

# FOOD-BASED NUTRITION STRATEGIES IN BANGLADESH

Experience of integrated horticulture and  
nutrition development



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nutrition development**

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## Foreword

Food-based intervention strategies to improve nutritional standards of rural communities in the developing world play a key role in poverty reduction efforts. The nutritional level of a community is an important indicator of its socio-economic status and, accordingly, nutrition and food-based interventions have high priority in development programmes and projects.

The Food and Agriculture Organization of the United Nations (FAO) has focused attention on world hunger through major initiatives such as the International Conference on Nutrition (ICN), World Food Summit (WFS), WFS: *five years later* and the International Alliance Against Hunger (IAAH). These resulted in commitments by governments to address global food insecurity and malnutrition. The United Nations Millennium Declaration of 2000 and the UN Millennium Development Goals (MDGs) too have made food and nutrition a cornerstone of development.

Horticulture-based food such as fruits, vegetables and nuts is important for the daily diet, providing essential micronutrients, fibre, vegetable proteins and other bio-functional components. FAO is implementing horticulture-based field operations and normative activities including field projects to improve household food security and nutritional levels in Latin America, the Caribbean, Africa, the Middle East and Asia. Technical assistance is being provided to national governments and relevant stakeholders for improved planning, targeting and monitoring of food security programmes. In collaboration with the People's Republic of Bangladesh, the FAO Regional Office for Asia and the Pacific undertook an initiative to promote nutrition based on horticultural food.

This report is an account of the nutrition component of the Integrated Horticulture and Nutrition Development Project (BGD/97/041) funded by the United Nations Development Programme (UNDP) and the Government of Bangladesh (GoB), with FAO as the technical agency. The five-year project commenced in 2001 and was implemented under National Execution (NEX) arrangements by the Ministry of Agriculture (MOA). A significant project outcome was the development of a community-based nutrition programme which has led to major improvements in the nutritional knowledge, skills and technologies of rural communities. A dietary impact assessment found substantially higher energy, protein and micronutrient intake among households covered by the project as compared to non-project households.

The project offered valuable lessons in using horticulture-based nutrition development strategies to improve food security and nutritional standards in other developing countries in the region, particularly in South and Southeast Asia. I trust this document will be a useful contribution to FAO's collaborative activities in horticulture and nutrition towards household food security and nutritional improvement in the Asia-Pacific region.



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## Abbreviations

BNNC	Bangladesh National Nutrition Council
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
DLS	Department of Livestock Services
FAO	Food and Agriculture Organization of the United Nations
GoB	Government of Bangladesh
HDTC	Horticulture Development and Training Centre
HRDB	Human Resource Development Board
HKI	Helen Keller International
HNPSP	Health, Nutrition and Population Sector Programme
IHNDP	Integrated Horticulture and Nutrition Development Project
ICDDR, B	International Center for Diarrhoeal Diseases Research, Bangladesh
INFS	Institute of Nutrition and Food Science
MOA	Ministry of Agriculture
MOE	Ministry of Education
NAC	National Advisory Committee
NNP	National Nutrition Programme
OIC	Officer in Charge
SAAO	Sub Assistant Agriculture Officer
SHPDE	Senior Horticulture Programme Development Expert
SMS	Subject Matter Specialist
SMO	Subject Matter Officer
SNP	School Nutrition Programme
SPFS	Special Programme for Food Security
UNDP	United Nations Development Programme



## EXECUTIVE SUMMARY

The overall objective of the Integrated Horticulture and Nutrition Development Project (IHNDP), Bangladesh was to improve the efficiency of the horticultural system and associated support services in the project areas using modern technologies to ensure food and nutritional security. The central aim was to create conditions for diversified food production for consumption by providing rural farmers with necessary knowledge, technology and skills to make nutritious food available to their community and improve household dietary quality.

