FACTS Reports

**Field Actions Science Reports**
The journal of field actions

**Special Issue 1 | 2010**
**Urban Agriculture**

# Homestead food production model contributes to improved household food security and nutrition status of young children and women in poor populations

## lessons learned from scaling-up programs in Asia (Bangladesh, Cambodia, Nepal and Philippines)

**A. Talukder, N.J. Haselow, A.K. Osei, E. Villate, D. Reario, H. Kroeun, L. SokHoing, A. Uddin, S. Dhunge and V. Quinn**

OpenEdition Journals

**Electronic version**
URL: http://journals.openedition.org/factsreports/404
ISSN: 1867-8521

**Publisher**
Institut Veolia

**Electronic reference**
A. Talukder, N.J. Haselow, A.K. Osei, E. Villate, D. Reario, H. Kroeun, L. SokHoing, A. Uddin, S. Dhunge and V. Quinn, « Homestead food production model contributes to improved household food security and nutrition status of young children and women in poor populations », *Field Actions Science Reports* [Online], Special Issue 1 | 2010, Online since 17 February 2000, connection on 10 December 2020. URL : http://journals.openedition.org/factsreports/404

Creative Commons Attribution 3.0 License

Field Actions Science Report
www.factsreports.org
© Author(s) 2010. This work is distributed under
the Creative Commons Attribution 3.0 License.

FACTS Reports

# Homestead food production model contributes to improved household food security and nutrition status of young children and women in poor populations - lessons learned from scaling-up programs in Asia (Bangladesh, Cambodia, Nepal and Philippines)

**A. Talukder[1,5], N.J. Haselow[5], A.K. Osei[5], E. Villate[4], D. Rearioo[4], H. Kroeun[1], L. SokHoing[1], A. Uddin[2], S. Dhungel[3], V. Quinn[6]**

[1]Helen Keller International, Cambodia
[2]Helen Keller International, Bangladesh
[3]Helen Keller International, Nepal
[4]Helen Keller International, Philippines
[5]Helen Keller International, Asia-Pacific Regional Office, Phnom Penh, Cambodia
[6]Helen Keller International, Washington D C, USA
This project was funded by Oxfam Novib in Bangladesh and Nepal, USAID and CIDA in Cambodia, and Monsanto in Philippines

**Abstract.** Micronutrient malnutrition is a serious public health problem among women and children in Bangladesh, Cambodia, Nepal and the Philippines. Helen Keller International has been implementing homestead food production (HFP) programs (coupled with nutrition education) in these countries to increase and ensure year-round availability and intake of micronutrient-rich foods in poor households, particularly among women and children. Between 2003 and 2007, the HFP program was implemented among ~30,000 households in these four countries. Data collected from representative samples taken for evaluations of HFP programs in these countries it will be illustrated the benefit of the program for households. Data were collected through interviews with households in villages that had the HFP program and from control households in non-HFP program villages. Blood samples collected from ~1000 children aged 6-59 months and ~1200 non-pregnant women before and after program implementation were analyzed for hemoglobin. The review showed that the HFP program significantly improved dietary diversification. The combined data from all four countries showed improved animal food consumption among program households, with liver consumption increasing from 24% at baseline to 46% at endline and the median number of eggs consumed by families per week increasing from 2 to 5. The sale of HFP products also improved household income. Anemia prevalence among children in program households decreased in all the countries; however, the decrease was only significant in Bangladesh and the Philippines. Although anemia prevalence also decreased among control households in three countries, the magnitude of change was higher in program households compared with control households.

**Keywords.** Health, public health, malnutrition, women, children, food.

## 1 Introduction

There is substantial evidence that malnutrition, particularly micronutrient deficiencies, is a contributing factor in up to 35% of mortality in children less than 5 years of age and growing body of evidence exists that malnutrition plays a similar role in maternal mortality (Black et al., 2008). At least one half of preschool-aged children and pregnant women in Bangladesh, Cambodia, Nepal and the Philippines are affected by micronutrient malnutrition, including deficiencies of vitamin A and iron (Helen Keller International/Institute of Public Health and Nutrition, 2002; Helen Keller International-Cambodia, 2001; Ministry of Health/Micronutrient Initiative/UNICEF-Nepal, 2008; Food and Nutrition Research Institute, 1998 and 2003). These deficiencies are also common among older children, adolescents and non-pregnant women. Micronutrient deficiencies are highly prevalent in these countries because the typical diet consists of mainly cereals and lacks the optimal diversity and quality to meet the nutrient

*Correspondence to:* Aminuzzaman Talukder
(zaman@hki.org)

needs of most people. Infants and young children are particularly at risk of micronutrient deficiencies because of their high nutritional needs relative to energy intake and the frequent episodes of infection (including sub-clinical infection) at this age which often results in reduced appetite, decreased nutrient absorption, and increased loss of nutrients from the body. Besides its effect on childhood mortality, malnutrition during early life often leads to stunted growth in children who survive (Martorell et al., 1995), and there may also be irreversible sequelae from micronutrient deficiencies that affect brain development and other functional outcomes. Micronutrient malnutrition has serious implications on the development of countries due to its long-term impact on health, cognitive function, and work productivity.

