review of 14 interventions to promote animal production in Bangladesh, India, Kenya, and Thailand.

Area Covered: Six of the studies are in Bangladesh; two are in India.

Conclusions: All of the studies reported a positive effect on household income. However, only four of the studies evaluated nutrition. For these four studies, there were some positive effects found in the reduction of iron deficiency, reduction in night blindness, and some evidence of increased child growth.

8) Talukder A., Kiess, L., Huq, N., De Pee, S., Darnton-Hill, I., & Bloem M. W. (2000). Increasing the production and consumption of vitamin A-rich fruits and vegetables: Lessons learned in taking the Bangladesh homestead gardening program to a national scale. *Food and Nutrition Bulletin*, 21, 165-172.

Times Cited: 22

### Abstract

Micronutrient malnutrition affects more than 20 million children and women (at least 50% of this population) in Bangladesh. The diets of more than 85% of women and children in Bangladesh are inadequate in essential micronutrients such as vitamin A, largely because adequate amounts of foods containing these micronutrients are not available, or the household purchasing power for these

foods is inadequate. In Bangladesh and many other developing countries, large-scale programmes are needed to make a significant impact on this overwhelming malnutrition problem. There has been limited experience and success in expanding small-scale pilot programmes into large-scale, community-based programmes. This paper describes the development and expansion of the Bangladesh homestead gardening programme, which has successfully increased the availability and consumption of vitamin A-rich foods. The programme, implemented by Helen Keller International through partnerships with local non-governmental organizations, encourages improvements in existing gardening practices, such as promotion of year-round gardening and increased varieties of fruits and vegetables. We present our experience with the targeted programme beneficiaries, but we have observed that neighboring households also benefit from the programme. Although this spillover effect amplifies the benefit, it also makes an evaluation of the impact more difficult. The lessons learned during the development and expansion of this community-based programme is presented. There is a need for an innovative pilot programme, strong collaborative partnerships with local organizations, and continuous monitoring and evaluation of programme experiences. The expansion has occurred with a high degree, which has helped to ensure the long-term sustainability of the programme. In addition to highlighting the success of this programme, useful insights about how to develop and scale up other food-based programmes as well as programmes in other development sectors are provided.

### Summary

**Article Type:** Impact evaluation of the expansion and household effects of the Bangladesh home gardening program, originally implemented by Hellen Keller International.

**Area Covered:** The program has been scaled up from pilot stage to include 180 sub districts in Bangladesh, reaching more than 700,000 people.

**Conclusions:** The study concludes that home gardens have a positive effect on nourishment, particularly on children. The program can also have impacts by targeting landless households and women.

**9)** Berti, P.R., Krusevec, J., & Fitzgerald, S. (2003) A review of the effectiveness of agricultural interventions in improving nutrition outcomes. *Public Health Nutrition*, 7, 599-609.

Times Cited: 16

### Abstract

Objectives: To review the impact of agriculture interventions on nutritional status in participating households, and to analyze the characteristics of interventions that improved nutrition outcomes.

Design: We identified and reviewed reports describing 30 agriculture interventions that measured impact on nutritional status. The interventions reviewed included home gardening, livestock, mixed garden and livestock, cash cropping, and irrigation. We examined the reports for the scientific quality of the research design and treatment of the data. We also assessed whether the projects invested in five types of 'capital' (physical, natural, financial, human and social) as defined in the Sustainable Livelihoods Framework, a conceptual map of major factors that affect people's livelihoods.

Results: Most agriculture interventions increased food production, but did not necessarily improve nutrition or health within participating households. Nutrition was improved in 11 of 13 home gardening interventions, and in 11 of 17 other types of intervention. Of the 19 interventions that had a positive effect on nutrition, 14 of them invested in four or five types of capital in addition to the agriculture intervention. Of the nine interventions that had a negative or no effect on nutrition, only one invested in four or five types of capital.

Conclusions: Those agriculture interventions that invested broadly in different types of capital were more likely to improve nutrition outcomes. Those projects which invested in human capital (especially nutrition education and consideration of gender issues), and other types of capital, had a greater likelihood of effecting positive nutritional change, but such investment is neither sufficient nor always necessary to effect change.