An immediate objective of the project was to “increase the nutritional awareness among the beneficiaries and develop a comprehensive food-based nutrition programme to reduce malnutrition in the target groups comprising mainly women and children”. The nutrition component of the project aimed to diversify the food habits of the target groups by promoting consumption of horticulture-based food as a sustainable solution to the problem of micronutrient malnutrition. Food preparation and dietary practices were improved at the household and community level while strengthening prevalent nutritional practices that were beneficial.

The project’s Nutrition Education Strategy set up community-based nutrition education programmes to create nutritional awareness among various groups such as women, farmers and schoolchildren. Mass media educational messages and programmes on the advantages of consuming vegetables and fruit were developed and disseminated.

Vegetable and fruit consumption in project areas has increased while programmes on food intake methods and young child feeding have promoted changes in nutritional behaviour among children. Nutritional improvement also resulted from simple agro-processing technologies such as dehydration, pickling, bottling, pulping and preparing preserves and relishes from a variety of vegetables and fruits. This built synergies between nutrition and food processing by reducing micronutrient losses, increasing shelf life, supplementing daily nutrient intake and adding value to some products.

Food consumption surveys found project households consuming between 46 to 64 per cent of vegetables and fruits produced in home gardens while 9 to 20 per cent of the produce was sold. This was significantly higher than among non-project households. Project intervention improved consumption of leafy, yellow and orange vegetables such as carrot and yellow pumpkin as well as vitamin C-rich fruits in project households. Over 60 per cent of project households started complementary feeding with infants between five to seven months old along with breast feeding as compared to only a third of non-project households.

Substantially higher intakes of energy, protein and micronutrients were noted among project households compared to non-project households even after adjustments for differences in farm sizes in the two categories. In the former, there were significantly higher intakes of iron by adult women; vitamin A by children, adolescent girls and adult women; vitamin C by children and adult women; and calcium among adolescent girls. Case studies show families eating at least two types of vegetables and a fruit every day and women or mothers using correct food preparation procedures.

Participatory nutrition education activities show the project strengthening nutritional knowledge with a growing number of women including horticultural food recipes in their diets. A significantly larger number of project households were washing vegetables before cutting, using

coriander leaves for cooking and eating fresh carrots, tomatoes, lemons or sour fruit, and green chili in daily meals. The diets of project households also appeared more diversified than those of non-project households.

Evaluations of the School Nutrition Programme show definite improvement in the children's nutritional knowledge. According to quarterly food frequency data, over three-fourths of the children eat leafy vegetables at least every other day while about half the children have fruit two to three times per week. Nutrition gardens are being established in the schools and providing practical and experimental learning opportunities to both children and the school system. There has been active participation by the teachers, children and the school management. A child-to-family approach is being strengthened by which children share school nutrition education experiences with parents and the community.

The dietary assessment also illustrates how proper collection of semi- and quantitative data can combine with practical experience and technical expertise to provide a sound basis for a nutrition education programme. Recognizing that nutritional well-being is a key component and contributor to the UN Millennium Development Goals (MDGs), there is a need to consider consolidation of efforts to combat non-income poverty and related undernutrition issues.

Although adapted to the conditions of Bangladesh, the project, by successfully integrating horticulture-based diversification of food production with improvement of household and community nutritional standards, has shown its wider regional applicability, particularly in South and Southeast Asia.

The IHNDP's food-based nutrition component can be part of national agricultural extension and nutrition programmes implemented by the agriculture and health ministries. The School Nutrition Programme can also be included in multi-sectoral programmes of ministries of education, agriculture and health. This practical food-based nutrition model and approach can be considered for integration into the broader framework of agricultural policies and poverty reduction strategies.

# 1. INTRODUCTION

Horticulture-based food varieties, namely fruit, vegetables and nuts, are important for the daily diet as these contain micronutrients, fibre, vegetable proteins and bio-functional components. Consumption of fruits and vegetables is vital for a diversified and nutritious diet. Increasing dietary diversification is the most important factor in providing a wide range of micronutrients and this requires an adequate supply, access to and consumption of a variety of foods. However, food surveys<sup>1</sup> show continuing low consumption of fruits and vegetables in many regions of the developing world.