The recent increase in global food prices has substantially raised overall poverty and has pushed more people into malnutrition. The food price crisis is thought to have moved over 100 million people back into poverty in 2008 and erased four years of the global progress towards the achievement of the first Millennium Development Goal (MDG), which is the reduction of extreme poverty and hunger by 2015 (Ivanic and Martin, 2008). The Food and Agriculture Organization of the United Nations (FAO) estimates that the number of hungry people in the world increased by 50 million people in 2008 as a result of the high global food prices, and for the first time in the last century, the estimated number of hungry people in the world is more than 1 billion (Food and Agriculture Organization, 2008). As a result of the food crisis, many households have been forced to adopt harmful coping strategies for survival, such as cutting back on food consumption, replacing micronutrient-rich foods with staple foods, selling household and agricultural assets, and increased borrowing, thereby putting many households in financial debt. These actions have long-term negative consequences for nutrition, health, child development and food security (Klotz et al., 2008). Women and children, who have special nutritional needs, are particularly at risk with negative implications on maternal health and well-being and on the survival, growth and development of children (Administrative Committee on Coordination/Standing Committee on Nutrition, 2000; Victora et al., 2008).

Conventional approaches to address micronutrient malnutrition in deficient populations are supplementation, food fortification, nutrition education and dietary diversification strategies (including agricultural interventions). Of these approaches, dietary diversification strategies are considered more sustainable because these are often community-based and have the advantage of being economically feasible and culturally acceptable, compared to the other methods for improving micronutrient status (Gibson and Hotz, 2002). Dietary diversification approaches for ensuring better micronutrient status of household members involves improving dietary intake by having a sufficient, affordable and diverse supply of micronutrient-rich foods throughout the year, and providing information to households to that ensure these foods are consumed in adequate amounts, particularly among the most vulnerable household members. Inadequate dietary intake is the main cause of micronutrient deficiencies and thus it seems logical that food and agriculture activities, ideally in conjunction with nutrition education, could contribute to improved micronutrient status (Kiess et al., 2001). Food-based approaches, particularly the ones that involve agricultural interventions, can also contribute to poverty reduction in a variety of ways, which in turn also adds to improving nutritional status (Victora et al., 2008; Bloem et al., 2001; De Pee et al., 2000). Increasing availability and consumption of micronutrient-rich foods through a household's own production is considered a sustainable approach because the process empowers women and households to take ultimate responsibility over the quality of their diet through their own production of nutrient-rich foods and educated consumption choices (Ruel and Levin, 2001). Until recently, projects that encourage households' own production of food have focused on home gardens that often promote the production of plant source foods only. While plant foods are important sources of micronutrients, particularly vitamin A, it is now well known that the bioavailability of vitamin A and other micronutrients from plants is lower than originally thought (West et al., 2002). Therefore, it is crucial to increase the consumption of animal foods, which are known to be rich sources of bioavailable vitamins and minerals, among micronutrient deficient populations. For this reason, Helen Keller International (HKI) initiated pilot projects in Bangladesh, Cambodia, Nepal and the Philippines to integrate animal husbandry and nutrition education into an on-going home gardening program to enhance the intake of bioavailable micronutrients by household members. This integrated approach is referred to as homestead food production (HFP).

### 1.1 Helen Keller International's homestead food production model

HKI has been implementing HFP programs in several countries in Asia since the early 1990s. The program, which was initiated as a pilot project in Bangladesh, is currently one of the major HKI interventions in Bangladesh, Cambodia, Nepal and the Philippines. The HFP program enables year-round availability of nutritious foods for participating households. The main objectives of the program are to 1) increase the diversity and year-round production of fruits and vegetables by participating households; 2) increase the year-round production of meat, poultry and eggs by participating households; 3) improve consumption of fruits and vegetables and animal source foods by members of households involved in the program, through increased production and nutrition-related education; and 4) improve health and nutrition outcomes of women and children in participating households. The HFP model achieves these objectives by encouraging households to establish household gardens and animal husbandry (mainly rearing poultry); and by conducting nutrition education to inform optimal intra-household nutrition and feeding practices. HFP also generates additional income for household members through the sale of surplus food products from the home gardens and/or animal husbandry. This income can be used to purchase other micronutrient-rich food items, and pay for household expenses such as health care and children's education needs (Talukder et al., 2000).

In most poor households in rural areas of South and Southeast Asia, home gardening is already a common practice; however, the gardens and gardening practices are sub-optimal and do not offer adequate nutritious year round products. Under the HFP model, household gardens are classified into three categories: "traditional", "improved" and "developed". Traditional gardens are seasonal and are often maintained on scattered plots with a few traditional fruits and vegetables such as pumpkins and gourds. This type of home garden is usually practiced by most households in Asia, especially when there is no external assistance for improved agricultural practices. Improved gardens are gardens maintained on fixed plots that produce more varieties of fruits and vegetables than the traditional gardens, but only during certain times of the year. Developed gardens are maintained on fixed plots and produce a wide variety of fruits and vegetables that are available throughout the year (i.e. year-round). HKI's HFP model encourages, promotes and assists households to establish the developed type of garden which yields a wide variety of fruits and vegetables on a year-round basis together with animal husbandry.

