



INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR



IFPRI Discussion Paper 00928

November 2009

Improving Diet Quality and Micronutrient Nutrition

Homestead Food Production in Bangladesh

Lora Iannotti

Kenda Cunningham

Marie Ruel

2020 Vision Initiative

This paper has been prepared for the project on
Millions Fed: Proven Successes in Agricultural Development
(www.ifpri.org/millionsfed)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR).

FINANCIAL CONTRIBUTORS AND PARTNERS

IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI receives its principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR). IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, and World Bank.

MILLIONS FED

"Millions Fed: Proven Successes in Agricultural Development" is a project led by IFPRI and its 2020 Vision Initiative to identify interventions in agricultural development that have substantially reduced hunger and poverty; to document evidence about where, when, and why these interventions succeeded; to learn about the key drivers and factors underlying success; and to share lessons to help inform better policy and investment decisions in the future.

A total of 20 case studies are included in this project, each one based on a synthesis of the peer-reviewed literature, along with other relevant knowledge, that documents an intervention's impact on hunger and malnutrition and the pathways to food security. All these studies were in turn peer reviewed by both the Millions Fed project and IFPRI's independent Publications Review Committee.

AUTHORS

Lora Iannotti, Washington University

Assistant Professor and formerly postdoctoral fellow in the Poverty, Health, and Nutrition Division, IFPRI

Email: liannotti@wustl.edu

Kenda Cunningham, International Food Policy Research Institute

Senior Research Assistant, Director General's Office

Email: k.cunningham@cgiar.org

Marie Ruel, International Food Policy Research Institute

Director, Poverty, Health, and Nutrition Division

Email: m.ruel@cgiar.org

Notices

¹ Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI-wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at www.ifpri.org/pubs/otherpubs.htm#dp.

Copyright 2009 International Food Policy Research Institute. All rights reserved. Sections of this document may be reproduced for noncommercial and not-for-profit purposes without the express written permission of, but with acknowledgment to, the International Food Policy Research Institute. For permission to republish, contact ifpri-copyright@cgiar.org.

Contents

Abstract	v
Abbreviations and Acronyms	vi
1. Introduction	1
2. The HFP Intervention: Program Model and Scale Up	3
3. HFP Impacts	10
4. HFP Challenges and Controversies	18
5. Sustainability of HFP	20
6. Lessons Learned	22
7. Conclusion	25
Appendix 1. Bangladesh Health and Population Statistics	26
Appendix 2. List of partner NGOs for HFP in Bangladesh	27
Appendix 3. List of HFP evaluations	29
Appendix 4. Detailed HFP Impact Pathways	30
References	31

List of Tables

Table 1. Scaling up HFP Projects in Bangladesh: 1988-2011	8
Table 2. Consumption patterns among NGNESP households	13
Table 3. HFP food security and other impacts ¹	14
Table 4. Food security impacts: Char II	15
Table 5. Food security impacts: Chittagong Hill Tracts	15
Table 6. Food security impacts: Barisal Division JOJ	16
Table 7. Intrahousehold decisionmaking power: women with <i>full influence</i> ^a before and after NGNESP	17

List of Figures

Figure 1. Homestead Food Production (HFP) in Bangladesh: Program and information milestones	3
Figure 2. Homestead Food Production (HFP) in Bangladesh: Geographic representation	4
Figure 3. HFP organizational structure	5
Figure 4. Gardening practices among NGNESP households	11
Figure 5. Uses of additional income (%) earned from HFP garden produce (NGNESP) and poultry products (ASF Pilot)	12

ABSTRACT

A critical yet often overlooked component of food security is diet quality. Even households who have access to sufficient amounts of food and calories may still lack essential micronutrients, increasing their risk for both short- and long-term health and development consequences. Interventions that address poor diet quality and related deficiencies of vitamin A, zinc, iron, among others, are important for achieving full food security in vulnerable populations. The homestead food production (HFP) program, introduced in Bangladesh by Helen Keller International nearly two decades ago, promotes an integrated package of home gardening, small livestock production and nutrition education with the aim of increasing household production, availability, and consumption of micronutrient-rich foods and improving the health and nutritional status of women and children. Implemented by NGO partners and the Government of Bangladesh, HFP has expanded its reach into over one half of the country's subdistricts and is now operating in several countries of Asia and Sub-Saharan Africa. Evidence shows that HFP in Bangladesh has improved food security for nearly 5 million vulnerable people in diverse agroecological zones. This has been achieved through: increased production and consumption of micronutrient-rich foods; increased income from gardens and expenditures on micronutrient-rich foods; women's empowerment; enhanced partner capacity; and community development.

Keywords: Millions Fed, Food Security, Bangladesh, Homestead Food Production, HFP, Micronutrient, Homestead Garden

ABBREVIATIONS AND ACRONYMS

AP	Active Participants
ASF	Animal Source Foods
BCC	Behavior Change Communication
CHT	Chittagong Hill Tracts
DAE	Department of Agricultural Extension
ENA	Essential Nutrition Actions
FP	Former Participants
HFP	Homestead Food Production
HG	Home Gardens/Home Gardening
HH	Households
HKI	Helen Keller International
HKW	Helen Keller Worldwide
HPAI	Highly Pathogenic Avian Influenza
JOJ	Jibon-O-Jibika (“Life and Livelihood”; Bangladesh NGO)
NGNESP	National Gardening and Nutrition Education Surveillance Project
NGOs	Non-Governmental Organizations
NOVIB	Netherlands Organization for International Development Cooperation
PNGOs	Partner Non-Governmental Organizations
RAE	Retinol Activity Equivalents
RDA	Rural Development Academy
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
VMFs	Village Model Farms
WB	World Bank

1. INTRODUCTION

A critical yet often overlooked component of food security is diet quality. Even households who have access to sufficient amounts of food and calories may still lack essential micronutrients, increasing their risk for both short- and long-term health and development consequences. Worldwide, the numbers of food insecure, as measured by sufficient availability or access to calories, are declining (FAO 2008). These figures, however, fail to capture the even more widespread problem of poor-quality diets and resulting risks of micronutrient deficiencies—often referred to as “hidden hunger.” Recent data estimate that 127 million preschool children are vitamin A deficient and nearly 5 million suffer from xerophthalmia, which causes irreversible eye damage and blindness in extreme cases. Vitamin A deficiency is a public health problem in nearly 80 developing nations: in these low income countries, more than 7 million pregnant women suffer from insufficient vitamin A (West 2002; West and Darnton-Hill 2008). Over half of the prevalence of anemia globally is estimated to be due to iron deficiency (Rastogi and Mathers 2002). Similarly, current estimates suggest that one-third of the world’s population consumes diets inadequate in zinc (Hess and King 2009). Overall, micronutrient deficiencies raise the risk for mortality from diarrhea, pneumonia, malaria, and measles (Black et al. 2008). These micronutrient deficiencies are responsible for a large proportion of infections, poor physical and mental development, and excess mortality in the developing world. Vitamin A deficiency alone is responsible for 6 percent of all deaths to children under five years old; zinc deficiency, 4 percent. Iron deficiency increases the risk of maternal mortality by 20 percent and reduces child IQ by 1.73 points for every 10 g/L decrease in hemoglobin concentration (Stoltzfus et al. 2004).

Several strategies to combat micronutrient deficiencies in Bangladesh have been undertaken, including supplementation, fortification, and the promotion of dietary diversification. Two decades ago, Helen Keller International (HKI) introduced the homestead food production (HFP) program to address vitamin A deficiency in Bangladesh. The original HFP model included support for small gardening and nutrition education to promote year-round production of vitamin A-rich fruits and vegetables, and to increase availability and household access to these foods to improve nutrition in vulnerable populations. HFP programming has now evolved and expanded to embody a unique, holistic intervention that has increased the availability of micronutrient-rich foods for millions of families while addressing several other aspects of food insecurity, including improved incomes and livelihoods, community development, and the empowerment of women. HFP programs now operate in several countries of South Asia, Southeast Asia and the Pacific, and Sub-Saharan Africa. In Bangladesh, HFP has directly benefited over five million people (Helen Keller International 2006a, 2006b).

Horticulture has played an important role in human history for over 13,000 years, marking a seminal evolutionary transition from hunting and gathering societies to the domestication of plants and animals (Diamond 2002). This ancient practice continues throughout the world, and in the current era of economic uncertainty and environmental conservation, agricultural self-reliance and locally grown foods have especially great appeal. HFP programming capitalizes on local knowledge and customs, both drawing from and building on these practices to help ensure community buy-in and sustainability. Many features have contributed to its success, while some others need improvement. A key element over the last 20 years in sustaining and expanding this program has been the flexibility to continue to improve upon its design, delivery, and utilization—ultimately enhancing its success in feeding millions, *well*.

In its 20 years of operation, HFP programming has reached nearly four percent of the population in Bangladesh and covered just over half of all the country’s subdistricts. HFP has been successfully implemented in vastly different agroecological zones from the chars (islands of silt) to the Chittagong Hills terrain. Various organizations and individuals contributed to the success of HFP in Bangladesh. The initiative has had a variety of bilateral and multilateral funding sources. The basic architecture of the HFP program begins with HKI establishing partnerships with local non-governmental organizations (NGOs) who in turn support communities; more than 75 local NGOs have been instrumental in funding, designing, and implementing the programs. These NGOs include the original 47 who worked with the

two government agencies—the Department of Agricultural Extension (DAE) and the Rural Development Academy (RDA)—in the decade-long NGO Gardening and Nutrition Education Surveillance Project (NGNESP), as well as 7 in the Chittagong Hill Tracts (CHT) project, a total of 13 for the three Char Projects, and 9 in the Jibon-O-Jibika project (Appendix 2). Each NGO supports approximately 25–30 village model farms (VMFs), each comprised typically of two mothers’ groups and 40 households. The VMFs are started within communities to serve as a center for production inputs and practical training for women groups; and to act as a community demonstration center for different aspects of homestead food production. Other key components of the intervention include: nutrition education; empowering women through economic development; building on local practices and customs; establishing linkages with other development activities; and monitoring and evaluation. As the program has been scaled nationally, the Government of Bangladesh has assumed an important administrative and planning role, together with nearly 80 local NGOs who have now worked together with HKI on HFP.

The key impacts of HFP in Bangladesh on food security include: increased production and consumption of micronutrient-rich foods; diversified diets; improved status of women; increased income from garden and livestock production; and capacity built at the community and household level. Three key lessons were learned from this large programming effort:

1. A standard, but flexible design was key to the successful implementation of HFP, and allowed for quality control and context responsiveness.
2. Strong partnerships with a range of local NGOs facilitated effective and efficient program implementation.
3. The strong information system and feedback loops allowed effective use of information to inform HFP programming in an on-going manner.

The experience also provides convincing evidence that agriculture interventions can improve nutrition. It provides:

1. a successful agriculture-based strategy approach to address micronutrient deficiencies that promises longer-term changes in dietary practices and sustainable benefits over time;
2. evidence that addressing nutrition requires a multifaceted, multidisciplinary approach; and
3. evidence that nutrition education should take the form of dialogue and negotiation with caregivers, households, and communities—rather than lectures and top-down knowledge transfer—to overcome barriers and maximize opportunities for behavior change.

This paper first describes the Bangladesh HFP intervention model providing detail regarding its history, the evolving input profile, processes of implementation and scaling up, and key players. Next, the food security impacts and pathways are discussed, followed by an overview of its fiscal, environment, and sociopolitical sustainability. Finally, the paper presents lessons learned and conclusions for moving forward with the HFP model, towards further improving diet quality and micronutrient nutrition among poor populations around the globe.