Horticultural interventions combined with extensive nutrition education offer a long-term, food-based strategy to control and eliminate micronutrient malnutrition. Horticultural production, relatively easy for unskilled people, can play an important role in poverty alleviation programmes and food security initiatives, providing work and income opportunities.

Fruits and vegetables can be produced on a small scale to meet a substantial part of dietary nutrient needs at the household and community level, health centres, refugee camps and related situations. Global demand for horticultural produce is expected to grow with population, rising standards of living and awareness of the health benefits of fruit and vegetables. Dietary patterns will also change with the expected increase in per capita consumption of fruits and vegetables. Developing countries may find new opportunities for trade in fruits and vegetables, offering a comparative advantage in the context of globalization.

The Food and Agriculture Organization of the United Nations (FAO) is implementing horticulture-based programmes through field operations and normative activities. A variety of direct interventions are being implemented through field projects to improve nutrition levels and household food security in Latin America, the Caribbean, Africa, the Middle East and Asia.

The Integrated Horticulture and Nutrition Development Project (BGD/97/041), funded by the United Nations Development Programme (UNDP) and the Government of Bangladesh (GoB), was implemented by the Ministry of Agriculture (MOA) with the Department of Agricultural Extension (DAE) as the Government Executing Agency. The project demonstrated and validated the use of food-based strategies to promote food and nutritional security.

By its nature, the project was technology driven, with an emphasis on “training and demonstration” at the horticulture development and training centres (HDTCs) as well as village sites. A total of 31 400 men and women benefited directly from the training, including marginal, landless and women farmers, homestead owners, school teachers, adolescent schoolchildren, unemployed rural youth and NGOs. The project supported the formation of small, relatively homogeneous farmers’ groups in the project villages to act as a critical mass for technology transfer. This was seen as central to the project’s grassroots intervention strategy.

## 1.1. Nutrition situation in Bangladesh

### 1.1.1. Dietary pattern

Cereals, largely rice, are the main food in Bangladesh. Nearly two-thirds of the daily diet consists of rice, some vegetables, a little amount of pulses and small quantities of fish if and

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<sup>1</sup> FAO. (2002). *World agriculture towards 2015/2030. Summary report*. Rome, Food and Agriculture Organization of the United Nations.

when available. Milk, milk products and meat are consumed only occasionally and in very small amounts. Fruit consumption is seasonal and includes mainly papaya and banana which are cultivated round the year. The dietary intake of cooking oil and fat is meagre. The typical rural diet in Bangladesh is, reportedly, not well balanced.<sup>2</sup>

Traditional dietary habits often do not meet good nutritional requirements, with a preference for polished rice and leafy vegetables of poor nutritional quality. In addition, cultural norms dictate a better diet for males over females with the male head of the household getting the best meal portions. Persistent poverty, inadequate nutrition information and gender inequity cause pervasive malnutrition among women, especially pregnant women and lactating mothers.

While food habits vary at regional and even individual household levels, in general, food preparation methods result in significant nutrient loss. Minerals and vitamins, especially B-complex vitamins are lost (40 percent of thiamine and niacin) even during the washing of rice before cooking. Boiling rice and then discarding the water results in even more nutrient losses. The manner of washing and cooking vegetables leads to considerable loss of vitamin C and B-complex vitamins.

Household food consumption studies<sup>3</sup> show that cereals make up the largest share (62 percent) of the diet, followed by non-leafy vegetables, roots and tubers, which together comprise more than four-fifths of the rural people's total diet. Protein and micronutrient-rich foods like fish, meat, eggs, milk, milk products, fats and oils account for less than 10 percent of the rural person's diet, and the consumption of vegetables and fruits is declining steadily.