The HFP model targets women from poor households as the primary beneficiaries, placing farming inputs, knowledge and skills in their hands. The model works by providing technical assistance, training, agricultural supplies and management support through local non-governmental organizations (NGOs) partners to support primarily women farmers from poor households. In establishing the HFP model, HKI first works with the local NGO partners to establish Village Model Farms (VMFs) in the target communities. These VMFs supply the seeds, seedlings, saplings and chicks to participating households for their year round food production. The VMFs also serve as a focal point for community support, demonstrating agricultural methods and providing practical training and inputs for production by targeted households. The owner of the VMF also coordinates and supports the women's group of household producers/farmers, and helps link them to additional health and agriculture services as well as markets.

As stated above, the first HFP pilot project was initiated by HKI in Bangladesh 20 years ago, and since then the model has been refined and scaled up throughout the country and also adapted to the local contexts in Cambodia, Nepal and the Philippines. Altogether, the program has reached over one million households, representing about 5.5 million beneficiaries, particularly women and children, in these countries. The HFP programs reviewed for this report were implemented with HKI support for at least three years before the program evaluations were conducted.

## 2 Methodology

Between 2003 and 2007, the HFP program was implemented among ~30,000 households in various project sites across Bangladesh, Cambodia, Nepal and the Philippines. Data collected from representative samples (10 to 20% of program households and a similar number of control households) taken for evaluations of HFP programs in these countries were reviewed to illustrate the benefit of the program for households. In these evaluations, randomly selected households from villages that participated in the HFP program were identified as 'program' households. 'Control' households were sampled from different villages that did not participate in the HFP program but had similar demographic profiles as the program villages. The program households received training and inputs for HFP, as well as nutrition education from HKI through trained personnel of local NGO partners.

In all the countries involved in this review, cross-sectional data were collected from the program and control households before the start of the HFP program (baseline) and after a period of the program implementation (endline). Baseline data were collected in 2003 and endline surveys took place between 2006-2007, after 3-4 years of the HFP program implementation, the length of which varied slightly by country (Table 1). In each country (except Cambodia), the baseline and endline surveys were conducted around the same time of the year to reduce normal seasonality production influences. The changes in outcome variables of interest between the baseline and endline surveys were compared between the program and control communities in each country in order to determine the impact of the HFP projects.

**Table 1.** Dates of baseline and endline data collection for HFP program evaluations in Bangladesh, Cambodia, Nepal and Philippines

| | Date of baseline survey | Date of endline survey |
|---|---|---|
| Bangladesh | July 2003 | June 2006 |
| Cambodia | October 2005 | May 2007 |
| Nepal | May 2003 | May 2006 |
| Philippines | April 2005 | July 2007 |

In all countries, a similar, but slightly contextually adapted precoded, structured questionnaire was used to collect data through interviews on household food production such as the diversity (number and varieties) of vegetable and fruits produced from the home garden and the number of eggs produced from the poultry in the house; household food consumption including the number of different varieties of fruits and vegetables consumed by household members and the consumption of animal foods like eggs and liver by household members in the week before the survey; household income and the income generated from sale of HFP products in the month preceding the survey and the utilization of such income; and household socioeconomic indicators, including decision-making process and power among household members. It is worth noting that other information on household characteristics was collected during these surveys but we have only mentioned the ones that are relevant for this review. Weight, height and mid-upper arm circumference of children and the mid-upper arm circumference of their non-pregnant mothers were measured in all the countries.

In a sub-sample of households in all four countries, blood samples were collected to assess change in anemia status. A finger prick of blood was collected by trained staff from ~1000 children aged 6-59 months and ~1200 non-pregnant women before and after program implementation for measurement of hemoglobin using a HemoCueTM analyzer. The sample included ~ 125 children aged 6-59 months and ~200 non-pregnant women from each of the program and control households in each country. Blood samples were collected only for chil-

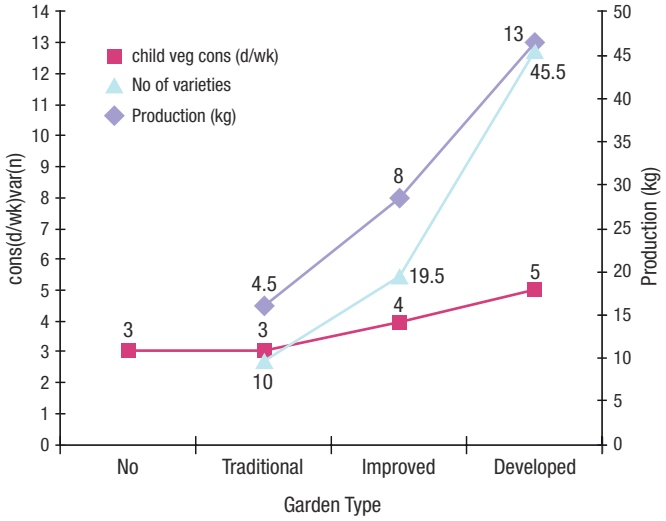


**Figure 1.** Type of garden related to production and consumption of vegetables in Bangladesh and Cambodia at endline.

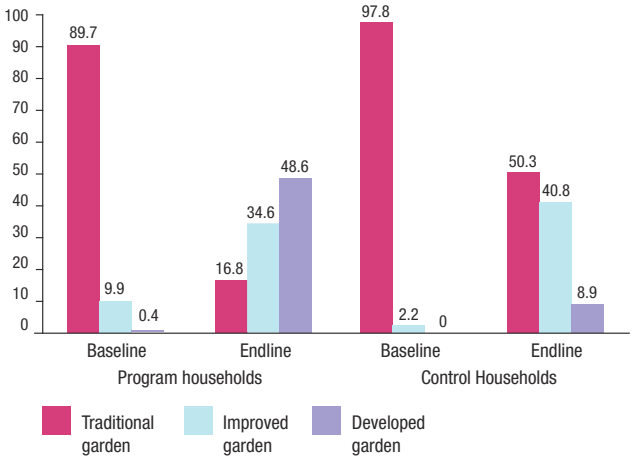


**Figure 2.** Changes in type of household gardens practiced by households in Cambodia between baseline and endline (2003-2007).