2. THE HFP INTERVENTION: PROGRAM MODEL AND SCALE UP

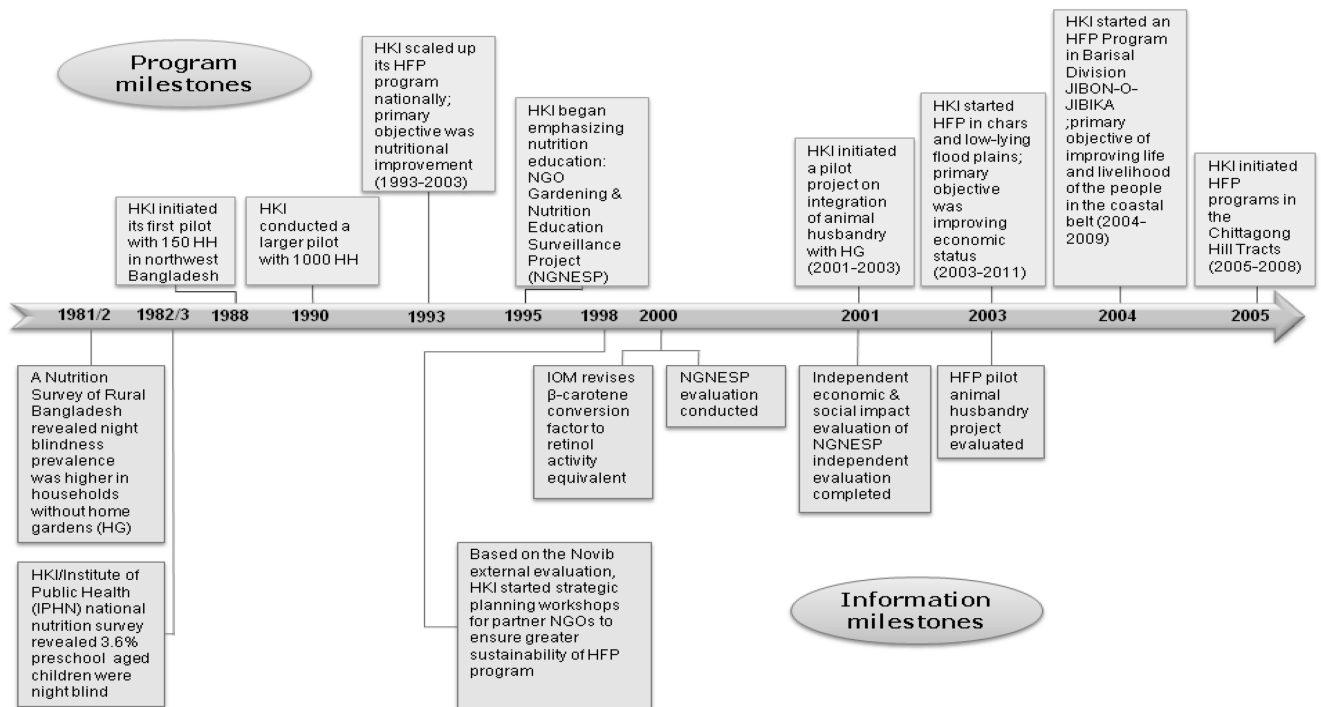
HFP Model

HFP programming in Bangladesh spans two decades (Figure 1) and has directly reached about 4 percent of the population in 240 of the 466 subdistricts in the country, covering diverse agroecological zones (Figure 2). (For more general information about Bangladesh, see Appendix 1.) The original model focused primarily on vitamin A deficiency, aiming at increasing consumption of vitamin A-rich vegetables and fruits available from home gardens, such as sweet gourd, shazna shak, black arum leaves, and bottle gourd leaves (Helen Keller International 2003c). More recently, the scope of the HFP model was broadened significantly to address multiple micronutrient deficiencies, including iron and zinc. This meant incorporating small animal husbandry into the model, because animal source foods are the best sources of bioavailable (easily absorbed and used) iron and zinc.

The objectives of HFP programs are to

1. increase year-round production, varieties, and quantities of vegetables and fruits produced by home gardening;
2. increase animal foods through small animal husbandry;
3. increase consumption of micronutrient-rich foods through increased household production and income, enhanced by improved knowledge and awareness through nutrition education;
4. improve the health and nutritional status of women and children; and
5. empower women through control over the resources that ensure better child care practices.

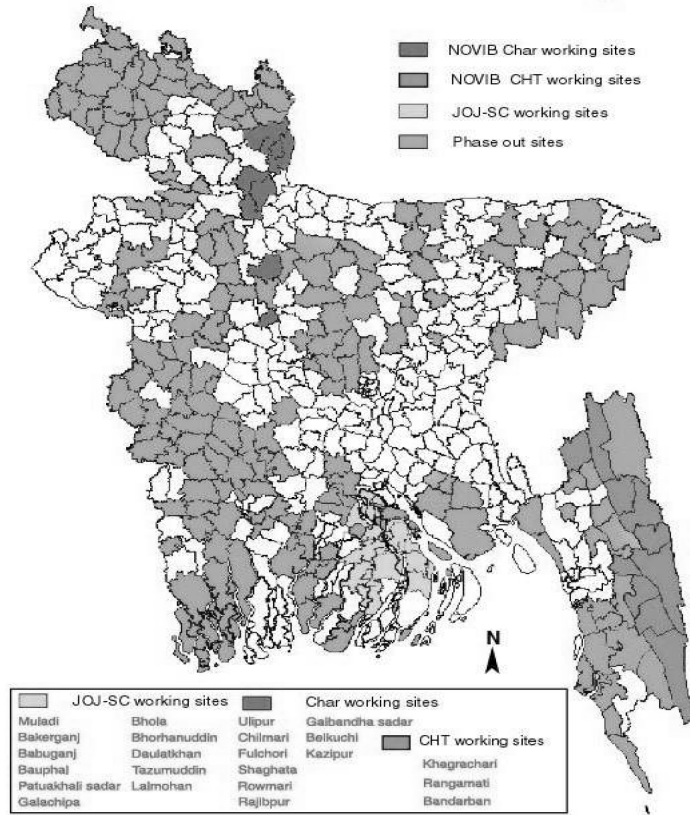
Figure 1. Homestead Food Production (HFP) in Bangladesh: Program and information milestones



Sources: Various HKI published and unpublished materials.

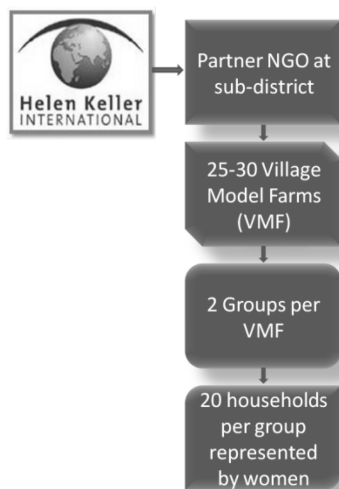
Figure 2. Homestead Food Production (HFP) in Bangladesh: Geographic representation

Homestead Food Production Program



To implement its HFP programs, HKI works through local NGO partners at the sub-district level (Figure 3). Each NGO in turn supports approximately 25 to 30 Village Model Farms (VMFs). Typically, there are two mothers' groups and 40 households per VMF. HKI may provide the NGOs with inputs (for example, seeds, seedlings, chicks, and the like) and technical assistance (for example, key nutrition messages). The local NGOs then provide similar support to the communities more directly. The mothers' groups are already existing community groups who meet regularly to support women in the community in a variety of ways. The HFP program lasts three years with HKI involvement, followed by another two years of ongoing community support from partner NGOs.

Figure 3. HFP organizational structure



HFP Approaches

Several prominent features of HFP have been responsible for its success:

1. incorporating into the model nutrition education and behavior change and communication (BCC);
2. building on local practices and using existing structures and organizations;
3. focusing on empowering women;
4. fostering income generation;
5. including strong technical assistance and capacity-building components; and
6. implementing monitoring and evaluation activities.

Home gardens alone will not improve nutrition; *nutrition education* is necessary to translate food production into improved dietary intakes, particularly for vulnerable household members. Several reviews examining the potential for agriculture programs and food-based strategies to improve nutrition have highlighted the importance of explicit nutritional objectives and nutrition education activities—specifically as behavior change communication (BCC)—to affect positive nutrition outcomes (Ruel 2001; Berti et al. 2004; World Bank 2007). A consistent recommendation from these reviews is that nutrition education/BCC should include education about appropriate intrahousehold allocation of resources that favor vulnerable household members such as mothers and young children, as well as key messages regarding optimal infant and young child feeding and care practices (World Bank 2007).

HFP nutrition education has been delivered in different forms over the years, particularly through VMF owners and NGO staff who are trained to communicate key nutrition messages and to carry out education sessions and recipe trials, as well as through social marketing campaigns. More recently, programs are also using BCC approaches to understand, negotiate, and communicate improvements in child-feeding practices among vulnerable groups.

In the HFP model, key nutrition messages are usually communicated through group meetings or individual counseling sessions. In the Char Project, for example, group leaders conduct meetings and counseling sessions to discuss the importance of regular consumption of vitamin A and iron-rich foods, iron tablets during pregnancy, iodized salt consumption, good breastfeeding, and complementary feeding practices (Helen Keller International, Bangladesh 2006b). Similarly, in the CHT project, partner NGOs

train group leaders who in turn conduct group meetings and counseling sessions with mothers, husbands, and mothers-in-law. Cooking demonstrations are also widely used to illustrate positive food preparation practices, such as washing vegetables before cutting, using oil to cook leafy vegetables, and including more pulses, meat, and eggs in dishes (Helen Keller International, Bangladesh 2008a).

A recent innovation in the nutrition education component of HFP has been the application of the Essential Nutrition Actions (ENA) framework. ENA represents a comprehensive approach to improving nutrition for children under two years old and reproductive age women, by supporting better practices in the seven key nutrition areas shown to have the greatest impact on improving maternal and child health (USAID 2006). These key nutrition areas include: optimal breastfeeding during the first six months of life; optimal complementary feeding from six months of age, with continued breastfeeding until two years and beyond; adequate nutritional care of the sick and malnourished child; optimal maternal nutrition during pregnancy and lactation; and the control of vitamin A deficiency, anemia, and iodine deficiency. In addition to incorporating these messages into group and counseling sessions, HFP programs are now working to create linkages between partner NGOs, beneficiaries, and government health services. The ENA approach was introduced into the CHT project in 2006.

The second prominent feature of HFP is that *it builds on local practices and involves existing structures and organizations*. This factor helps assure both acceptance within communities and the sustainability of gardening and of positive nutrition behaviors. Local practices include: using local cultivation techniques and varieties; understanding and working with traditional customs; and navigating the cultural barriers and facilitators related to adopting optimal infant and young child feeding and household dietary practices. A critical factor for success is the focus on creating community resources and venues, to provide farmers with ongoing inputs and advice. Local sources such as the VMFs allow better market access for participants: for example, women can get access to inputs, technical information, and better marketing opportunities because of the growth in support services at the local level. In other words, the VMFs provide support to the *community*, while the HFP systems are owned and operated *individually*. Finally, local level ownership is ensured through a cost-sharing requirement: inputs are not provided for free, but rather farmers are required to contribute financially. Thus, the project is owned by participants from the outset.

Rooted in local values, customs, and practices, HFP inherently emphasizes community participation at all stages of the program—design, implementation, and monitoring and evaluation. HKI's collaboration with NGOs through particularized local approaches includes strategic planning workshops, proposal and work plan development, program monitoring, financial management, and organized involvement of government and other local authorities (Helen Keller International 2003b). An additional strength of the model is that it links agricultural activities to other health and development activities in the community, in recognition of the complex nature of food insecurity and undernutrition.

Third, HFP works to *empower women*—specifically, poor rural women. In Bangladesh, women are traditionally responsible for managing homestead activities, preparing family meals, and feeding children, among their many responsibilities. The HFP approach supports women in these culturally acceptable roles to upgrade skills and knowledge to improve food production, income, and practices. The result is often better allocation of household resources, improvements in caring practices, and overall empowerment of women (Helen Keller International 2006a). As HFP beneficiaries of gardening activities, nutrition education, and income generation, women enhance their bargaining power and become more productive in their traditional roles. Additionally, pregnant women and children under three are two populations for which inadequate nutrition has the largest impact; therefore, targeting women with nutrition-oriented interventions is also critically important for reducing childhood undernutrition.

Other distinguishing characteristics of the HFP model contribute to its success. The *income-generating component* for VMF owners and households contributes to its economic viability, reflecting returns to land and labor. At the organizational level, viability is enhanced through cost-sharing with the many local NGOs. The model also incorporates *technical assistance and capacity building* at all levels of the program structure. Finally, *program monitoring and evaluation* are integral aspects of the model, incorporating information systems that provide feedback and enable improvements in HFP interventions.

Key Players

Various bilateral and multilateral donors contributed to the funding of HFP in Bangladesh. The Australian Government Overseas Aid Program (AusAID), Danish International Development Agency (DANIDA), United States Agency for International Development (USAID), UK Department for International Development (DFID), Oxfam Netherlands (NOVIB), and the World Bank (WB) provided funding to supplement that from the Government of Bangladesh. These funding sources, as well as the overall program support provided by Helen Keller International, provided the necessary support for the implementation work carried out by such a diverse set of local NGOs.

The Government of Bangladesh has also played a critical role in HFP programming. Two agencies in particular, the Department of Agricultural Extension (DAE) and the Rural Development Academy (RDA) (under the Ministry of Local Government and Rural Development) have worked with the HKI-HFP program. DAE works throughout Bangladesh and is an important contact for HKI in all the subdistricts where projects are implemented. DAE helps by disseminating positive results and findings of the program through their local networks. DAE also performs a range of other functions: coordinating and incorporating HFP programs into their overall district and national plans; providing information on input sources; ensuring quality control and coordinating with private sector for inputs and marketing; facilitating trainings with HKI; and providing updated research findings to enhance programming. The role of the other government agency, RDA, has mainly been to provide training facilities and human resources for training and staff development of local NGO partners.

A strong enabling environment was also a prerequisite for the success of HFP throughout Bangladesh. Certain policies, institutional frameworks, and social norms provided the foundation for this type of intervention. First, gardening is an ancient food production method in Bangladesh. Reliance on existing practices, local varieties, and even tools smoothed the introduction of the project (Talukder et al. 2000). Second, women have traditionally been responsible for gardening and provision of food for the family in Bangladesh. Therefore, targeting women for HFP programs was logical and culturally appropriate (Bushamuka et al. 2005). Third, working with long-established partner NGOs within intervention communities fostered acceptance and facilitated success: NGOs in Bangladesh already know how to mobilize local resources, build community support, and encourage participatory involvement (Helen Keller International 2003b).

Scaling Up

A national nutrition survey (1981-1982) and a national nutritional blindness survey (1982-1983) found that the prevalence of vitamin A-related night-blindness in Bangladesh was three percent; more than one million children less than six years of age suffered from some degree of xerophthalmia (National Nutrition Survey; National Nutritional Blindness Prevalence Survey; Talukder et al. 1993). These findings provided the impetus for what would become a large-scale program throughout Bangladesh in just two decades—a comprehensive HFP intervention promoting the production and consumption of foods rich in vitamin A and other micronutrients. Table 1 summarizes the scaling-up process of HFP programs in Bangladesh.