Rural consumption of leafy and non-leafy vegetables has remained more or less the same over the past two decades after increasing over the preceding 30 years. Fruit consumption has declined in rural areas after more than doubling in the 1970s. With an average national per capita consumption of 23 g of leafy vegetables, 89 g of non-leafy vegetables and 14 g of fruit, the average Bangladeshi eats a total of 126 g of fruit and vegetables daily. This is far below the minimum daily consumption of 400 g of vegetables and fruit recommended by FAO and the World Health Organization (WHO).<sup>4</sup>

### **1.1.2. Nutritional status**

Despite considerable improvement in the national rural health status, the nutritional well-being of rural people continues to be neglected.<sup>5</sup> Children and women in Bangladesh suffer from high levels of malnutrition and micronutrient deficiencies such as low birth weight (LBW), undernutrition (underweight, stunting and wasting), vitamin A deficiency, iodine-deficiency disorders (IDD) and iron-deficiency anaemia (IDA). At the same time, new health problems related to over-nutrition such as obesity are emerging.

Maternal undernutrition (body mass index less than 18.5 kg/m<sup>2</sup>) in non-pregnant women in the country, while declining from 54 percent in 1996–1997 to 38 percent in 2003, is still very high.<sup>6, 7</sup> Undernutrition, both before and during pregnancy, causes intrauterine growth

<sup>2</sup> Jahan, K. & Hossain, M. 1998. *Nature and extent of malnutrition in Bangladesh, Bangladesh National Nutrition Survey, 1995–1998*. Dhaka, Institute of Nutrition and Food Science, Dhaka University, Bangladesh.

<sup>3</sup> Bangladesh National Nutrition Survey (1995–1996).

<sup>4</sup> FAO/WHO. 2003. *Diet, nutrition and the prevention of chronic diseases. Report of a joint FAO/WHO. Expert Consultation*. WHO Technical Report Series 916. Geneva. World Health Organization.

<sup>5</sup> World Bank. 2005. *Maintaining Momentum to 2015? An impact evaluation of interventions to improve maternal and child health and nutrition in Bangladesh*. Washington, The World Bank.

<sup>6</sup> Bangladesh Demographic and Health Survey, 2000.

<sup>7</sup> Helen Keller International/IPHN, 2004.

retardation and is one of the major reasons for the high LBW (36 percent) prevalence in the country.

Low birth weight is more common among adolescent mothers. Marriage at very young age has serious consequences for pregnancy, future survival, health, growth and development. When combined with positive energy balance (adequate energy intake) in later life, LBW increases the risk of obesity, diabetes, high blood pressure and coronary heart disease. Between 1990 and 2004, underweight levels among children fell from 67 to 48 percent and child stunting fell from 66 to 43 percent,<sup>8, 9</sup> but the levels are still unacceptably high.

The consumption of vitamin A-rich foods is still low, suggesting that the underlying causes of vitamin A deficiency require further attention. The diets of pregnant women in low-income groups are deficient not only in micronutrients but also in energy. Anaemia is a severe public health problem affecting pre-school children (49 percent) and pregnant women (47 percent), and a moderate public health problem among non-pregnant women (33 percent) and adolescents (29 percent).<sup>10</sup> Anaemia caused by iron deficiency impairs the growth and learning ability of children, lowers resistance to infectious diseases and increases the risk of maternal death and LBW. Children are malnourished by inadequate dietary intake or infectious diseases.

The underlying causes include (i) household food insecurity resulting from inability to grow or purchase a nutritionally adequate amount and variety of food; (ii) lack of dietary diversity; (iii) inadequate maternal and child care due to inappropriate hygiene, health and nutrition; (iv) low rates of exclusive breast feeding; (v) inadequate access to quality health services; (vi) poor environmental hygiene and sanitation along with low levels of income and maternal formal education. Malnutrition early in life has long-lasting and negative effects on overall growth, morbidity, cognitive development, educational attainment and adult productivity.<sup>11</sup>

Because of this, the nutritional status of children, particularly below five years of age, is seen as one of the most sensitive indicators of a country's vulnerability to food insecurity and overall socio-economic development. Women of child-bearing age are also highly vulnerable to nutritional deficiencies because of increased need for food and nutrients during pregnancy and lactation.