### Summary

Article Type: An analysis and review of 30 agricultural interventions in terms of their impact on nutritional status.

Areas Covered: Article covers interventions throughout the developing world and include interventions from Bangladesh, Nepal, and India.

Conclusions: Many of the interventions used study designs that made it difficult to assess changes in nutritional status. Of the projects evaluated, home gardening projects had the highest success rates than other interventions in terms of nutrition. The paper also emphasized the importance of educational components to intervention but also cited interventions with positive nutrition effects and no educational component.

### **Other Articles Reviewed and of Interest to Topic:**

Citation	Subject
Black, R.E., Allen, L.H., Bhutta, Z.A., Caulfield, L.E., de Onis, M., Ezzati, M., Mathers, C., & Rivera, J. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. <i>Lancet</i> , 371, 243-260.	Article #1 in a three-part series (with Bhutta and Victoria). Explores the disease burdens associated with under-nutrition, micro-nutrient deficiencies, and suboptimum breastfeeding, as well as the short-term impacts.
Victoria, C.G., Adair, L., Fall, C., Hallal, P.C., Martorell, R., Richter, L., & Sachdev, H.S. (2008). Maternal and child undernutrition: Consequences for adult health and human capital. <i>Lancet</i> , 371, 340-357.	Article #2 in a three-part series (with Bhutta and Black). Cites devastating effects maternal and child undernutrition on adult health and human capital indicators and suggests that rapid weight gain after infancy may be linked to some chronic diseases.
Bhutta, Z.A., Ahmed, T., Black, R.E., Cousens, S., Dewey, K., Giugliani, E., Haider, B.A., Kirkwood, B., Morris, S.S., Sachdev, H.P.S., & Shekar, M. (2008). What works? Interventions for maternal and child undernutrition and survival. <i>Lancet</i> , 371, 417-440.	Final article in series (with Black and Victoria). Cites successful interventions to address undernutrition, many of the interventions are non-agricultural.
Nube M. (2008). The Asian enigma: predisposition for low adult BMI for people of South Asian descent. <i>Public Health Nutrition</i> , 1-10.	Study concludes that low body mass index by people of South Asian descent cannot be explained by purely socio-economic factors but more likely a predisposition for low BMI and a combination of a lack of nutrition and discrimination of women.
Braun J.V., & Ruel, M. (2008). Accelerating progress toward reducing malnutrition in India. <i>IFPRI Policy Brief</i> , January 2008.	Strategy and policy actions for the reduction in child malnutrition in India.
Anderson, Peter. (2007). A Review of micronutrient problems in the cultivated soil of Nepal. <i>Mountain Research and Development</i> , 27, 331-335.	Discusses how farming techniques have stripped soil of necessary nutrients, cautionary regarding the ability of Nepalese soil to grow certain crops.
Pingali P., & Stringer R. (2007). Resource quality and changing diets in Asia: Implications for research and policy. <i>Food Policy</i> , 32, 281-298	Describes the determinants and trends in the diversification and Westernization of Asian diets. Implications of the evolving demand trends for food supply and retail