Table 1. Scaling up HFP Projects in Bangladesh: 1988-2011

Project	Dates	Partner NGOs	Sub-districts	Households	Beneficiaries
Original pilot	1988–90	1	1	150	825
Larger pilot	1990–93	0	2	1,000	5,500
NGNESP	1993–2003	47 ^a	210	877,850	4,700,000
ASF pilot	2002–03	2	2	600	3,300
CHAR-I	2003–05	4	10	10,000	70,000
CHAR-II	2005–08	7	10	10,000	65,000
CHAR-III	2008–11	8	10	10,000	64,000
NOVIB-CHT	2005–08	7	10	10,000	55,000
JOJ-Barisal	2004–10 ^b	9	11	22,440	116,688

^a The total number of partners for NGNESP was 49, but two of these were governmental organizations.

^b JOJ-Barisal was originally to end in 2009, but the end date was extended because of a cyclone.

Sources: Various HKI presentations, publications, and internal reports.

Beginning in 1990, a pilot HFP program targeted 1,000 households. A mid-term evaluation of this project demonstrated that its combined home gardening, nutrition education, and gender interventions could improve vegetable consumption among women and children, and the NGO Gardening and Nutrition Education Surveillance Project (NGNESP) was subsequently launched in 1993.

The NGNESP project combined home gardening, nutrition education, and other community development activities. After seven years of operation, NGNESP covered more than 860,000 households in 210 of the 460 subdistricts of Bangladesh and was deemed successful in achieving its household food security aims (Bushamuka et al. 2005). Whereas the HFP program objectives, basic inputs, and organizational structure remained relatively constant, the flexibility of the model allowed for context-specific adaptations, enhancing its effectiveness and ensuring its continuation in Bangladesh—and its expansion to other parts of the world.

The year 2002 marked another milestone in the history of HFP in Bangladesh, when a pilot animal husbandry project was introduced in response to new findings on the bioavailability of pro-vitamin A from vegetables and fruits. The consensus in the international community had endorsed a higher conversion factor for pro-vitamin A to retinol activity equivalent (RAE) (IOM 2000). (Some of the research contributing to this shift in fact originated from work at HKI on home gardening promotion (de Pee et al. 1998, 2008).) A subsequent movement promoted animal-source foods in the diets of vulnerable populations, as a more efficient and bioavailable source of essential micronutrients, including vitamin A, iron, and zinc, and as the only source of vitamin B-12 (Randolph et al. 2007; Schroeder 2008). HKI accordingly carried out a pilot project in Bangladesh, Nepal, and Cambodia to test the feasibility of including animal husbandry in its existing home gardening model. In Bangladesh, the pilot project was carried out with two NGOs—Social Development Committee (SDC) and Gono Kallayan Sangstha (GKS)—and involved 600 households in the Faridpur and Sirajgonji districts of northwest Bangladesh (Helen Keller International 2004).

Three more projects were initiated in the subsequent years and continue to operate today. In 2003, the *Novib Char Project* (funded by Netherlands Organization for International Development Cooperation) was launched in the chars (islands of silt within rivers) and low-lying flood plains reaching 10 subdistricts in the north and 10,000 households. The *Jibon-O-Jibika* project (funded by Save the Children–USA) in the Barisal division was started in 2004 with the NGO Forum and Cyclone Preparedness Program (CPP). And finally, the HFP to Improve Household Food and Nutrition Security in the Chittagong Hill Tracts (funded by Oxfam Novib) was initiated in 2005, targeting 10,000 households. Each year new program areas and partners are added, emphasizing agroecological diversity—for example, tea estates in hilly

terrains, flood-prone areas, peri-urban and urban slums, and areas with high salinity soil (Talukder et al. 2000).

Scaling up HFP within Bangladesh has been effective and sustainable because of the large number of partner NGOs (see Appendix 2), with their extensive infrastructure throughout the country and their dedicated focus on working with poorer households (Talukder et al. 2000).

3. HFP IMPACTS

Food and Nutrition Security

The HFP program provides valuable information on the impact of specific approaches to agricultural intervention in nutrition. Few other interventions focusing on improving household food availability and dietary quality have been evaluated for their impact on nutrition (Bhutta et al. 2008). More rigorous evaluations of HFP impact may be needed. Nevertheless, there is sufficient evidence to conclude that HFP is improving household food security, and in some cases nutrition and other intermediary outcomes.

A variety of assessments and evaluations have already been carried out on the Bangladesh HFP program, including small-scale assessments of pilot projects, interim mid-term evaluations, monitoring data surveillance, and larger-scale impact evaluations (Appendix 3). The first evaluation of the pilot home gardening project was conducted in 1991, and the most recent in 2008. Two of the nine evaluations were independent assessments by outside reviewers. Six used a pre-/post-design to study changes occurring between baseline and endline points of the project; two of these evaluations included a control group to account for external conditions influencing program impact. (Evidence of program impact may be inflated or attenuated in pre-/post-design by non-program factors. For example, a drought occurring in the post-survey period could *attenuate* the impact, while a drought in the pre-survey period would *inflate* impact.) Use of a control group, however, does not rule out biases, especially if groups have not been randomized and are not comparable.

Most of the published evidence describing HKI's Bangladesh HFP impact draws on the cross-sectional evaluation of NGNESP conducted in 2002, comparing three groups: *active participants* (households receiving assistance for less than three years); *former participants* (households who had completed the program and were still operating a homestead food production for three-plus years without HKI); and a *control group* (households from within target subdistricts, from areas without NGNESP activities). The main outcomes in evaluations of HFP can be classified according to the three components of food security: 1) increases in *food availability*—measured by type of garden (improved or developed) and changes in the amounts and varieties of fruits and vegetables produced; 2) increases in *food access*—measured by increased income and expenditures on micronutrient-rich foods and household level consumption; and 3) increases in *food utilization*—measured by changes in individual intake of micronutrient-rich foods, as well as indicators of micronutrient status, anthropometry, or functional outcomes (for example, night-blindness). The potential pathways through which HFP may have an impact on improved diet quality and nutrition are illustrated in Appendix 4.

Food Availability

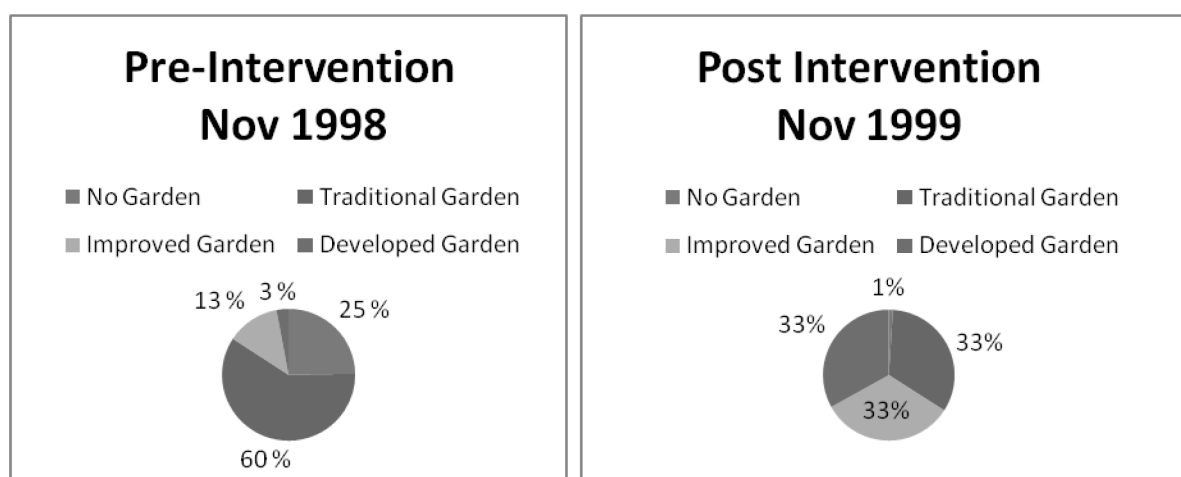
HKI uses a measure of *garden type* to assess the adoption of HFP production interventions: traditional; improved; and developed. *Traditional gardens* involve the production of gourds and traditional vegetables, are seasonal, and are found in scattered plots. *Improved gardens* are typically fixed plots involving production of a wider variety of vegetables, but not year-round. *Developed gardens* offer a wider range of vegetables and fruits, produced in fixed plots and all year long (Helen Keller International, Bangladesh 2003). Changes in the quantity and diversity of food commodities produced are viewed as an indicator of impacts on household food availability. As shown in Figure 4, the NGNESP evaluation documented a marked increase in the percentage of households with improved or developed gardens, from baseline to post-intervention. This was also accompanied by an increase in the average number of vegetable types grown, from three to six in the same time period (Taher et al. 2004).

The NGNESP evaluation (2002) also demonstrated significant increases in the proportion of households growing fruits and vegetables year round among active participants (77.8 percent), as compared to former participants (50.4 percent) and control households (15.4 percent) (Bushamuka et al. 2005). The quantity and variety of foods produced in home gardens were also improved through HFP when compared to controls. In a three-month period, households produced a median amount of 135 kg

and 120 kg of vegetables in the active and former groups, respectively, compared to 46 kg in the controls. Increases in fruit production were of smaller magnitude. In an evaluation of the animal production pilot in 2003, egg production was considerably higher for the HFP intervention group—200 eggs in the three-month period—than the control group (21 eggs) (Helen Keller International 2004).

Later assessments reexamined monitoring data from HFP. An assessment evaluating the impact of the HFP Chars Project on mitigating the *monga* (cyclical food insecurity) season in 2007, after the first year and a half, showed that the percentage of households with *developed* gardens increased from 0 to 49 and the percentage with *improved* garden types increased from 1 to 18 (Helen Keller International 2008b). Similarly, the Jibon-O-Jibika impact assessment found that the percentage of households with *developed* gardens went from 0.1 to 60.4 percent, and *improved* gardens from 1.3 to 31.3 percent (Helen Keller International 2008a).

Figure 4. Gardening practices among NGNESP households



Source: Compiled by authors with information from NGNESP evaluations (Talukder et al. 2000) and the Helen Keller International 2000 presentation—NGO Gardening and Nutrition Education Surveillance Project—at the USAID/BD Mission meeting.

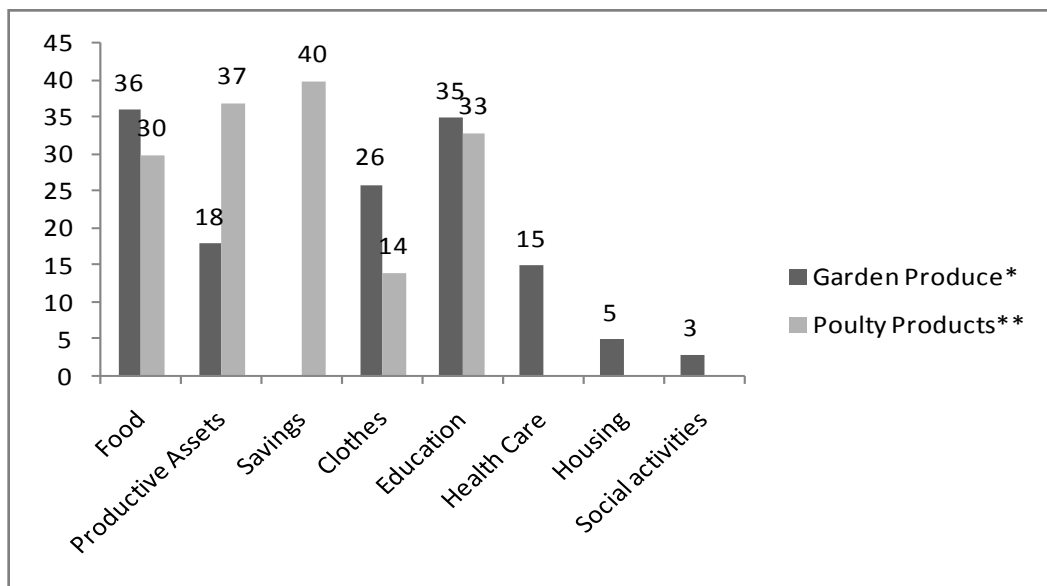
Food Access

HKI typically analyzes the “access” component of food security by examining differences in the income earned from home gardens in the last two to three months of the survey, as well as the kinds of expenditures made using the proceeds from the home gardens. This approach does not take into account the complete picture of household income, expenditures and wealth: information is not collected on how income earned from gardens and small animal production contributes to overall household income, total expenditures, asset acquisition, and savings. Nor does it tell us whether households substitute home production for some food purchases, or whether they experience reductions in other forms of household revenue due to redirecting household labor and investments. Nevertheless, this information does reveal spending priorities of target households and demonstrates ways in which HFP engenders broader food security and community development. Figure 5 shows the patterns of spending for income generated from the sale of garden produce and poultry products among HFP participating households (based on two separate surveys). It shows a variety of uses of this income, including some differences between income earned from garden produce and poultry products. Overall, roughly one-third of households report spending some of this income on food, productive assets and education. Interestingly, 40 percent of households report using additional income earned from poultry products for savings. (No data was available for income from garden produce used for savings.) Households also report spending some of this additional income on clothes, health care, housing, and social activities.

The increased availability of food at the household level also opens the opportunity for income usually spent on food to be spent elsewhere. If the households did not produce these foods, they would have to purchase goods produced elsewhere: therefore, the total household spending ability generated by HFP is likely higher than just the income from selling HFP products.