dren and not mothers in the Philippines survey because children were considered the primary focus of anemia assessment for the impact evaluation in this country. Anemia was defined as hemoglobin <110 g/L for children aged 6-59 months, and hemoglobin <120 g/L for non-pregnant women (World Health Organization, 2001).

Vitamin A intake was assessed among sub-samples by using the 24-hour vitamin A semi-quantitative food frequency questionnaire developed by HKI (De Pee et al., 2006). In addition to the impact evaluation surveys presented in this review for the HFP programs, we also used secondary data from the second national vitamin A survey conducted in Bangladesh in 1999 to assess the impact of home gardening and poultry production on nightblindness prevalence in children.

All the respondents were informed about the purpose of the survey and verbal and written consent was received from all before their participation. The confidentiality of all information released by respondents was assured. Ethical approval for the studies was granted by the National Ethics Committee in all four countries.

Country specific data was analyzed separately using the Statistical Package for Social Science (SPSS). For each of the four countries, proportions and means of key outcome variables of interest were used to describe the data collected from the baseline and endline surveys. Within each of the program and control groups, comparisons were made on each outcome indicator between the baseline and endline surveys to assess if these parameters changed significantly over time. The program and control groups were then compared on such changes to assess the impact of the program. Country-specific program evaluation results have been presented in various reports and bulletins (Helen Keller International/Cambodia, 2004; Helen Heller International, 2007; Helen Keller International, 2008). For most of the results presented in this review, we did not pool the raw data and re-analyze it, but rather reviewed the findings presented in the various reports and bulletins and presented these findings to illustrate the impact of the HFP program. However, in cases where the raw data from the different countries were available for a particular indicator, the raw data were re-analyzed separately for each country and also pooled together and re-analyzed to verify and clarify the findings obtained from the already published reports and bulletins.

## 3 Results

### 3.1 Changes in vegetable production and consumption

Figure 1 presents the consolidated findings from the endline evaluation surveys in Bangladesh and Cambodia HFP program villages on the number of vegetable varieties being produced, the volume of production in the two months prior to the survey and the frequency of vegetable consumption by children in the week before the survey for the different types of home gardens (traditional, improved and developed garden types) in these communities. The data show that the number of varieties of vegetables and the volume being produced was highest among households that practiced the developed gardening, which is promoted by HKI in its HFP program, compared to households that practiced the improved and traditional types of garden. The number of varieties of vegetable produced and the volume produced from home gardens was three and four times respectively higher in developed gardens than traditional gardens. The diversity of vegetable consumption by young children was only four types of vegetables eaten when households practiced traditional gardening compared to thirteen types of vegetables eaten when households practiced the developed gardening. Frequency of consumption of vegetables by children was also 1.6 times higher among children in households that have developed gardens relative to traditional gardens. The high dietary diversity among children from households that practiced developed gardens was also associated with increased consumption of vitamin A rich foods. More children in households with developed gardens consumed vitamin A-rich foods, such as green leafy vegetables and yellow fruits, compared with children in households without a garden or with a traditional garden.

As shown in figure 2, the type of gardens grown by households that have home gardens changed significantly ($P < 0.05$) between baseline and endline surveys for both the program and

control households in Cambodia. The presence of developed gardens, with diverse varieties of vegetables, was very low in both program and control areas at baseline. However, at the endline evaluation, a significantly greater proportion of households in the program area were practicing developed gardening compared with the control households. As mentioned earlier, HKI's HFP program promotes the developed garden type. Therefore this increase suggests that the HFP program resulted in more households practicing the developed garden type.

## 3.2 Impact on animal food consumption

The findings from pooled data of the surveys in Bangladesh and Cambodia showed that consumption of chicken liver increased from 24% to 46% from baseline to endline in program households. Egg consumption by household members, as well as by mothers and children, also increased significantly in the program households ($P < 0.05$) (Table 1).