## **1.2. Contribution of horticultural produce to human nutrition**

Most people have a mixed diet of plant and animal food. Potatoes also form an important part of the diet being an important source of energy. Root and tuber crops together with bananas can supplement a cereal or rice-based staple diet. Starch is the main component of root and tuber crops, and plantain and green bananas. Oils and fats, also a source of energy, occur only in small amounts in fresh produce except for coconut and avocado.<sup>12</sup> Most fresh fruits contain simple sugar ranging between 50 to 100 kcal per 100 g.

Proteins are essential to the building and repair of muscles and organs and are needed in increasing amounts by growing children. Although fresh horticulture produce has low protein content, on a dry weight basis, some food types such as beans have between 15 and 20 percent of protein.

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<sup>8</sup> BBS. 1989/90. *Child Nutrition Surveys*. Dhaka, Bangladesh Bureau of Statistics.

<sup>9</sup> Bangladesh Demographic and Health Survey 2004.

<sup>10</sup> Bangladesh Bureau of Statistics/United Nations Children's Fund, 2004.

<sup>11</sup> UNICEF, 1998.

<sup>12</sup> Coconut has 40 percent fat and avocados, 15–25 percent oil.

Small amounts of micronutrients (minerals and vitamins) are needed for good health along with energy food and protein. Sodium, potassium, iron, calcium, phosphorus and many trace elements are essential for the body. Vegetables, especially leafy, have significant amounts of calcium, iron and some other minerals including vitamins A and C. Vitamins are vital in the control of body chemical reactions. Fresh horticultural produce also has large amounts of fibre or “roughage” which, although indigestible, plays an important part in digestion. A diet with high fibre content reduces susceptibility to disease.

Inadequate consumption of fruits and vegetables is estimated to cause about 31 percent of ischaemic heart disease and 11 percent of strokes worldwide.<sup>13</sup> Overall, it is estimated that up to 2.7 million lives could be saved every year with a sufficient increase in fruit and vegetable consumption. Dietary diversification through horticultural food intake and supported by nutrition education is, therefore, seen as a sustainable approach to fighting micronutrient malnutrition.

## **2. DEVELOPMENT AND IMMEDIATE OBJECTIVE**

The overall development objective of IHNDP was to enhance food security and food nutrition levels. For this, a multi-pronged strategy was used including:

- ❖ improving efficiency of the horticultural production system and associated support services;
- ❖ application of modern technologies and diversified cropping patterns to boost productivity and incomes of small farmers in a sustainable manner;
- ❖ promoting conditions to ensure that households have sufficient access to fruits and vegetables at affordable prices;
- ❖ providing households necessary knowledge and skills to prepare and consume these foods to complement their diet, particularly targeting poor women farmers; and
- ❖ developing a comprehensive food-based nutrition programme to reduce malnutrition in the target groups comprising mainly women and children.

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<sup>13</sup> WHO. 2002. *World Health Report. Reducing risks, promoting healthy life*. Geneva, World Health Organization.

### **3. THE NUTRITION EDUCATION STRATEGY**

The project's nutrition component aimed to diversify food habits of the target groups and promote horticultural food consumption as a sustainable remedy for malnutrition. This was done by improving food preparation and dietary practices at household and community level, and strengthening prevalent nutritionally beneficial methods.

#### **3.1. Components**

The main components of the Nutrition Education Strategy were:

- (a) development of community-based nutrition education programmes to create nutritional awareness among various groups such women (farmers) and schoolchildren;
- (b) mass media educational messages and programmes on the advantages of incorporating vegetables and fruits in the diet;
- (c) promotion of behavioural change related to food intake and feeding of young children; and
- (d) development of food-based nutrition programmes to encourage intake of vegetable and fruit as part of the strategic nutrition interventions.