In the NGNESP evaluation, former participants reported the highest income earned from gardening produce (490 taka), followed by active participants (347 taka), and then controls (200 taka). Food was the most frequently reported expenditure (out of home gardening proceeds) in all groups; food expenditure was significantly higher in the active and former groups compared to the control, as were expenditures on education, clothing, productive assets and health care (Bushamuka et al. 2005). In the animal production pilot evaluation in 2004, income generation from poultry production sales showed a greater impact on earnings than home gardening—a finding that merits further exploration. A later evaluation of the HFP Chars Project showed that 46.3 percent of household income was earned from home gardens compared to 6.7 percent at baseline, and participating households spent significantly more on education, savings, and food (especially fish). (Helen Keller International, Bangladesh 2006b).

Figure 5. Uses of additional income (%) earned from HFP garden produce (NGNESP) and poultry products (ASF Pilot)



Source: Compiled by authors using NGNESP evaluation data (Bushamuka et al. 2005, Table 3) and ASF Pilot project data (Helen Keller International HFP Bulletin No. 2. 2004).

Notes:

* Statistics from active participating households in NGNESP evaluation, 2000

** Endline statistics (n=309) from pilot project of animal husbandry integration, 2003.

Few studies have examined how homestead gardens have changed total household income. One IFPRI study examined the profitability of fish and vegetable production in Bangladesh compared with rice, and concomitant changes in household income; it showed modest increases in income as a result of switching from rice-growing to foods promoted under HKI’s gardening programs (Ruel 2001). HFP program assessments have yet to investigate how the promotion of fruit and vegetable production affects household decisionmaking about other crops produced. As well, there is limited information about market accessibility issues in relation to income earned from garden or animal production. One study showed that households without home gardens primarily depend on the market for their consumption of vegetables (97.5 percent), compared with only 3.2 percent for households with developed gardens (Helen Keller International, Bangladesh 2003).

Food Utilization

By increasing food availability through production, and increasing access through higher income and food expenditures, HFP is expected to promote increased intake of higher quality foods and, ultimately, improved micronutrient status (Appendix 4). HFP evaluations have primarily focused on the intake of micronutrient-rich foods by vulnerable groups (mothers and young children). Few studies have examined nutritional impacts using markers such as anthropometry, anemia, or vitamin A (serum retinol or night-blindness).

Monitoring data from NGNESP showed an important association between household food availability (in quantity and number of varieties) and vitamin A intakes (Bloem et al. 1996). Taher and colleagues concluded that HKI's homestead gardening programs in Bangladesh increased the intake of pro-vitamin A carotenoids, especially among women and children (Taher et al. 2004): the percentage of mothers and children 6-59 months eating dark green leafy vegetables increased from approximately one-third to over three-quarters (Table 2).

Table 2. Consumption patterns among NGNESP households

Indicator	1999	2000
Mothers and dark-green leafy vegetables: 3 of 7 days prior	37%	86%
Children (6-59 mo.) and dark-green leafy vegetables: 3 of 7 days	28%	76%
Mothers' intake of retinol equivalent per day from fruits and vegetables	30	230
Children's intake of retinol equivalent per day from fruits and vegetables	10	40

Source: Taher et al. 2004

During the pilot phase of animal production, beneficiary groups produced 200 eggs in three months, whereas control groups produced only 21 eggs. The evaluation found increases in the percentage of households consuming any eggs (5 percent increase in control, compared to 27 percent increase in intervention) as well as in the number of eggs consumed in the last 7 days, for children 6-59 months and mothers. There was also evidence that money from the sale of poultry was used for the purchase of other foods (Helen Keller International 2004).

In sum, there is evidence that the HFP program in Bangladesh has improved individual intakes of micronutrient-rich food through gardening and animal production. Although the home gardening and animal production programs initially focused on vitamin A consumption, it is probable that the intake levels of other important nutrients also improved with the increased consumption of vegetables, fruits and animal-source foods (Ramakrishnan and Huffman 2008). Although HKI has carefully selected regions of the country vulnerable to undernutrition based on anthropometry and micronutrient status indicators (for example, night-blindness), they have still to evaluate the impact of their programs on these nutritional status outcomes in Bangladesh. In Cambodia, however, anthropometric measures and hemoglobin concentrations were collected on mothers and children less than five years of age at baseline and endline and there was no evidence found that increases in consumption of micronutrient rich foods led to either improved anthropometry or reduced anemia—a finding that may reflect inadequate evaluation design or problems with the intervention, or both (Olney et al. 2008). Other countries such as Nepal are planning to evaluate the nutritional status impacts of large-scale HFP programs.

Table 3 summarizes the findings of the NGNESP evaluation of the HFP program in Bangladesh on food security and other outcomes (discussed below, along with other development outcomes).

Table 3. HFP food security and other impacts¹

Impact category	Description	Example Metric
Production	More home gardens	Year-round gardening increased to 33%
	Increased varieties of foods	Vegetable varieties increased by more than two-fold
	Increased quantities of foods	135 kg instead of 46 kg of vegetables in 3 months
Economic Status	Improved socioeconomic status through sales	Average extra income: US\$8 bi-monthly
	Future economic benefits	10% saved out of income earned
	Employment opportunities	NGNESP alone created more than 60,000 rural jobs
Consumption	Increased consumption of home grown vitamin A-rich foods	Egg consumption increased by 48%
	Increased expenditures of non-cereal foods	Lentils and animal products bought with income earned
Intake Women's Status	Increased vegetables and fruits eaten	Children with developed gardens ate 1.6 times more vegetables
	Garden management	73% managed by women
	Income decision-makers	Women as main decision-makers At least 90% of target households are represented by women

Source: Compiled by the authors with information drawn from various reports (World Bank 2007; Zeina paper) and from Helen Keller International's presentation "An Evaluation of the Household Food Security through Nutrition Gardening Programme by Sarkar et al.)

¹ Summary of changes in relation to the control group or the baseline (NGNESP)

The HFP model has been applied in various agroecological settings quite successfully. Since 2002, HKI has implemented HFP in the riverine “chars” region of northern Bangladesh. These chars, or temporary islands, are especially vulnerable to erosion and flooding. Char dwellers experience *monga*, a local term for cyclical poverty and hunger (Helen Keller International 2008b). This particular HFP project encouraged home gardening and raising livestock through the use of specially adapted low-cost technologies; it also offered nutrition education (Helen Keller International 2006b). The project had a demonstrated impact on increased production of micronutrient-rich foods, dietary diversity, and income from sale of foods produced, as shown in Table 4. It was reported that “activities enhanced [households’] ability to mitigate food insecurity and to cope with flood or *monga*” (Helen Keller International 2008b).

Table 4. Food security impacts: Char II

Impact Indicator	Target	Baseline 2006	Endline 2008
Established <i>improved</i> or <i>developed</i> home gardens	70%	1%	98%
Mothers eating dark green leafy vegetables 4 days a week	40%	2%	78%
Children (12-59 mos.) eating dark green leafy vegetables 4 days a week	40%	2%	67%
Mothers eating eggs at least 2 days a week	30%	15%	43%
Children (12-59 mos.) eating eggs at least 2 days a week	30%	1%	40%
Children (12-59 mos.) eating chicken and other meat at least 1 day a week	30%	17%	35%
Women participating in decisions on how HG income is spent	90%	69%	99%
Generating income from homestead food production surplus	30%	27%	59%
NGOs able to develop a sustainable mechanism for implementing HFP activities	4	3	5

Source: Adapted from Helen Keller International, Bangladesh 2008, “End of Project Report for Project Number BAN-501107-0006006.”

The Chittagong Hill Tracts HFP project was also deliberately located in an especially vulnerable region of the country. CHT has suffered a longstanding civil conflict. The area is characterized by great cultural diversity (with 13 different tribal groups), poor physical infrastructure, underdeveloped agricultural practices, and isolation from government services (Helen Keller International, Bangladesh 2008a). Project evaluations show increased production and consumption of nutritionally rich foods (Table 5). Thus, HKI has successfully targeted and scaled up the HFP intervention in regions with particular vulnerabilities.

Table 5. Food security impacts: Chittagong Hill Tracts

Impact Indicator	Target	Baseline 2006	Endline 2008
Established <i>improved</i> or <i>developed</i> home gardens	70%	4%	98%
Mothers eating dark green leafy vegetables 4 days a week	25%	5%	93%
Children (12-59 mos.) eating dark green leafy vegetables 4 days a week	21%	1%	87%
Mothers eating red, orange and yellow fruits 4 days a week	82%	62%	93%
Children (12-59 mos.) eating red, orange and yellow fruits 4 days a week	84%	64%	87%
Mothers eating eggs 3 days a week	1%	0%	43%
Children (12-59 mos.) eating eggs 3 days a week	1%	1%	47%
Mothers eating chicken and other meat 3 days a week	2%	1%	21%
Children (12-59 mos.) eating chicken and other meat 3 days a week	1%	.4%	18%
Generating income from homestead food production surplus	30%	12%	61%
Women participating in decisions on how HG income is spent	70%	85%	100%
NGOs able to develop a sustainable mechanism for implementing HFP activities	4	2	5

Source: Helen Keller International, Bangladesh 2008. End of Project Report for Project Number BAN-501107-0006005.

Through surveys by the Nutritional Surveillance Project of HKI and the Institute of Public Health Nutrition of the Government of Bangladesh, the Barisal Division of Bangladesh was identified as an especially vulnerable region based on high prevalence of underweight and stunting in children and chronic energy deficiencies in non-pregnant women. The Jibon-O-Jibika project (Bengali for “Life and Livelihood”) targeted this particularly vulnerable region, focusing on 2,200 “ultra-poor” women for home

gardening and goat rearing and some early food security achievements (Helen Keller International, Bangladesh 2007). Although this particular project is not complete, the provisional data presented in Table 6 show that food security is being enhanced throughout the Barisal Division.

Table 6. Food security impacts: Barisal Division JOJ

Impact Indicator	Baseline (2005)	MN Rd-3 (2007)
Established improved home gardens	1%	31%
Established developed home gardens	0%	60%
Households consuming 3 or more eggs/week	38%	50%
Mothers eating eggs at least 3 times in last 7 days	15%	22%
Children eating eggs at least 3 times in last 7 days	15%	24%
Mothers eating pulses at least 3 times in last 7 days	29%	47%
Children eating pulses at least 3 times in last 7 days	18%	37%
Mothers eating vitamin A-rich vegetables at least 3 times in last 7 days	45%	86%
Children eating vitamin A-rich vegetables at least 3 times in last 7 days	27%	65%
Women empowerment: decide themselves how/whether to spend money they earned	28%	38%
Women empowerment: decide jointly how/whether to spend money they earned	8%	44%
Women empowerment: decide how/whether to spend money they earned – no role	64%	17%
Vegetables and fruits produced	3 kg	60 kg
Money earned from vegetables, fruits and poultry sales	223 Tk	340 Tk

Source: Compiled by authors with information drawn from Helen Keller International, Bangladesh 2007—"Homestead Food Production Reduces Malnutrition in Rural Bangladesh" and Helen Keller International's HFP Bulletin 5, 2008.

Other Development Indicators

There have been other important development outcomes of HFP in Bangladesh, most notably the empowerment and improved status of women in the household and improvements in the livelihoods of the most vulnerable groups.

Empowerment of women, as demonstrated by greater decision-making power within the household, is considered an important impact of HFP. Women reported greater contributions to household income because of home gardens. Higher proportions of women reported "full" decision-making power on a range of issues among the active and former participant groups, as compared to the control group (Bushamuka et al. 2005). Also, HFP programs engendered new employment opportunities for women; on average, at least 70 percent of the households targeted by HKI and partnering NGOs are represented by women. There is an additional food security benefit in that, when programs target women, there is a higher probability that the vegetables are consumed, particularly by children (Talukder et al. 2000). Table 7 illustrates the advances made through NGNESP for women's empowerment.

Table 7. Intra-household decisionmaking power: women with *full influence*^a before and after NGNESP

Type of Decision	Group ^b	Before NGNESP	2002	Percentage Increase
Household land use	FP	10.6	34.5	225%
	AP	3.8	26.9	608%
	Control	7	16	129%
Group meeting participation	FP	8.6	51.2	495%
	AP	2	32.8	1540%
	Control	4	18.3	358%
Making purchases (Small household goods)	FP	14.1	49.1	248%
	AP	6.7	41.7	522%
	Control	7.6	21.8	187%
Making purchases (Large household goods)	FP	11.1	23.3	110%
	AP	5.8	22.7	291%
	Control	6.5	12.3	89%
Daily workload	FP	25.2	65	158%
	AP	23	64	178%
	Control	18.2	36.6	101%
Vegetable consumption (Type & quantity)	FP	34.4	80.5	134%
	AP	28.5	77.3	171%
	Control	26.7	53.7	101%

Notes: ^a Full Influence is defined as women who make final decisions, either alone or by consulting their husbands.

^b FP = Former Participants, AP = Active Participants

Source: Helen Keller International 2002 presentation—"NGO home gardening and nutrition education surveillance project—Economic and social impact evaluation.

Vulnerable groups in Bangladesh have been targeted by HKI's programs for several decades. In general, the HFP program targets poor, rural, and landless beneficiaries who are recognized to have limited access to micronutrient-rich foods (Faber et al. 2002). HKI and their partners deliberately locate projects in regions of the country that are especially vulnerable, owing to environmental or human-made conditions. Char dwellers in the northern part of the country, residents of the Chittagong Hill Tracts, and households in the Barisal Division have all been identified as vulnerable populations and have therefore been targeted by HFP projects aiming to increase their food security and improve their quality of life and livelihoods.