**Table 2.** Consumption of chicken liver and eggs in Bangladesh and Cambodia at baseline and endline surveys of the HFP program (2003-2007)

| | Baseline survey | | Endline survey | |
|---|---|---|---|---|
| | % | N | % | N |
| Households that consumed chicken liver in the 7 days before the survey | 24 | 720 | 46 | 720 |
| Median # eggs consumed in 7 days before the survey: | | | | |
| Household | 2 | 720 | 5 | 720 |
| Mothers | 1 | 254 | 1.5 | 402 |
| Children | 1 | 266 | 2 | 407 |

## 3.3 Income earned from Homestead Food Production and its utilization

Evaluation findings from Bangladesh and Cambodia showed a significant improvement in household income from sale of products from home gardens and animal husbandry between the baseline and endline surveys in the HFP program communities. Evaluation findings from Bangladesh showed that the household's bi-monthly earnings from sale of vegetables and fruits obtained from the home gardens increased from an average of US$0.62 at baseline to US$1.25 at endline. The average income from sale of eggs and poultry also increased from US$1.62 to US$2.16 between these surveys. The average increase in income earned by households from the sale of HFP garden products between baseline and endline was much higher in Cambodia than Bangladesh. On average, Cambodian households earned US$3.75 at baseline, which increased to US$17.50 at endline, from the sale of vegetables and fruits from home gardens. There was only a small increase of income earned by households in Cambodia from the sale of poultry products (US$9 at baseline to US$9.75 at endline). It is worth noting that at both the baseline and endline surveys, Cambodian households earned more from the sale of HFP products than Bangladesh households.

Most households in both countries used the income earned from the sale of HFP products to purchase additional food for the household (Table 3). Up to 92% of households in Cambodia and 70% of households in Bangladesh used the income earned from the sale of home garden produce to purchase food. Also over 80% of households in Cambodia and close to half of households in Bangladesh (46%) spent the income obtained from selling animal products obtained from the HFP to purchase other foods (Table 3). Significant proportions of households in Bangladesh also used the income earned from the sale of HFP products on

**Table 3.** Proportion of households in Bangladesh and Cambodia that spent income earned by selling garden produce, poultry and egg on various items at endline.

| Household Commodities | Bangladesh* (in last 2 months) | | Cambodia (in last 1 month) | |
|---|---|---|---|---|
| | % household spending income from selling home garden products on: | % household spending income from selling egg and poultry on: | % household spending income from selling home garden products on: | % household spending income from selling egg and poultry on: |
| Food | 70 | 46 | 92 | 82 |
| Education | 30 | 26 | 1 | 3 |
| Productive/Reinvestment | 22 | 25 | 1 | 3 |
| Clothes | 14 | 22 | 0 | 3 |
| Saving | 11 | 24 | 0 | 0 |
| Medicine | 8 | 0 | 2 | 6 |
| Housing | 1 | 3 | 0 | 0 |
| Amusement | 1 | 2 | 0 | 0 |
| Social activities | 0 | 1 | 1 | 2 |
| Other | 0 | 0 | 3 | 1 |

* Multiple responses allowed

other important household expenditures such as education, including materials and clothing for school and investing in income-generating activities of the household such as reinvesting in the HFP to purchase seeds, seedlings, saplings, and chicks or to invest in other income-generating activities. Review of the survey results from Bangladesh, Cambodia and Nepal showed that for almost three-quarters (73%) of the households in HFP villages in these countries, the majority of homestead food production activities, including deciding what type of garden practice to use at the homestead, were managed by women. This suggests that women were the likely decision-makers regarding the use of the income earned by selling garden produce.

### 3.4 Impact on anemia prevalence among children aged 6-59 months

Anemia prevalence among children 6-59 months of age decreased in program households in all the four countries after the projects' implementation (figure 3). However, the decrease in anemia prevalence among children was significant only in Bangladesh [63.9 at baseline vs. 45.2% at endline ($P < 0.001$)] and the Philippines [42.9 at baseline vs.16.6% at endline ($P < 0.001$)]. Among control households, anemia prevalence among children remained unchanged in Nepal, decreased slightly in Cambodia, but showed significant decreases in Bangladesh and Philippines (figure 3). However, in all four countries, the magnitude of the decrease in anemia prevalence among children was higher in program households compared to the control households, although the intergroup difference was not statistically significant.

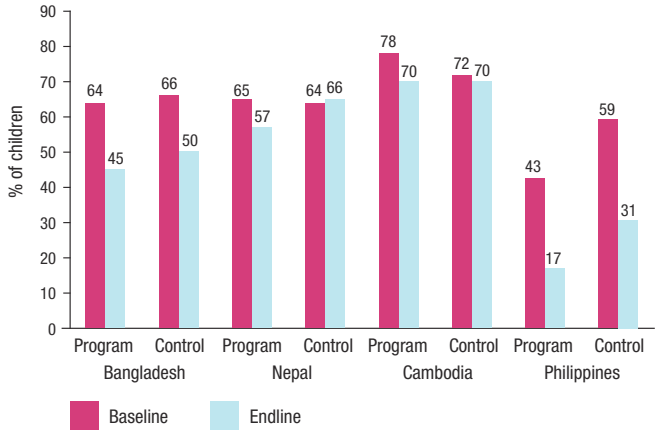


**Figure 3.** Anemia prevalence among children aged 6-59 months from HFP program and control households in Bangladesh, Cambodia, Nepal and the Philippines at baseline and endline (2003-2006).

### 3.5 Impact on anemia prevalence among non-pregnant mothers of children aged 6-59 months

In communities that received the HFP program, anemia prevalence among non-pregnant mothers of children aged 6-59 months decreased by a magnitude of 26% ($P = 0.009$) and 12% ($P = 0.075$) in Nepal and Bangladesh, respectively. However, anemia prevalence among non-pregnant mothers of the children in the control communities remained relatively unchanged in both countries (figure 4). There was no significant change in anemia prevalence among non-pregnant mothers in both the HFP program and control communities in Cambodia (figure 4).