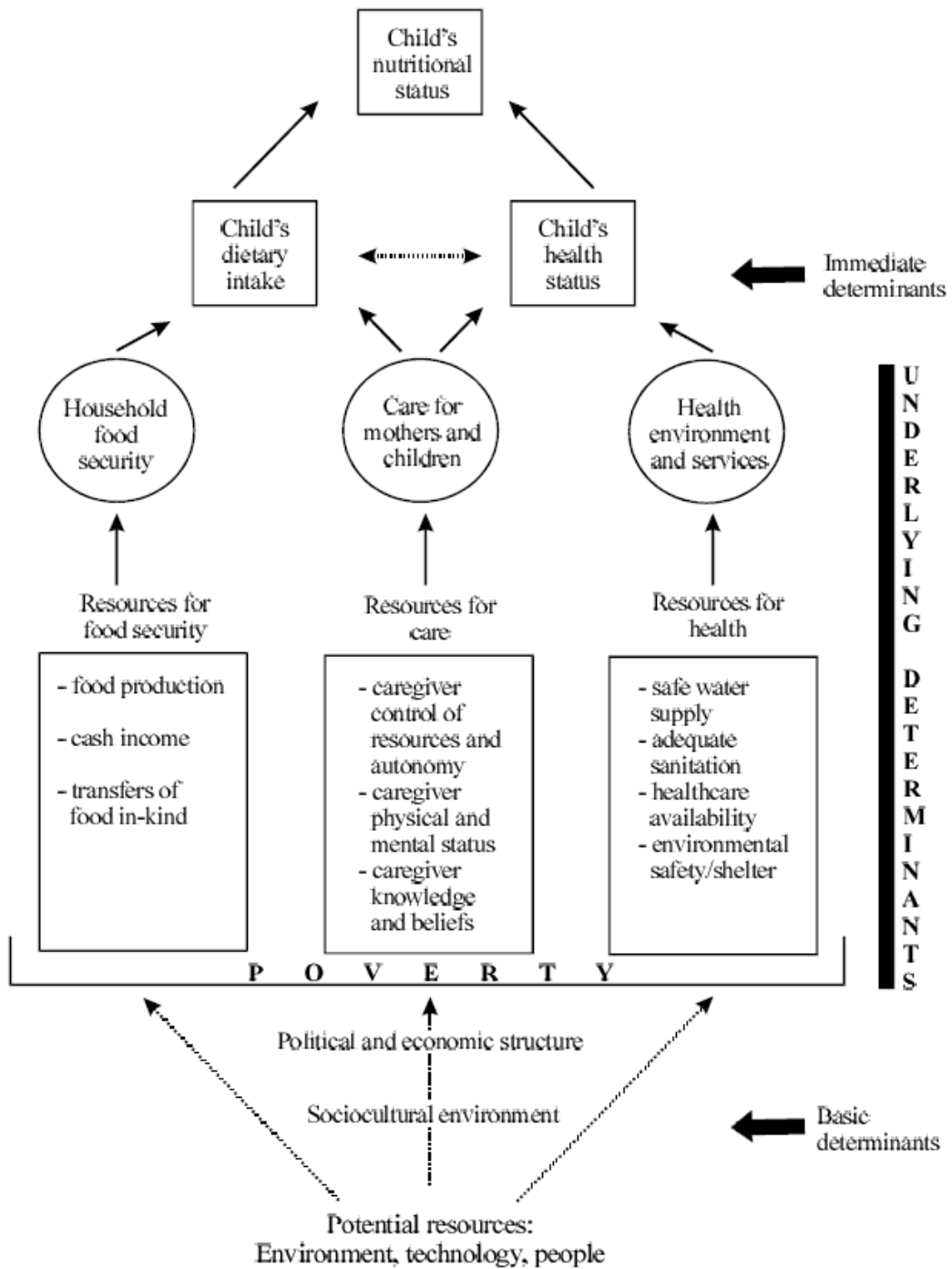
	systems are also presented.
Roos N., Wahab A., etc. (2007). Linking Human Nutrition and Fisheries: Incorporating Micronutrient-Dense, Small Indigenous Fish Species in Carp Polyculture Production in Bangladesh. <i>Food and Nutrition Bulletin</i> , 28(2), (supplement), S280.	Introduction of Mola (type of native fish) into fisheries did not decline carp production and has the potential to combat micronutrient deficiencies.
Harttgen, K., & Misselhorn, M. (2006). A multilevel approach to explain child mortality and undernutrition in South Asia and Sub-Saharan Africa. Ibero: America Institute for Econ. Research (IAI) Discussion Papers, September.	Analyzes the determinants of child mortality as well as child undernutrition based on data from 6 developing countries in South Asia. Use a multi-level model to explain the influences on the phenomena of high child mortality rates.
Navaneetham, K., & Jose, S., Poverty, malnutrition and mortality in South Asia: A review of issues and options,” CICRED Seminar on Mortality as Both a Determinant and a Consequence of Poverty and Hunger, Thiruvananthapuram, India, Gebruary 23-25, 2005, pp. 1-21.	This article reviews literature on some of the causal issues for the lack of nutrition in South Asia with a particular emphasis on low birth weight. Reviews some promising interventions and discusses differences between South Asia and Sub-Saharan Africa.
Hassan, Nazmil. (2004). Introductory speech on linking agriculture production to human nutrition, found at: <a href="http://www.ifpri.org/pubs/cp/alvMal/front.pdf">http://www.ifpri.org/pubs/cp/alvMal/front.pdf</a>	Conference speech regarding linking agricultural biofortification programs with nutrition needs in Bangladesh.
Umali-Deninger, D., & Shoupouri, S. (2003). Food security, is India at risk?. In L. Rattan, D. Hansen, N. Uphoff, and S. Slack (Eds.), <i>Food Security and Environmental Quality in the Developing World</i> (pp. 31-47). London: CRC Press.	Chapter focuses on the future concerns for food security in India as population growth and environmental concerns put pressure on this issue.
Rosegrant, M. W. (2003). Global food security: Challenges and policies. <i>Science Magazine</i> , 302, 1917-1919.	Global view on declining investment in research and policy reform on food security
Conway, Gordon. (2003). Rockefeller Foundation – 2003 speech entitled, “From the Green Revolution to the Biotechnology Revolution: Food for Poor People in the 21 <sup>st</sup> Century.”	Covers strategies primarily for Africa but discusses Asia and the need to integrate biotech with government policies, research agendas, etc.
Srinivasan, T.N. (2000). Poverty and undernutrition in	Article discusses ineffective policies that