4. HFP CHALLENGES AND CONTROVERSIES

Challenges

Overall, the HFP program has been readily accepted and adopted by the stakeholders involved. However, there have been a range of internal and external obstacles to implementation.

Environmental Factors

Extreme water conditions—both scarcity and overabundance—have been identified as obstacles, depending on the time of year and the location. Natural disasters, including floods, cyclones, and monsoons, also present challenges to food production, delaying program implementation and disrupting previous achievements—and are particularly prevalent in those parts of the country targeted by HFP. In the new HFP char project, Char Project 2, HKI (together with partner NGOs) developed strategies to protect farming assets, such as moveable animal shelters and waterproof storage vessels (Helen Keller International, Bangladesh 2005), focusing on chars and low-lying flood plains in 10 subdistricts of northern Bangladesh. In 2007, however, flooding disrupted communications, scattered households, and destroyed 238 of the 250 VMFs (Huq 2007).

Civil Conflicts and Animal Diseases

The Chittagong Hill Tracts program works with 13 diverse tribal groups, who are sometimes engaged in low-grade civil conflict. Avian influenza affected much of Bangladesh in 2007, but fortunately, the CHT program was unaffected by the outbreak (Helen Keller International, Bangladesh 2008a).

Cultural and Economic Barriers: Production and Consumption Norms

Bangladeshi farmers traditionally grow rice, due to its economic value; they were initially hesitant to switch to fruits and vegetables (Talukder et al, 2000). As well, increasing the production of higher quality foods through HFP has not always ensured corresponding changes in the diets of vulnerable groups. Some HFP programs—but not all—have conducted preliminary research to provide insight into the barriers and opportunities to changing behavior and to suggest behavior change and communication techniques—including negotiation and dialogue—that may be used for positive change.

There have also been internal implementation challenges associated with HFP. Monitoring and evaluation data show that certain inputs, such as seeds, saplings, and seedlings, may be available in the village nurseries without reaching the beneficiaries: the weak linkages between household farmers and village nursery owners have been identified as an implementation constraint (Helen Keller International, Bangladesh 2003).

HKI collaborates with many local NGOs throughout Bangladesh. Nevertheless, with program expansion, one challenge has been the lack of NGOs working in more remote areas of the country. Related challenges are: problems of coordination among some partner NGOs; limited NGO capacity (especially to implement at scale); and lack of resources. In order to successfully implement the HFP model, several partner NGOs require more than just technical assistance; they need extensive staff training (capacity-building) and additional staff. Overall, the diversity of partner NGOs has allowed for efficient and effective program scale-up, but it has also resulted in variable quality of implementation (Talukder et al. 2000).

Although many of these challenges have been recognized and addressed over the years, new challenges continue to arise. Observers have identified the following remaining tasks: “the development of innovative regional and national marketing systems for garden produce; the establishment of stronger linkages with commercial seed producers; the integration of homestead gardening with other food production schemes; and the opportunities and challenges of using the gardening networks to deliver other services, such as micronutrient supplements” (Talukder et al. 2000, 171).

The Global Economic Downturn

As HFP evolves, it is especially important to take into account the international food systems and markets in which participants operate, especially in the context of the global recession and the food price crisis. These factors make it very timely to target poor urban communities—but adapting HFP programming to urban contexts brings a new set of challenges.

Controversies

An initial debate concerns whether micronutrient status, including vitamin A, iron, and zinc, can be improved through home gardening, in view of the low bioavailability of these nutrients in fruits and vegetables. HFP evaluations have not adequately measured impact on micronutrient status to allow for definitive conclusions.

Animal production was added to HFP to better ensure improvements in micronutrient nutrition, but this component has introduced other controversies, mostly related to feasibility (labor and capital inputs are higher for animal production than for home gardens). Also, this component still needs to be studied for impact on consumption of animal source foods (especially in young children), the contribution to household income, and, again, its effect on micronutrient status. The risk of zoonotic disease associated with animal-source food production has also been debated. Highly pathogenic avian influenza (HPAI), as well as other poultry diseases such as Newcastle disease, threaten poultry stocks and human health in Asia and has hindered the intervention's acceptance, especially by government officials. In response, HFP programming provides vaccines for the animals along with information about prevention of HPAI and other zoonotic diseases.

Finally, there remains skepticism over the potential of HFP to improve maternal and child micronutrient status at scale. Rigorous (and costly) evaluations, using the same standards of quality and randomized evaluation designs used in supplementation trials, have not been applied to HFP interventions. As a result, there is inconclusive evidence that the model works to improve nutrition, especially at scale, and no credible data regarding its cost-effectiveness compared to other approaches. Although many of the evaluations of HFP have shown impacts on household income and on food production, availability, and diversity, few studies have carefully assessed the impact of HFP on maternal and child nutritional status. Consequently, there is still a perception among some development practitioners and nutritionists that the “proof of concept” that HFP can improve nutrition is still missing.

The Bangladesh evaluations have not used state-of-the-art impact evaluation techniques, such as randomization, nor have they measured impacts on maternal and child anthropometry and micronutrient status. Some past HFP evaluations show certain design flaws. For example, a lack of comparability was apparent in the three “comparison” groups included in the NGNESP evaluation as evidenced by the differing socio-economic characteristics at baseline (Bushamuka et al. 2005). These differences, however, will likely not have invalidated the reported results and in fact, may have attenuated impact. Programmatic differences may also have been present between the active and former participant groups in this evaluation. The evaluations do, however, provide consistent and plausible evidence that HFP has been successful in improving many aspects of household and community livelihoods and food security, as well as intake of micronutrient-rich foods by mothers and young children. Still, more rigorous and detailed impact evaluations of HFP (and of its impact pathways) are needed to quell the controversy over the effectiveness of HFP in addressing micronutrient deficiencies.

5. SUSTAINABILITY OF HFP

It has been estimated that, throughout Asia, approximately 95 percent of the households continue to engage in homestead food production even after their program participation is over. In Bangladesh and Cambodia, fewer than 3 percent of participants drop out of HFP projects annually (Helen Keller International Asia Pacific 2001). The 2002 NGNESP evaluation included a category of former participants—those who had completed the program and operated without HKI assistance for at least three years—as a comparison group alongside the active participants and control groups (Bushamuka et al. 2005). Although not attaining the levels of the active group, the former participants showed better food security indicators than those from the control group, relating to year-round production, crop diversification, production, and consumption. Regarding income earned from gardening products, the former participants actually did better than the active participants, possibly reflecting longer experience and better access to marketing channels (Bushamuka et al. 2005).

HFP sustainability is similarly demonstrated by an ongoing interest in the program and its growing presence throughout the country. The Government of Bangladesh continues to invest and participate in HFP. Each year, hundreds of local NGOs approach HKI and request participation (Talukder et al. 2000). New and continuing HFP programs have by now directly reached over 5 million Bangladeshi households (Helen Keller International 2006a, 2006b).

HFP represents a food-based and household-based strategy that comprehensively addresses availability of and access to higher quality foods. It addresses some of the underlying structural determinants of undernutrition: poverty, food insecurity, and low social status of women. HFP thus improves the likelihood of long-term, sustained positive change for nutrition outcomes. HFP can also be a critically important coping strategy for poor households faced with crises such as the recent food/energy price crisis and the unfolding economic recession (Helen Keller International 2008c).

The program's most challenging objective is the goal of reducing micronutrient deficiencies in vulnerable groups over the long term. Ultimately, effectively addressing micronutrient deficiencies involves increasing intake of bioavailable sources of micronutrients. There are several complementary approaches to achieve this goal: micronutrient supplementation, food fortification and food-based strategies such as HFP (and biofortification).

Agricultural interventions (like other development interventions) should be financially sustainable. Positive indications of financial viability of the HFP model are seen in the return on investment at the VMF and household levels and in effective cost-sharing among HKI, local NGOs, and households. Returns on labor and land investments in home gardens can be high compared to field agriculture. Relatively little investment is required, and locally available materials—including fencing, home-generated manure, and indigenous pest control—may be used (de Pee et al. 2008). Moreover, the multiple uses for many of the garden products create a range of opportunities for returns: for example, products from the garden have been used as fodder for the animals or for making handicrafts such as baskets. Indigenous crops are promoted exclusively, since external organizations are not involved in day-to-day operations.

HFP programming costs have been only minimally examined in relation to benefits. One frequently cited estimate from NGNESP puts costs at \$7.66 per household, derived by dividing the project's estimated budget since 1993 (after seven years of operation) by the total number of beneficiaries (Bushamuka et al. 2005). Sometimes cited as the cost per garden, this figure represents the cost of agriculture inputs, training, and technical assistance. It is unclear, however, whether it includes overhead costs, or the additional costs borne by other implementing organizations. More rigorous cost-benefit studies of HFP could yield information such as the rate of return on investments and a more comprehensive analysis of costs and outputs over the entire program period.

Even in the absence of more thorough analyses, it seems clear that the cost-sharing option of HFP contributes to its financial sustainability. Financial responsibility for the program is shared among HKI, participating households, and partner NGOs (Helen Keller International 2003c); this co-financing applies

to both program costs and agricultural inputs. Sharing the financial burden of activities over a three-year collaboration period reinforces the concept of joint ownership and enhances program sustainability (Talukder et al. 2000).

Homestead gardening is also an environmentally sustainable endeavor. A founding principle integral to the initial program goal of increasing production and consumption of vitamin A-rich foods was the use of ecologically sound methods (Helen Keller International 2003c). Some of the environmentally friendly aspects of home gardening practices in general include: recycling; safe household waste management and waste water usage; and an increased appreciation of nature among participating families (Landon-Lane 2004). HFP programs, more specifically, embrace additional environmentally friendly agricultural practices: planting trees; use of organic fertilizers and pesticides; safe use of pesticides; and live fencing that enriches the soil with nitrogen. The majority of households involved in HFP programs maintain soil fertility through the use animal manure and compost as an alternative to chemical fertilizers (Helen Keller International 2002b).

Regarding the social and political aspects of sustainability, the active role of the Government of Bangladesh is a vital factor, in particular, HFP has been incorporated into district- and national-level planning, particularly through the DAE. In addition, the involvement and capacity building of partner NGOs has also ensured longevity for HFP. In a typical HFP model, HKI is involved for a period of three years followed by another two years of ongoing partner NGO engagement; following this period, communities are expected to operate HFP independently.

Collaboration and capacity strengthening for partner NGOs is regularly practiced through planning workshops and information sharing. Homestead gardening is flexibly integrated into already existing community-based health and development programs (Helen Keller International 2003c). Evaluations reveal that partner NGOs have higher skill capacities following project involvement than non-partner NGOs. For example, 84 percent of partner NGOs (compared to 70 percent of non-partner NGOs) have staff with training skills; 100 percent (compared to 90 percent) have gender equality as a component of their programs; 84 percent (compared to 40 percent) have a monitoring system; and 100 percent (compared to 20 percent) conduct nutrition education (Helen Keller International 2003b). Regular reviews of lessons learned have led to modifications of the home gardening model and to collaboration with additional organizations.

6. LESSONS LEARNED

Two decades of operation in Bangladesh have generated lessons for optimizing HFP implementation and impact. Some of the ideas have already been incorporated into the design and delivery of the program, and others will be applied in future projects, here and elsewhere.

Standard with Flexible Components

The HFP intervention can be described as a model that is applicable in many diverse settings but has a standard set of inputs and organizational structure. As such, it allows for centralized quality control, as well as for adjustments by implementing organizations in response to new evidence. For example, when the conversion factor for pro-vitamin A and retinol equivalents was formally increased (IOM 2000), the HFP model was revised to include small animal production and promotion of animal-source foods. Another advantage of standardization is the ease of replication and scaling up, as shown in the reach of HFP both within Bangladesh and elsewhere in South Asia.

A completely static model cannot respond to context and community needs and will ultimately be less effective. HKI therefore included aspects of the HFP intervention model that are dynamic and responsive to local conditions. One mechanism of flexibility is the formation of partnerships with local NGOs: since 1993, HKI has worked with 79 partner organizations throughout Bangladesh, who use varying approaches suitable to the communities where they operate (Talukder et al. 2001). Another element of flexibility is the use of pilot projects to facilitate the early introduction of culturally appropriate and localized components (Sifri 2007). The NGNESP was originally a pilot started in 1990, as was the animal husbandry component introduced in 2001.

Local Partnerships

Although HKI has been the primary NGO designing and promoting HFP in Bangladesh and elsewhere, many important stakeholders have also been involved. As mentioned above, the Government of Bangladesh and local NGOs are integral to the planning and execution of this program. Local partnerships are vital for program sustainability, as existing structures, institutions, and ways of operating are generally more effective for implementing a program over the long term. Local capacity is also strengthened through partnerships, as all parties share information, respond to new challenges, and work together to strengthen HFP programs throughout Bangladesh. More documentation is needed on these processes and partnerships to better understand the challenges and opportunities.

Community Roots

The importance of a community-based approach has long been recognized in the development literature. In the case of HFP, its importance cannot be overstated. The HFP intervention is built on local farming practices and an understanding of the sociocultural norms of the targeted population (Sifri 2007). The paradox of HFP success is that it both relies on and transcends local practices in order to increase production and improve consumption and nutrition. HKI and partner NGOs recognize that—like indigenous crops that grow best in local conditions—agricultural practices evolve more smoothly when starting with commonly accepted methods. Village nurseries are often used as a site for demonstrating and experimenting with new techniques, such as use of botanical pesticides and fertilizers, crop rotation practices, and live fencing (Talukder et al. 2001).