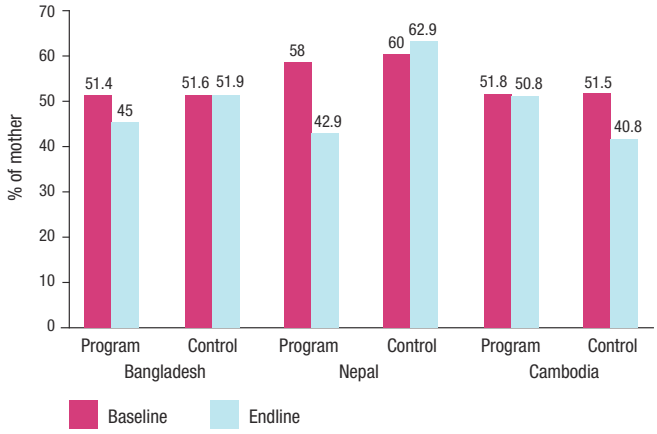


**Figure 4.** Anemia prevalence among non-pregnant mothers of children aged 6-59 months in HFP program and control households in Bangladesh, Cambodia and Nepal at baseline and endline (2003-2006).

### 3.6 Impact on night blindness among children less than five years of age

HKI re-asserted the importance of HFP in the control of night blindness based on the findings of the last national vitamin A survey in rural Bangladesh (Helen Keller International/ Cambodia, 2004). The study showed that among children aged 12-59 months who had not received a vitamin A capsule (VAC) in the six months before the survey, the prevalence of night blindness (clinical vitamin A deficiency) was significantly lower in households with a garden and/or poultry than households without a garden and poultry (figure 5). However, among children who received a VAC, no such difference was found, which seems to indicate that the large-dose VAC overshadowed any additional impact of the diet.

## 4 Discussion

Review of results from the evaluations of HKI's HFP programs in Bangladesh, Cambodia, Nepal and the Philippines showed that the program increased food diversity both in terms of production and consumption of vegetables among beneficiary households. The HFP program also improved consumption of animal products such as chicken liver and eggs by household members, particularly women and children. Such increased diversity in vegetable and animal food consumption is important to ensure adequate intake of essential vitamins and minerals for optimal growth and development, because eggs and liver are good sources of micronutrients and increasing dietary diversity is shown to improve micronutrient intake

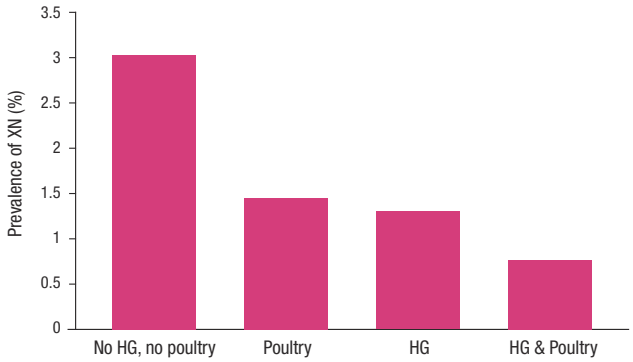


**Figure 5.** Prevalence of night blindness (XN) among children aged 12-59 months who had not received a VAC, by home garden (HG) and poultry ownership (n=4296), National Vitamin A Survey, Bangladesh, 1999.

(De Pee et al., 2000). This was evident in the reduction in anemia among children and their non-pregnant mothers and the reduction in nightblindness among children in some of the countries studied. Insufficient dietary intake of iron is believed to be the main cause of anemia in most developing countries. Although these impact evaluations did not study the impact of HFP on dietary iron intake or iron status, we believe improved intake of dietary iron and other micronutrients such as vitamin A, as a result of the HFP program, might have contributed to the reduction in anemia prevalence.

In rural areas of all the countries in the study, food from HFP, including vegetables, fruits and poultry, is often the only source of micronutrients in the family diet (Helen Keller International/Cambodia, 2004). The production of fruits, vegetables, eggs and meat provides the rural households with access to the nutrients required, which otherwise may not be readily available or may not be within their economic means. Equally important, surplus HFP produce can be sold, generating additional income for the family. The nutrition education component of the HFP program promotes nutritionally-informed food purchasing and consumption choices, and our findings show that the majority of households use this additional income to buy supplementary food items, such as meat, fish and cooking oil, thereby further increasing the diversification of the family's diet (Kiess et al., 1998). The income is also used to cover other essential household expenses and to invest in productive assets, including reinvesting in HFP. More recently, HKI has found that this investment in productive assets helps families to cope during times of economic difficulty or natural disaster (Kiess et al., 1998).

As seen by the reduction of night blindness (a clinical sign of vitamin A deficiency) among children living in households with gardens and/or poultry, HFP-type programs can also have a positive effect on vitamin A status. HFP has been shown to be an important way to improve the intake of vitamin A- and other micronutrient-rich foods in all HFP programs, particularly in poor households in countries like Bangladesh, Nepal, Cambodia and the Philippines. Among the ways by which HFP increases the consumption of micronutrient-rich foods and contributes to improved micronutrient status are the following:

- By increasing the number of varieties of micronutrient rich fruits and vegetables, and animal-source foods available year-round, the consumption of these foods becomes consistent throughout the year.
- By coupling HFP with targeted nutrition education, nutritional practices are improved, particularly for women and young children.
- By providing additional income through the sale of surplus HFP produce, families can have extra resources to purchase additional high quality foods.