<p>South Asia. <i>Food Policy</i>, 25, 269-282.</p>	<p>have been implemented to meet the needs of the rural poor in South Asia. Only a policy that develops widespread growth will have a lasting impact.</p>
<p>Smith, L., &amp; Haddad, L. (2000). <i>Explaining child malnutrition in developing countries: A cross-country analysis</i>. Washington D.C.: International Food Policy Research Institute.</p>	<p>Study using an econometric model to associate factors involved in child malnutrition. Advocates a comprehensive strategy that addresses basic and underlying causes.</p>
<p>Haddad, L., Hoddinott, J., &amp; Alderman, H. (Eds.). (1997). <i>Intrahousehold resource allocation in developing countries: Models, methods, and policies</i>. Baltimore: Johns Hopkins University Press.</p>	<p>Examines the complex dynamics of intra-household resource allocation.</p>
<p>Nandi, B. (1998). Nutritional Security: Asian Perspective Beyond 2000. <i>FAO Working Paper Series: 1/1</i>. Following sections are most informative: Nutritional Scenario, Nutritional Transition, Strategies and Measures towards Nutritional Security, Appendix C.</p>	<p>Provides informative data on nutrition rates in Asia, discusses government policy in South Asian Countries for nutritional security, and breaks down and gives reasons for different malnutrition maladies such as wasted, stunted, underweight, etc.</p>
<p>Bouis, HE, &amp; Novenario-Reese, MJG. (1997). The Determinants of Demand for Micronutrients: An Analysis of Rural Households in Bangladesh. <i>FNCD Discussion Paper No. 32</i>, 1-92</p>	<p>Analysis of consumption patterns for rural Bangladesh households based on income effects.</p>
<p>Alderman, H., &amp; Garcia, M. (1994). Food security and health security: Explaining the levels of nutritional status in Pakistan. <i>Economic Development and Cultural Change</i>, 42, 485-507.</p>	<p>An older study in rural Pakistan, finding that health indicators were more important than household income for determining child nutritional status, and that maternal education also had a strong influence.</p>
<p>McGuire, J., &amp; Popkin, B.M. (1990). Beating the zero sum game: Women and nutrition in the Third World. <i>Food and Nutrition Bulletin</i>, 12(1), 3-11.</p>	<p>At any given level of poverty the nutritional efficiency of resources within the household depends on income control, time allocation, intra-household food distribution, and the abilities and skills of those who provide nutrition-</p>

	enhancing services.
Deolalikar, A. B. (1988). Nutrition and labor productivity in agriculture: Estimates for rural South India. <i>A Review of Economics and Statistics</i> , 70, 406-413.	Econ study of the state of agriculture and nutrition in certain sections of India, due to old data it is mostly a background piece.

Appendix 1. Conceptual framework of child malnutrition, Smith and Haddad (2000).



Sources: Adapted from UNICEF 1990, 1998; and Engle, Menon, and Haddad 1999.