Community participation is important throughout the project cycle, from design through implementation and evaluation. “Having a two-way channel for information exchange has been instrumental for achieving sustainable, improved gardening practices” (Talukder et al. 2000). Ultimately, HFP is a community-based intervention; participant ownership is a critical aspect contributing to its success.

Information Systems

Throughout the world, HKI operates and participates in various kinds of surveillance and information systems. The history of HFP in Bangladesh shows an active feedback process, between information collected and programming interventions.

Three forms of information sources have been used. First are the national (or sometimes local) surveys that guide the siting of projects in particular regions. The best example is the 1982/3 IPHN/HKI survey on vitamin A deficiencies which inspired the NGNESP HFP.

Second, monitoring surveys are conducted in program sites every four months, to identify problems and compile progress reports. The information is shared and responded to within the community in a problem-solving approach (Talukder et al. 2000). Plans are being discussed to make even better use of this information, to integrate more operations research methodologies, and possibly to use more modern technologies (for example, cell phones) for data collection.

Third, evaluations are used to inform and improve HFP programming. Evaluations are important for motivating donor investments in HFP and fostering commitment on the part of governments and other partners. Stronger evidence is needed for the nutritional impacts of food-based, comprehensive interventions like HFP. HKI is currently working with organizations like International Food Policy Research Institute (IFPRI) to improve evaluation design, apply program theory, and investigate impact pathways more systematically.

Food-Based Approach

Two important lessons may be drawn regarding the HFP food-based approach to preventing and alleviating micronutrient malnutrition. First, the concept of the best foods to promote for vulnerable group consumption has evolved within the HFP program framework, responsive to scientific findings. The shift to animal-source foods as a more bioavailable source of micronutrients is one example; and there have been other changes as well, in messages about foods and the best methods of preparation to enhance absorption of micronutrients from gardening produce.

Second, HFP is among the few programs that provide evidence of the effectiveness of agricultural interventions in improving the quality of diet of vulnerable populations. HFP results show that foods grown in gardens, such as dark green leafy vegetables or eggs from animal production, may be more frequently consumed by children and mothers, especially when a BCC component is integrated in the agricultural intervention. Whether these changes in diet improve micronutrient status is a question that needs further research.

Multidisciplinary Action

HFP programming blends the contributions of several disciplines to address the complex problems of food insecurity and undernutrition in Bangladesh. Inputs are shaped by expertise from the fields of agronomy, nutrition, public health, economics, and environmental science, to form an integrated package of interventions. Programs are more likely to have an impact if they simultaneously address both the underlying and the immediate determinants of malnutrition (Ruel 2008). HFP benefits from the synergies among interventions aimed at improving household food security, income, women's empowerment, health, and nutrition. In recent years, there has been recognition of the need for linkages with the health sector in particular, in view of the well-known interactions between nutrition and disease. These linkages can help provide both preventative and curative health care for mothers and children. HFP is still in the early stages of this effort, and more involvement is needed with Ministries of Health, primary health care systems, and other health care stakeholders.

Dialogue, Communication, and Skill-Building

Education and technical assistance have long been integral to HFP programming. Capacity building at all levels—for partner NGOs, community members, caregivers, other household members, and so on—is

viewed as critical to the success and sustainability of HFP. Education raises awareness and helps ensure better choices and better practices for growing foods year round that are rich in micronutrients (Sifri 2007). Over the years, the nutrition education component of HFP has evolved and taken different forms to more effectively communicate with caregivers. Behavior change communication techniques have been shown effective for improving nutrition, especially in young children. HKI is currently working to strengthen and expand the BCC aspects of HFP programming and to adopt the Essential Nutrition Actions (ENA) approach.

7. CONCLUSION

In Bangladesh, HFP has improved food security for nearly 5 million vulnerable people living in diverse agroecological zones. This holistic, integrated package of home gardening, small livestock production and nutrition education not only improves household food production and diet quality; it also empowers women, households, and communities through economic and social development. It respects local customs and practices and gains longevity in return. HFP leaves a legacy of knowledge, awareness and understanding with its many partners and beneficiaries. If HFP continues to be responsive to new information and receptive to changes in the environment and the sociopolitical landscape, it will overcome barriers to implementation and effectiveness and continue on its path to improving household food security and diet quality, and the well-being of many throughout the world.

HFP programming has been replicated in several countries of Asia and the Pacific. In Cambodia, Nepal, and the Philippines, HFP has improved the food security and livelihoods of over 1 million households. HFP programming has begun to take hold in Sub-Saharan Africa, with programs operating in Burkina Faso, Mozambique, Niger, Senegal, and Tanzania. Programs in Africa tend to be smaller and more variable than in Asia, ranging from school gardens in Burkina Faso to the promotion of bio-fortified orange-flesh sweet potatoes in Mozambique. Animal production has not yet been introduced in any of these country programs.

HFP programs have not fully met expectations, however, in demonstrating improvements in maternal and child micronutrient status. Although there is convincing evidence of HFP's impact on household production, improved diet quality, and intake of micronutrient-rich foods, its contribution to reducing the prevalence of deficiencies in vitamin A, iron or zinc has yet to be revealed. It may be that inputs and delivery strategies need to be modified to better reach mothers and young children—or, alternatively, that better impact evaluations need to be designed to capture impacts on anthropometry and markers of micronutrient nutrition. HFP monitoring and evaluation strategies should be grounded in program theory and should clearly identify, measure, and analyze program impact pathways. Stronger, more rigorous experimental evaluation designs are needed to measure impact and cost-effectiveness, and to address skepticism about HFP's potential role in addressing micronutrient deficiencies in a sustainable way. Finally, HKI and its partners need to establish and strengthen linkages to the health sector to fulfill its multifaceted approach. HFP's nutritional goals can be fully achieved only by incorporating the bi-directional linkages between health and nutrition, to complement its strong agriculture and food security inputs.

APPENDIX 1. BANGLADESH HEALTH AND POPULATION STATISTICS

Indicator	Statistic	Year
Total population	158,665,000	2007
Population under 18	64,486,000	2007
Population under five	18,900,000	2007
Annual births	3,998,000	2007
Annual under-five deaths	244,000	2007
Life expectancy at birth	64	2007
Total Fertility Rate	2.9	2007
Infants with low birth weight (%)	22	2000-2007
Under-fives who are underweight (%)*	46	2000-2007
Under-fives who are wasted (%)*	16	2000-2007
Under-fives who are stunted (%)*	36	2000-2007
Vitamin A supplementation: at least one dose (6-59 mo.) (%)	95	2007
Vitamin A supplementation: full coverage (6-59 mo.) (%)	94	2007
Under-five mortality (per 1,000)	72	2007
Infant mortality rate (per 1,000)	49.80%	2005
GDP per capita (ppp US\$)	41.30%	2005
Below national poverty line (%)	84%	1990-2005
Below international poverty line of US\$1.25 (%)	50	2005
Adult literacy (%)	54	2000-2007

Notes: ^a UNICEF acquired this data from the NCHS/WHO datasets.

Sources: UNICEF Bangladesh Statistics—accessed 4/30/2009; Human Development Report 2007/2008; Bangladesh Demographic and Health Survey 2007: National Institute of Population Research and Training—2009

APPENDIX 2. LIST OF PARTNER NGOS FOR HFP IN BANGLADESH

Non-Governmental Organization	Project Participation	Dates
Banchte Shekha	NGNESP	1993-2003
Bangladesh Cha Sramik Union (BCSU)	NGNESP	1993-2003
Bangla-German Sampreeti (BGS)	NGNESP	1993-2003
Bangladesh Rural Advancement Committee (BRAC)	NGNESP	1993-2003
Bangladesh Rural Advancement Through Voluntary Enterprise (BRAVE)	NGNESP	1993-2003
Bangladesh Rural Improvement Foundation (BRIF)	NGNESP	1993-2003
Community Development Association C(DA)	NGNESP	1993-2003
COAST Trust	NGNESP	1993-2003
CONCERN Bangladesh	NGNESP	1993-2003
Dak Diye Jai (DDJ)	NGNESP	1993-2003
DIPSHIKHA	NGNESP	1993-2003
Daridrya Nirashan Prochesta (DNP)	NGNESP	1993-2003
Dushtha Shasthya Kednra (DSK)	NGNESP	1993-2003
Friends In Village Development Bangladesh (FIVDB)	NGNESP	1993-2003
Gandhi Asram Trust (GAT)	NGNESP	1993-2003
Grameen Jonokallyan Sangsad (GJKS)	NGNESP	1993-2003
Grameen Samaj Kendra (GSK)	NGNESP	1993-2003
GSS	NGNESP	1993-2003
IMPACT Foundation Bangladesh	NGNESP	1993-2003
Integrated Social Development Effort (ISDE)	NGNESP	1993-2003
Jatiyo Kallyan Sangstha (JAKAS)	NGNESP	1993-2003
Jagrata Juba Sangha (JJS)	NGNESP	1993-2003
Mass Organization For Technical, Health, Education & Rehabilitation of the Disadvantaged (MOTHER)	NGNESP	1993-2003
NIJPATH	NGNESP	1993-2003
Noakhali Rural Development Society (NRDS)	NGNESP	1993-2003
Program for Community Development PCD	NGNESP	1993-2003
Palli Mongal Karmosuchi (PMK)	NGNESP	1993-2003
Palli Punargathan Club (PPC)	NGNESP	1993-2003
PRODIPAN	NGNESP	1993-2003
Proshika Manobik Unnayan Kendra	NGNESP	1993-2003
Progoti Samajkallayan Sangstha (PSS)	NGNESP	1993-2003
Rangpur Development Samajik Sangstha (RDSS)	NGNESP	1993-2003
Rural Organization for Voluntary Activities (ROVA)	NGNESP	1993-2003
SANGKALPA	NGNESP	1993-2003
Society Development Committee (SDC)	NGNESP	1993-2003
SETU	NGNESP	1993-2003
Society for Health Extension Development (SHED)	NGNESP	1993-2003
Shirashuni Humanitarian Enhance Territorial Unity (SHETU)	NGNESP	1993-2003

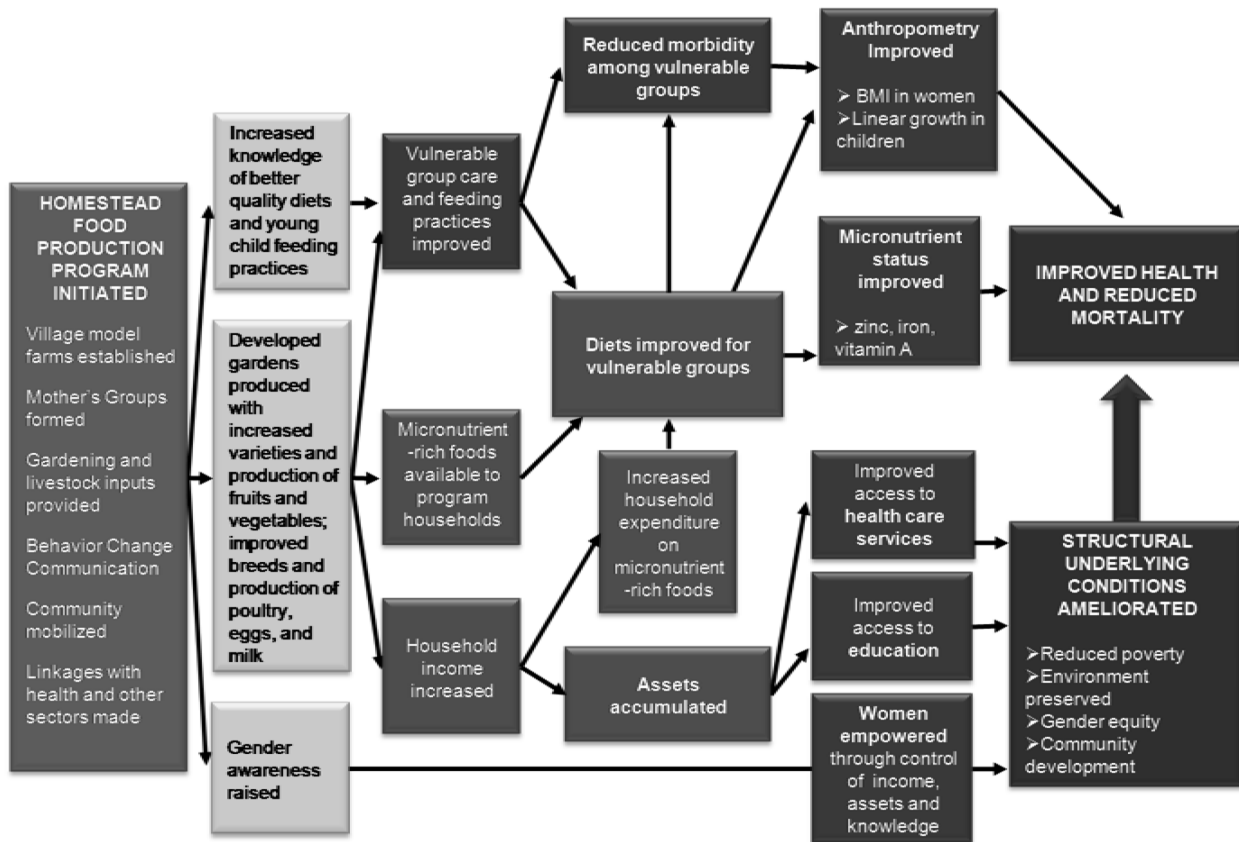
Non-Governmental Organization	Project Participation	Dates
Social Development and Agnitran Project (SODAP)	NGNESP	1993-2003
SRIZONY	NGNESP	1993-2003
Sabalamby Union Samity (SUS)	NGNESP	1993-2003
UDDIPAN	NGNESP	1993-2003
UTTARAN	NGNESP	1993-2003
Voluntary Association for Rural Development (VARD)	NGNESP	1993-2003
Welfare Association of Village Environment (WAVE)	NGNESP	1993-2003
UPAKAR	NGNESP	1993-2003
Young Power in Social Action (YPSA)	NGNESP	1993-2003
Tenghamara Mohila Sobuz Sangha (TMSS)	NGNESP	1993-2003
Rangpur Dinajpur Rural Service-Bangladesh (RDRS)	NGNESP/CHAR-I	1993-2005
Gana Unnayan Kendra (GUK)	CHAR-I/II	2003-2008
Gono Kalyan Sangstha (GKS)	CHAR-I/II	2003-2008
SKS Foundation (SKS)	CHAR-I/II/III	2003-2011
ZIBIKA	CHAR-II	2005-2008
North Bengal Rural Development Sangstha (NBRDS)	CHAR-II	2005-2008
Debi Chowdhurani Palli Unnayan Kendra (DCPUK)	CHARI-II/III	2005-2011
Gram Unnayan Karma (GUK)	CHARI-II/III	2005-2011
Gram Bikash Sangstha (GBS)	CHAR-III	2008-2011
Palli Samonnaya O Shikkha Kallyan Parishad (Pasashik Parsad)	CHAR-III	2008-2011
Centre for Integrated Rural & Agriculture Development (CIRAD)	CHAR-III	2008-2011
Nari-O-Shishu Kallyan Sangstha (NSKS)	CHAR-III	2008-2011
Manab Mukti Sangstha (MMS)	CHAR-III	2008-2011
Integrated Development Foundation (IDF)	NOVIB-CHT	2005-2008
Strategic Actions Society (SAS)	NOVIB-CHT	2005-2008
Ashroy-Angan	NOVIB-CHT	2005-2008
Gram Unnayan Sangathan (GRAUS)	NOVIB-CHT	2005-2008
Adivasi Unnayan Kendra (Center for Indigenous Peoples' Development (CIPD)	NOVIB-CHT	2005-2008
Assistance for the Livelihood of the Origins (ALO)	NOVIB-CHT	2005-2008
ANANDO	NOVIB-CHT	2005-2008
Integrated Community Development Association (ICDA)	SC-JIBON-O-JIBIKA	2004-2009
Community Service Center (CSC)	SC-JIBON-O-JIBIKA	2004-2009
Society Development Agency (SDA)	SC-JIBON-O-JIBIKA	2004-2009
SPEED TRUST	SC-JIBON-O-JIBIKA	2004-2009
South Asian Partnership-Bangladesh (SAP-Bangladesh)	SC-JIBON-O-JIBIKA	2004-2009
Dip Unnayan Society (DUS)	SC-JIBON-O-JIBIKA	2004-2009
USHIK	SC-JIBON-O-JIBIKA	2004-2009
Grameen Jono Unnayan Shangstha (GJUS)	SC-JIBON-O-JIBIKA	2004-2009
Voluntary Organization for Social Development (VOSD)	SC-JIBON-O-JIBIKA	2004-2009