## 5 Conclusion and recommendations

HKI's HFP programs in Asia improved household food security by increasing the year-round availability and diversity of micronutrient-rich foods at the household level, by informing optimal nutritional behavior through nutrition education, and by improving the economic resources of the participating families. Through targeting women as HFP managers, HFP programs empowered women, giving them more control over resources and income generated from the HFP program. Such control over HFP resources and income enhances women's participation in household decision-making. This also has a positive impact on overall household spending, food preparation, food choices and intra-household food allocation as well as care-seeking behavior of the women (De Pee and Bloem, 2007).

The program also appears to have a positive impact on the nutritional status of women and children. HFP was shown to have an impact on reducing night blindness among children, although additional studies that assess the impact of the program on serum vitamin A levels would strengthen and further define the effect. The program's impact on anemia reduction among children aged 6-59 months and non-pregnant women (mothers of these children) appears promising, although results were not consistent across all four countries. Such varied results across countries might be due to the slight variation in the design of the impact evaluation and the differences in etiology of anemia among these groups in the different countries. Thus, a more tightly control study design may be necessary to evaluate the impact of HFP on anemia. It also suggests that, among young children in particular, additional interventions that are based on sound knowledge of contextual factors associated with anemia may be needed to adequately reduce anemia in this population.

The HFP program results presented in this review are encouraging. The program's contribution to overall household food consumption and improved micronutrient status, however, can be maximized by implementing the HFP program in coordination with other interventions for combating micronutrient deficiencies such as deworming, vitamin A supplementation and home fortification with micronutrient powders. The program can also be improved by choosing foods with higher vitamin A content for home gardening and by improving the nutrition education component to promote consumption of animal products, use of extra income to purchase nutritious foods as well as improving bioavailability of vitamins and minerals through ensuring adequate fat intake

(Helen Keller International, 2008). Key essential nutritional actions, using behavioral change communication techniques, targeted at mothers and children under two years of age, should be incorporated as an integral part of the strategy in order to more effectively promote optimal nutrition practices to maximize food availability. As shown by the results of this review, homestead food production has the potential to increase micronutrient intake and improve the health and nutritional status of nutritionally at-risk women and children through various pathways, including increased household production for the families' own consumption, increased income from the sale of products, and improved social status of women through greater control over resources (Helen Keller International, 2007b; Bushamuka et al, 2005; De Pee et al, 2008).

The integration of HFP into other types of development programs should be explored and encouraged as a way to scale up the HFP model more quickly. For instance, HFP can complement programs aimed at improving gender equality through its positive effect on women's empowerment and increased control of household resources. In addition, the HFP model, which promotes developed gardening with targeted nutrition education, should be introduced into agriculture programs that promote home gardening and livestock to better ensure that available food translates into increased consumption and also into improved nutrition among vulnerable household members. The HFP model can also be used to target specific vulnerable groups, such as households with people living with HIV/AIDS, because such households require additional food and have added healthcare costs, which put further demands on their limited resources[1].

HKI's HFP program has been proven to be successful in four Asia-Pacific countries in improving the availability, production and consumption of micronutrient-rich foods through poultry raising, animal husbandry, and home gardening, coupled with nutrition education. Lessons learned from these evaluations and monitoring results have been used to expand and improve the HFP program over time, and most recently to integrate Essential Nutrition Action (nutrition education) into the model. Nevertheless, additional data are needed to better understand the impact of the HFP program on the health and nutritional status of women and children. Moreover, there is a need for improved documentation of program activities and standardization of tools and procedures for monitoring and evaluation across all countries with the program to ensure better comparison of programs across countries. This will also allow data from different countries to be pulled together easily for the kind of analysis presented in this review. Studies are being designed to look more closely at the program, including evaluations of the program impact pathways to improve program delivery.

HFP is a strategy that has shown positive results in poor countries for improved household food consumption, decreased prevalence of anemia among children in some countries, increased household income, and potential empowering of women. Due to these multiple benefits of the program, HFP could conceivably contribute to the achievement of the MDGs including those for poverty reduction, promotion of gender equity and women's empowerment, reduction of child mortality, and improvement of maternal health. For these reasons, it is important that the HFP program be expanded to other areas in these countries and implemented in more countries where micronutrient deficiencies are a public health problem.

[1]HKI included households with PLWHA in its HFP program in Cambodia and is evaluating the program.

## 6 Bibliography


Administrative Committee on Coordination/ Standing Committee on Nutrition (2000), Fourth Report on the World Nutrition Situation: Nutrition Throughout the Life Cycle. Administrative Committee on Coordination/ Subcommittee on Nutrition, United Nations, Geneva, Switzerland.

Black, R.E., Allen, L.H., Bhutta, Z.A., Caulfield, L.E., de Onis, M., Ezzati, M., et al (2008), Maternal and child undernutrition: global and regional exposures and health consequences. Lancet 371:243-60.

Bloem, M.W., Moench-Pfanner, R. and Kiess, L. (2001), Combating Micronutrient Deficiencies – An important component of poverty reduction. Biomed Environ Sci. 14: 92-97.