Source: Various HKI published and unpublished documents, and correspondence with HKI staff.

APPENDIX 3. LIST OF HFP EVALUATIONS

Evaluations	Design	Comparison groups (sample size if relevant)
Vitamin A home gardening pilot evaluation (1991)	Internal pre-/post- design: baseline (July 1988) and endline (Dec 1990)	None (~150 families)
Mid-term NGNESP evaluation (1993)	Internal pre-/post- evaluation: baseline and endline	Target (n=1,000) Interaction (n=100) Control (n=200)
Mid-term review of NGNESP (1997)	Internal review at mid-term (Nov-Dec 1997)	None
Evaluation of NGNESP (2000)	Multistage-cluster design — systematic sampling procedure for both surveys/questionnaires (Sept - Nov 1999 — baseline study; Nov 2000 –Jan 2001 evaluation studies)	719 hhs in each survey
Situation analysis among NGOs working in HFP in Bangladesh (2001)	1-1.5 hour visits with NGO staff; structured questionnaire	Partner NGOs (n=27) Non-Partner NGOs (n=54)
NGNESP economic and social impact evaluation (2002)	Independent impact evaluation; External post-evaluation: cross-sectional design	2160 hhs —720 hhs surveyed in each group: Active (n=711) Former (683) Control (603)
Pilot animal production and consumption project (2002/2003)	Internal pre-/post- evaluation: baseline (April/May 2002) and endline (Mar-Apr 2003)	Target Control Baseline (n=700) Endline (n=692)
HFP chars in the riverine islands and floodplains (Feb-Mar 2008)	External review using qualitative and quantitative data at endline	None
HFP/CHT project evaluation -baseline (January 2005) and endline (June 2008)	Internal evaluation comparing baseline and endline changes	None

APPENDIX 4. DETAILED HFP IMPACT PATHWAYS



REFERENCES

- Allen, L. H. 2003. Interventions for micronutrient deficiency control in developing countries: Past, present, and future. *Journal of Nutrition* 133 (11-2): 3875S–3878S.
- Anik, R. K. 2007. The homestead food production program. Helen Keller International, Asia Pacific. Powerpoint presentation.
- Baten, A. 2007. Overview on HFPP-CHAR Project. Helen Keller International, Bangladesh. Powerpoint presentation.
- Berning, C., B. Correa, K. Sirman, and F. Sosa. 2008. Homestead food production in Barisal, Bangladesh. M.A. thesis, George Washington University, Washington, D.C.
- Berti, P. R., J. Krasevec, and S. FitzGerald. 2004. A review of the effectiveness of agriculture interventions in improving nutrition outcomes. *Public Health Nutrition* 7 (5): 599–609.
- Bhutta, Z. A., T. Ahmed, R. E. Black, S. Cousens, K. Dewey, E. Giugliani, B. A. Haider, B. Kirkwood, S. S. Morris, H. P. S. Sachdev, and M. Shekar. 2008. What works? Interventions for maternal and child undernutrition and survival. *The Lancet* 371 (9608): 417–440.
- Black, R., L. Allen, Z. Bhutta, L. Caulfield, M. de Onis, M. Ezzati, C. Mathers, and J. Rivera. 2008. Maternal and child undernutrition: Global and regional exposures and health consequences. *The Lancet* 371 (9608): 243–260.
- Bloem, M. W., N. Huq, J. Gorstein, S. Burger, T. Kahn, N. Islam, S. Baker, and F. Davidson. 1996. Production of fruits and vegetables at the homestead is an important source of vitamin A among women in rural Bangladesh. *European Journal of Clinical Nutrition* 50 (Supplement 3): S62–S67.
- Bouis, H., B. de la Briere, L. Guitierrez, K. Hallman, N. Hassan, O. Hels, W. Quabili, A. Quisumbing, and S. Thilsted. 2000. *Commercial vegetable and polyculture fish production in Bangladesh: Their impacts on income, household resource allocation, and nutrition*. Gender and Intrahousehold Aspects of Food Policy Project Brief 2. Washington, D.C.: International Food Policy Research Institute.
- Brown, D. 2003. Solutions exist for constraints to household production and retention of animal food products. *Journal of Nutrition* 133 (11, sup2): 4042S–4047S.
- Bushamuka, V. N., S. de Pee, A. Talukder, L. Kiess, D. Panagides, A. Taher, and M. Bloem. 2005. Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. *Food and Nutrition Bulletin* 26 (1): 17–25.
- Chowdhury, T., and H. Torlesse. n.d. Homestead gardening practices and the consumption of non-grain foods in households in rural Bangladesh. Helen Keller International. Powerpoint presentation.
- Christian, P. 2002. Recommendations for indicators: Night-blindness during pregnancy—A simple tool to assess vitamin A deficiency in a population. *Journal of Nutrition* 132 (Supplement 9): 2884S–2888S.
- de Pee, S., C. E. West, D. Permaesih, S. Martuti, Muhilal, and J. G. A. J. Hautvast. 1998. Orange fruit is more effective than are dark-green, leafy vegetables in increasing serum concentrations of retinol and B-carotene in schoolchildren in Indonesia. *American Journal of Clinical Nutrition* 68 (5): 1058–1067.
- de Pee, S., A. Talukder, and M. Bloem. 2008. Homestead food production for improving nutritional status and health. In *Nutrition and health: Nutrition and health in developing countries*, 2nd edition, ed. R. D. Semba and M. W. Bloem. Totowa, N.J., U.S.A.: Humana Press.
- Delgado, C. 2003. Rising consumption of meat and milk in developing countries has created a new food revolution. *Journal of Nutrition* 133 (11, sup2): 3907S–3910S.
- Demment, M. W., M. M. Young, and R. L. Sensenig. 2003. Providing micronutrients through food-based solutions: A key to human and national development. *Journal of Nutrition* 133 (11, sup2): 2879S–3885S.
- Diamond, J. 2002. Evolution, consequences, and future of plant and animal domestication. *Nature* 418 (August 8): 700–707.

- Faber, M., M. A. S. Phungula, S. L. Venter, M. A. Dhansay, and A. J. S. Benade. 2002. Home gardens focusing on the production of yellow and dark-green leafy vegetables increase the serum retinol concentrations of 2–5-year-old children in South Africa. *American Journal of Clinical Nutrition* 76 (5): 1048–1054.
- Food and Agriculture Organization of the United Nations (FAO). 2008. The state of food insecurity in the world. Rome: FAO.
- Gibson, R. 2005. *Principles of nutritional assessment*, 2nd edition. New York: Oxford University Press.
- Haider, B., and Z. Bhutta. 2008. Dietary diversification strategies including home gardening, livestock farming and dietary modifications. In *What works? Interventions for maternal and child undernutrition and survival*, ed. Z. A. Bhutta, T. Ahmed, R. E. Black, S. Cousens, K. Dewey, E. Giugliani, B. A. Haider, B. Kirkwood, S. A. Morris, H. P. S. Sachdev, and M. Shekar. Karachi, Pakistan: Aga Khan University. Also in *The Lancet* 371 (9608): 417–440.
- Helen Keller International. 2000. NGO gardening and nutrition education surveillance project (NGNESP): USAID/BD Mission Meeting. HelenKeller Worldwide. Powerpoint presentation.
- _____. 2002a. NGO home gardening and nutrition education surveillance project: Economic and social impact evaluation. USAID-HKI Meeting, October 9, HelenKeller Worldwide. Powerpoint presentation.
- _____. 2002b. Economic and social impact evaluation: NGO gardening and nutrition education surveillance project (NGNESP). Helen Keller International. Powerpoint presentation.
- _____. 2003. *Integration of animal husbandry into home gardening programs to increase vitamin A intake from foods: Bangladesh, Cambodia, and Nepal*. Asia-Pacific Regional Bulletins, Special Issue. New York: Helen Keller Worldwide.
- _____. 2003. *Strengthening the capacity of local NGOs through food production and nutrition programs in Bangladesh, Cambodia, and Nepal*. Asia-Pacific Regional Bulletins, Special Issue. New York: Helen Keller Worldwide.
- _____. 2003. *HKI's homestead food production program sustainably improves livelihoods of households in rural Bangladesh*. Homestead Food Production Bulletin No. 1. New York: Helen Keller Worldwide.
- _____. 2004. *Homestead food production improves household food and nutrition security*. Homestead Food Production Bulletin No. 2. New York: Helen Keller Worldwide.
- _____. 2006. *Homestead food production: The potential and opportunity to improve the food security and rural livelihood in Barisal division*. Homestead Food Production Bulletin No. 3. New York: Helen Keller Worldwide.
- _____. 2006. *Homestead food production—An effective integrated approach to improve food security among the vulnerable char dwellers in northern Bangladesh*. Homestead Food Production Bulletin No. 4. New York: Helen Keller Worldwide.
- _____. 2008. *Homestead food production—Improving nutrition and food security and empowering women in the rural Barisal Division of Bangladesh*. Homestead Food Production Program Bulletin No. 5. New York: Helen Keller Worldwide.
- _____. 2008. *Homestead food production—An effective strategy in mitigating household food insecurity and coping with disasters (flood and monga)*. Homestead Food Production Program Bulletin No. 6. New York: Helen Keller Worldwide.
- _____. 2008. *Global food crisis and HKI's response*.
<http://www.hki.org/research/documents/Food%20Crisis%20and%20HKI.pdf>. Issued June 3.
- Helen Keller International, Asia-Pacific. 2001. *Homestead food production—A strategy to combat malnutrition and poverty*. Jakarta, Indonesia: Helen Keller International.
- Helen Keller International, Bangladesh. 1999. Household food security through nutrition gardening: Mid-term evaluation report. NGO Gardening and Nutrition Education Surveillance Project (NGNESP). Helen Keller International, Dhaka, Bangladesh.

- Helen Keller International, Bangladesh. 2003. Monitoring of activities in village nurseries and household gardens: A summary report of surveys 14–19 (July 1999–June 2001). NGO Gardening and Nutrition Education Surveillance Project (NGNESP), Grant No. HRN-A-0098-00013-00 and BAN-501107-0000434. Helen Keller Worldwide, New York.
- Helen Keller International, Bangladesh. 2005. Improving nutrition and food security through homestead food production in the riverine islands and floodplains of Bangladesh. Proposal for Program Cost Extension. Helen Keller International, Dhaka, Bangladesh.
- Helen Keller International, Bangladesh. 2006. Homestead food production to improve household food and nutrition security in the Chittagong Hill Tracts. Progress Report for project BAN-501107-0006005, January–December 2005. Helen Keller Worldwide, New York.
- Helen Keller International, Bangladesh. 2006. Improving nutrition and food security through homestead food production in the riverine islands and floodplains of Bangladesh (HKI Char Project 2). Progress Report for project BAN-501107-0006006, July–December 2005. Helen Keller Worldwide, New York.
- Helen Keller International, Bangladesh. 2007. Homestead food production program in Barisal Division: Jibon-O-Jibika Project. Program update, June. Helen Keller Worldwide, Dhaka, Bangladesh.
- Helen Keller International, Bangladesh. 2008. Homestead food production to improve household food and nutrition security in the Chittagong Hill Tracts. End of Project Report for project BAN-501107-0006005, July 2007–June 2008. Helen Keller Worldwide, New York.
- Helen Keller International, Bangladesh. 2008. Homestead food production program (HFPP): Producing more than home gardens. Helen Keller International, Dhaka, Bangladesh. Photocopy.
- Helen Keller International, Bangladesh. 2008. Homestead food production program. Helen Keller International, Dhaka, Bangladesh. Powerpoint presentation.
- Helen Keller International, Cambodia. 2003. *Handbook of home gardening in Cambodia: The complete manual for vegetable and fruit production*. New York: Helen Keller International.
- Helen Keller International/Nepali Technical Assistance Group (NTAG). 2008. Action against malnutrition through agriculture: A child survival project for Nepal. Request for Applications (RFA) No. USAID-M-OAA-GH-08-252, submitted to Child Survival and Health Grants Program (CSHGP), February 28.
- Hess, S. Y., and J. C. King. 2009. Effects of maternal zinc supplementation on pregnancy and lactation outcomes. In *International zinc nutrition consultative group technical document 2: Systematic reviews of zinc intervention strategies*, ed. K. Brown and S. Y. Hess, Food and Nutrition Bulletin Supplement 30 (1): S60–S78. Boston, Mass., U.S.A.: United Nations University Press.
- Huq, S. M. 2007. Devastating flood in Bangladesh: HFPP CHAR project. Helen Keller International, Dhaka, Bangladesh. Powerpoint presentation.
- Institute of Medicine (IOM), Panel on Micronutrients, Food, and Nutrition Board. 2000. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, D.C.: National Academies Press.
- Karim, R., G. Stallkamp, S. de Pee, N. Akhter, A. Talukder, and R. Moench-Pfanner. 2005. Creating food security by poultry production. Helen Keller International, New York. Powerpoint presentation.
- Landon-Lane, C. 2004. *Livelihoods grow in gardens: Diversifying rural incomes through home gardens*. Rome: Food and Agriculture Organization of the United Nations.
- Leroy, J. L., and E. Frongillo. 2007. Can interventions to promote animal production ameliorate undernutrition? *Journal of Nutrition* 137 (October): 2311–2316.
- Leroy, J. L., M. Ruel, E. Verhofstadt, and D. Olney. 2009. The micronutrient impact of multisectoral programs focusing on nutrition: Examples from conditional cash transfer, microcredit with education, and agricultural programs. Micronutrient Forum. Photocopy.
- Murphy, S. P., and L. H. Allen. 2003. Nutritional importance of animal-source foods. *Journal of Nutrition* 133 (11m sup2): 3932S–3935S.

- National Nutritional Blindness Prevalence Survey. 1982–1983. Dhaka, Bangladesh: Institute of Public Health Nutrition and Helen Keller International.
- Nielsen, H., N. Roos, and S. H. Thilsted. 2003. The impact of semi-scavenging poultry production and the consumption of animal-source foods by women and girls in Bangladesh. *Journal of Nutrition* 133 (11, sup2): 4027S–4030S.
- Nutrition Survey of Rural Bangladesh. 1981–1982. Dhaka, Bangladesh: University of Dhaka, Institute of Nutrition and Food Science.
- Olney, D. K., A. Talukder, L. L. Iannotti, M. T. Ruel, and V. Quinn. 2008. Assessing impact and impact pathways of a Homestead Food Production program on household and child nutrition in Cambodia. *Food and Nutrition Bulletin*, forthcoming.
- Pachón, H., K. B. Simondon, S. T. Fall, P. Menon, M. T. Ruel, C. Hotz, H. Creed-Kanashiro, B. Arce, M. R. L. Domínguez, E. A. Frongillo, and D. L. Brown. 2007. Constraints on the delivery of animal-source foods to infants and young children: Case studies from five countries. *Food and Nutrition Bulletin* 28 (2): 215–229.
- Quisumbing, A. R., ed. 2003. *Household decisions, gender, and development: A synthesis of recent research*. Washington, D.C.: International Food Policy Research Institute.
- Ramakrishnan, U., and S. L. Huffman. 2008. *Multiple micronutrient malnutrition: What can be done*. In *Nutrition and health in developing countries*, ed. R. D. Semba and M. W. Bloem. Totowa, N.J., U.S.A.: Humana Press.
- Randolph, T. F., E. Schelling, D. Grace, C. F. Nicholson, J. L. Leroy, D. Peden, D. C. Cole, M. W. Demment, A. Omoro, J. Zinsstag, and M. Ruel. 2007. Role of livestock in human nutrition and health for poverty reduction in developing countries. *Journal of Animal Sciences* 85: 2788–2800.
- Rastogi, R., and C. D. Mathers. 2000. Global burden of iron deficiency anaemia in the year 2000. In *Global burden of disease 2000*. Geneva: World Health Organization.
<http://www.who.int/healthinfo/statistics/bod_irondeficiencyanaemia.pdf>.
- Rice, A., R. Stoltzfus, A. de Francisco, and C. Kjolhede. 2000. Evaluation of serum retinol, the modified-relative dose-response ratio, and breast-milk vitamin A as indicators of response to postpartum maternal vitamin A supplementation. *American Journal of Clinical Nutrition* 271 (3): 672–673.
- Ruel, M. T. 2001. *Can food-based strategies help reduce vitamin A and iron deficiencies? A review of recent evidence*. Washington, D.C.: International Food Policy Research Institute.
- _____. 2008. Addressing the underlying determinants of undernutrition: Examples of successful integration of nutrition in poverty-reduction and agriculture strategies. *SCN News* 36: 21–29.
- Sarkar, N. R., A. Taher, A. Talukder, and A. Hall. n.d. An evaluation of the household food security through nutrition gardening programme. Helen Keller International, Bangladesh and Indonesia. Powerpoint presentation.
- Schroeder, D. G. 2008. *Malnutrition*. In *Nutrition and health in developing countries*, ed. R. D. Semba and M. W. Bloem. Totowa, N.J., U.S.A.: Humana Press.
- Sifri, Z. 2007. Large-scale home gardening programs: The Helen Keller International experience in Bangladesh. Report for International Food Policy Research Institute, Washington, D.C. Photocopy.
- Steinfeld, H. 2003. Economic constraints on production and consumption of animal-source foods for nutrition in developing countries. *Journal of Nutrition* 133 (11, sup2): 4054S–4061S.
- Stoltzfus, R., L. Mullany, and R. Black. 2004. Iron deficiency anaemia. In *Comparative quantification of health risks: Global and regional burden of disease attributable to selected major risk factors*, ed. M. Ezzati, A. Lopez, A. Rodgers, and C. Murray. Geneva: World Health Organization.
- Taher, A., A. Talukder, N. R. Sarkar, V. N. Bushamuka, A. Hall, S. de Pee, R. Moench-Pfanner, L. Kiess, and M. W. Bloem. 2004. Homestead gardening for combating vitamin A deficiency: The Helen Keller International, Bangladesh, experience. In *Alleviating malnutrition through agriculture in Bangladesh*:

- Biofortification and diversification as sustainable solutions*, ed. N. Roos, H. E. Bouis, N. Hassan, and K. A. Kabir. Washington, D.C.: International Food Policy Research Institute.
- Taher, A., D. Panagides, R. A. Karim, A. Habib, A. Baten, A. Uddin, N. Sultana, G. Stallkamp, and A. Talukder. 2004. Homestead food production in the chars. Helen Keller International, Bangladesh. Powerpoint presentation.
- Taludker, A., R. K. N. Islam, R. Klemm, and M. Bloem. 1993. *Home gardening in South Asia: The complete handbook*. Dhaka, Bangladesh: Helen Keller International.
- Taludker, A., L. Kiess, N. Huq, S. de Pee, I. Darnton-Hill, and M. W. Bloem. 2000. Increasing the production and consumption of vitamin A-rich fruits and vegetables: Lessons learned in taking the Bangladesh homestead gardening programme to a national scale. *Food and Nutrition Bulletin* 21 (2): 165–172.
- Talukder, A., H. Torlesse, S. de Pee, A. Taher, T. Chowdhury, H. Kroeun, D. Panagides, L. Kiess, and M. W. Bloem. 2003. Integration of animal husbandry into home gardening programs to increase vitamin A intake. Helen Keller Worldwide, International Vitamin A Consultative Group (IVACG), Morocco. Powerpoint presentation.
- UNICEF (United Nations International Children’s Emergency Funds). 2007. Info by Country: Bangladesh Statistics. <http://www.unicef.org/infobycountry/bangladesh_bangladesh_statistics.html>. Accessed on May 6, 2009.
- USAID (U.S. Agency for International Development). 2006. Technical reference materials: Nutrition. PVO Child Survival and Health Grants Program, Washington, D.C.
- West, K. P., Jr. 2002. Extent of vitamin A deficiency among preschool children and women of reproductive age. *Journal of Nutrition* 132 (Supplement 9): 2857S–2866S.
- West, K. P., Jr., and I. Darnton-Hill. 2008. Vitamin A deficiency. In *Nutrition and health in developing countries*, ed. R. D. Semba and M. W. Bloem. Totowa, N.J., U.S.A.: Humana Press.
- World Bank. 2007. *From agriculture to nutrition: Pathways, synergies and outcomes*. Washington, D.C.: The World Bank.
- World Health Organization (WHO). 2007. WHO country cooperation strategy 2008–2013. Country Office for Bangladesh, Dhaka.
- World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC). 2008. *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*. Geneva: World Health Organization.

IFPRI DISCUSSION PAPERS
Prepared for the “Millions Fed: Proven Successes in Agricultural Development”

910. *Combating stem and leaf rust of wheat: Historical perspective, impacts, and lessons learned.* H. J. Dubin and John P. Brennan, 2009.
911. *The Asian Green Revolution.* Peter B. R. Hazell, 2009.
912. *Controlling cassava mosaic virus and cassava mealybug in Sub-Saharan Africa.* Felix Nweke, 2009.
913. *Community forestry in Nepal: A policy innovation for local livelihoods.* Hemant Ojha, Lauren Persha, and Ashwini Chhatre, 2009.
914. *Agro-environmental transformation in the Sahel: Another kind of “Green Revolution.”* Chris Reij, Gray Tappan, and Melinda Smale, 2009.
915. *The case of zero-tillage technology in Argentina.* Eduardo Trigo, Eugenio Cap, Valeria Malach, and Federico Villarreal, 2009.
916. *Zero tillage in the rice-wheat systems of the Indo-Gangetic plains: A review of impacts and sustainability implications.* Olaf Erenstein, 2009.
917. *The impact of shallow tubewells and boro rice on food security in Bangladesh.* Mahabub Hossain, 2009.
918. *Hybrid rice technology development: Ensuring China’s food security.* Jiming Li, Yeyun Xin, and Longping Yuan, 2009.
919. *Pearl millet and sorghum improvement in India.* Carl E. Pray and Latha Nagarajan, 2009.
920. *Institutional reform in the Burkina Faso cotton sector and its impacts on incomes and food security: 1996–2006.* Jonathan Kaminski, Derek Headey, and Tanguy Bernard, 2009.
921. *Private sector responses to public investments and policy reforms: The case of fertilizer and maize market development in Kenya.* Joshua Ariga and T. S. Jayne, 2009.
922. *The mungbean transformation: Diversifying crops, defeating malnutrition.* Subramanyan Shanmugasundaram, J. D. H. Keatinge, and Jacqueline d’Arros Hughes, 2009.
923. *The global effort to eradicate rinderpest.* Peter Roeder and Karl Rich, 2009.
924. *Rural and urban linkages: Operation Flood’s role in India’s dairy development.* Kenda Cunningham, 2009.
925. *Rich food for poor people: Genetically improved tilapia in the Philippines.* Sivan Yosef, 2009.
926. *“Crossing the river while feeling the rocks:” Incremental land reform and its impact on rural welfare in China.* John W. Bruce and Zongmin Li, 2009.
927. *Land-tenure policy reforms: Decollectivization and the Doi Moi System in Vietnam.* Michael Kirk and Tuan Nguyen, 2009.
928. *Improving diet quality and micronutrient nutrition: Homestead food production in Bangladesh.* Lora Iannotti, Kenda Cunningham, and Marie Ruel, 2009.
929. *Improving the proof: Evolution of and emerging trends in impact assessment methods and approaches in agricultural development.* Mywish K. Maredia, 2009.

For all discussion papers, please go to www.ifpri.org/pubs/pubs.htm#dp.
All discussion papers can be downloaded free of charge.

**INTERNATIONAL FOOD POLICY
RESEARCH INSTITUTE**

www.ifpri.org

IFPRI HEADQUARTERS

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org