Bushamuka, V.N., de Pee, S., Talukder, A., Kiess, L., Panagides, D., Taher, A. and Bloem, M.W. (2005), Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. Food Nutr Bull. 26: 17-25.

De Pee, S. and Bloem, M.W. (2007), The bioavailability of (pro)vitamin A carotenoids and maximizing the contribution of homestead food production to combating vitamin A deficiency. Int J Vit Nutr Res. 77: 182-192.

De Pee, S., Bloem, M.W. and Kiess, L. (2000), Evaluating food-based programmes for their reduction of vitamin A deficiency and its consequences. Food Nutr Bull. 21: 232-238.

De Pee, S., Halati, S. and Bloem, M.W. (2006), 24-hour vitamin A semi-quantitative method for estimating vitamin A intake. Helen Keller International, Asia Pacific Region.

De Pee, S., Talukder, A. and Bloem, M.W. (2008), Homestead food production for improving nutritional status and health. In: Semba RD, Bloem MW (eds) Nutrition and Health in Developing Countries. Second edition. Humana Press, Totowa, NJ.

Food and Agriculture Organization (2008), The State of Food Insecurity in the World: High food prices and food security - threats and opportunities. Food and Agriculture Organization, Rome, Italy.

Food and Nutrition Research Institute (1998 and 2003), Philippine Nutrition Facts and Figures. Department of Science and Technology of the Food and Nutrition Research Institute, Manila-Philippines.

Gibson, R.S. and Hotz, C. (2002), Dietary diversification/modification strategies to enhance micronutrient content and bioavailability of diets in developing countries. Br J Nutr. 85(Suppl. 2): S159-66.

Helen Keller International/Institute of Public Health and Nutrition (2002), Anemia is a severe public health problem in pre-school children and pregnant women in rural Bangladesh. Bangladesh Nutritional Surveillance ProjectBulletin #10. Helen Keller International, Dhaka, Bangladesh.

Helen Keller International-Cambodia (2001), Initial finding from the 2000 Cambodia National Survey, supporting document to the micronutrient workshop held on February 20, 2001 in Phnom Penh, Cambodia, Helen Keller International, Phnom Penh, Kingdom of Cambodia.

Helen Keller International-Cambodia (2004), Homestead Food Production Activities in Cambodia – A Mapping Review Report. Helen Keller International, Phnom Penh, Cambodia.

Helen Keller International (2007), Homestead Food Production Program improves food and nutrition security by increasing consumption of micronutrient-rich foods and family income in HHs with HIV/AIDS and other chronic diseases. Nutrition Bulletin # 7. Helen Keller International/Cambodia.

Helen Keller International (2008), Homestead Food Production Program in Char area in Bangladesh. Report of the final evaluation of the project. Helen Keller International, Dhaka, Bangladesh.

Ivanic, M. and Martin, W. (2008), Implications of higher global food prices for poverty in low income countries. The World bank Policy Research Working Paper 4594. World bank, Washington, DC, USA.

Kiess, L., Bloem, M.W., de Pee, S., Hye, A., Khan, T., Talukder, A. and Huq, N. (1998), Bangladesh: Xeropthalmia free. The results of an effective vitamin A capsule program and homestead gardening. In: American Public Health Association 126th Annual Meeting Report. American Public Health Association, Washington (Abstract).

Kiess, L., Moench-Pfanner, R. and Bloem, M.W. (2001), Food-based strategies: Can they play a role in Poverty alleviation? Food Nutr Bull. 22: 436–442.

Klotz, C., de Pee, S., Thorne-Lyman, A., Kraemer, K. and Bloem, M. (2008), Nutrition in the perfect storm: Why micronutrient malnutrition will be a widespread health consequence of high food prices. Sight and Life bulletin. 2: 7-13.

Martorell, R., Schroeder, D.G., Rivera, J.A. and Kaplowitz, H.J. (1995), Patterns of linear growth in rural Guatemalan adolescents and children. JNutr. 125(Suppl 4):1060S-1067S.

Ministry of Health/Micronutrient Initiative/UNICEF-Nepal (1998), Nepal Micronutrient Status Survey. Child Health Division of the Ministry of Health, Kathmandu-Nepal, New ERA, The Micronutrient Initiatives, United Nations Children's Fund and World Health Organization.

Ruel, M.T. and Levin, C.E. (2001), Assessing the potential for food-based strategies to reduce vitamin A and iron deficiencies: A review of recent evidence. Food Consumption and Nutrition Division Discussion Paper no 92. International Food Policy Research Institute, Washington DC, 2000. See also Food Nutr Bull 22: 94-95.

Talukder, A., Kiess, L., Huq, N., de Pee, S., Darnton-Hill, I. and Bloem, M.W. (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 Nutr Bull. 21 (2): 165-172.

Victora, C.G., Adair, L., Fall, C., Hallal, P.C., Martorell, R., Richter, L. and Sachdev, H.S. (2008), Maternal and child undernutrition: consequences for adult health and human capital. Lancet 371(9609):340-57.

West, C.E., Eilander, A. and van Lieshout, M. (2002), Consequences of revised estimates of carotenoid bioefficacy for dietary control of vitamin A deficiency in developing countries. J Nutr. 32:2920S-2926S.

World Health Organization (2001), Iron deficiency anemia; assessment, prevention and control. A guide for programme managers. World Health Organization, Geneva, Switzerland.