#### **3.2. Nutrition outputs**

The two nutrition outputs of the project were:

- ❖ community-based nutrition education programmes established to create awareness among schoolchildren, household women and elders; and
- ❖ programmes on food based nutrition initiated to encourage consumption of horticultural commodities and allied products as a nutrition intervention strategy.

The following success criteria or indicators provided benchmarks for the nutrition strategy:

- ❖ increased per capita consumption of fruits, vegetables and spices through availability at affordable prices;
- ❖ a better balanced diet incorporating more vegetables and fruits; improvement in the nutritional status of children, women and elders;
- ❖ behavioural change towards use of new food recipes incorporating fruits, vegetables and spices;
- ❖ better child weaning food formulations incorporating cereal, fruit pulp, and mashed vegetables; and
- ❖ reduction in vitamin and iron deficiencies; improvement in child growth rates and overall socio-economic status through increased productivity and literacy.

#### **3.3. Targeting for nutrition education**

The project specifically targeted the landless, marginal and small farmers from selected villages surrounding the 15 HDTCs of the project which were deliberately located in areas of high potential for horticultural development. The term "landless" in Bangladesh does not necessarily

**Table 1. Landholding criteria used for classification of farmers in project**

<i>Classification</i>	<i>Land area (acres)</i>
Landless	<0.50
Marginal	0.50 to 0.99
Small	1.00 to 2.49

2.37 acre = 1 ha

mean being entirely without land and a household in this category can have up to 0.49 acres (approx 2 000 sq m) (see Table 1).

The main beneficiaries of the project included landless women horticulture farmers from five to seven villages within the vicinity of the HDTCs. The project also provided support to other people in the community associated with horticultural production and disposal.

The target beneficiaries of nutrition education included:

- (a) landless, marginal and small farmers, especially disadvantaged and impoverished women
- (b) adolescent schoolgirls
- (c) NGO women farmers and workers
- (d) district officers and *Upazila* level staff
- (e) rural schoolteachers

### **3.4. Location of the project**

Fifteen HDTCs<sup>14</sup> of the Department of Agricultural Extension and four to five villages within the vicinity of the HDTC area were covered by the project (Figure 1).

### **3.5. Implementation strategy**

Project activities were planned, administered and coordinated from the project headquarters at DAE, Khamarbari, Dhaka. The HDTC officers were responsible for implementation of all project activities at field level. The Assistant Horticulture Officers, Agriculture Overseers, Sub Assistant Agriculture Officers and other staff assisted the HDTC officers and were closely engaged in the day-to-day implementation of field-level activities.

#### **3.5.1. Social mobilization**

A group approach was adopted to provide extension services to the farmers under the project, in keeping with the key principle of DAE's approach to working with groups. This offered the opportunity for a more effective use of extension resources for problem identification and solution, sharing of information and a cost-effective choice of extension methodology.

The groups were formed with the participation of the landless, marginal and small farmers, particularly disadvantaged and impoverished women engaged in horticultural production. Of

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<sup>14</sup> Gaital (Kishoreganj), Kewatkhali (Mymensingh), Jamalpur Sadar, Burirhat (Rangpur), Natore Sadar, Tebunia (Pabna), Baradi (Meherpur), Kallayanpur (Chapai Nawabganj), Rajbari Sadar, Daulatpur (Khulna), Rahmatpur (Barisal), Pachgachia (Feni), Ramgarh (Khagrachari), Banarupa (Rangmati) and Balaghat (Bandarban).



the total farmer beneficiaries targeted, 48 percent were landless, 41 percent were marginal and 11 percent were small farmers. Each group was managed by a three-member committee. A total of 1 292 groups were formed with 17 802 farmers, 14 657 of them being women (82 percent).

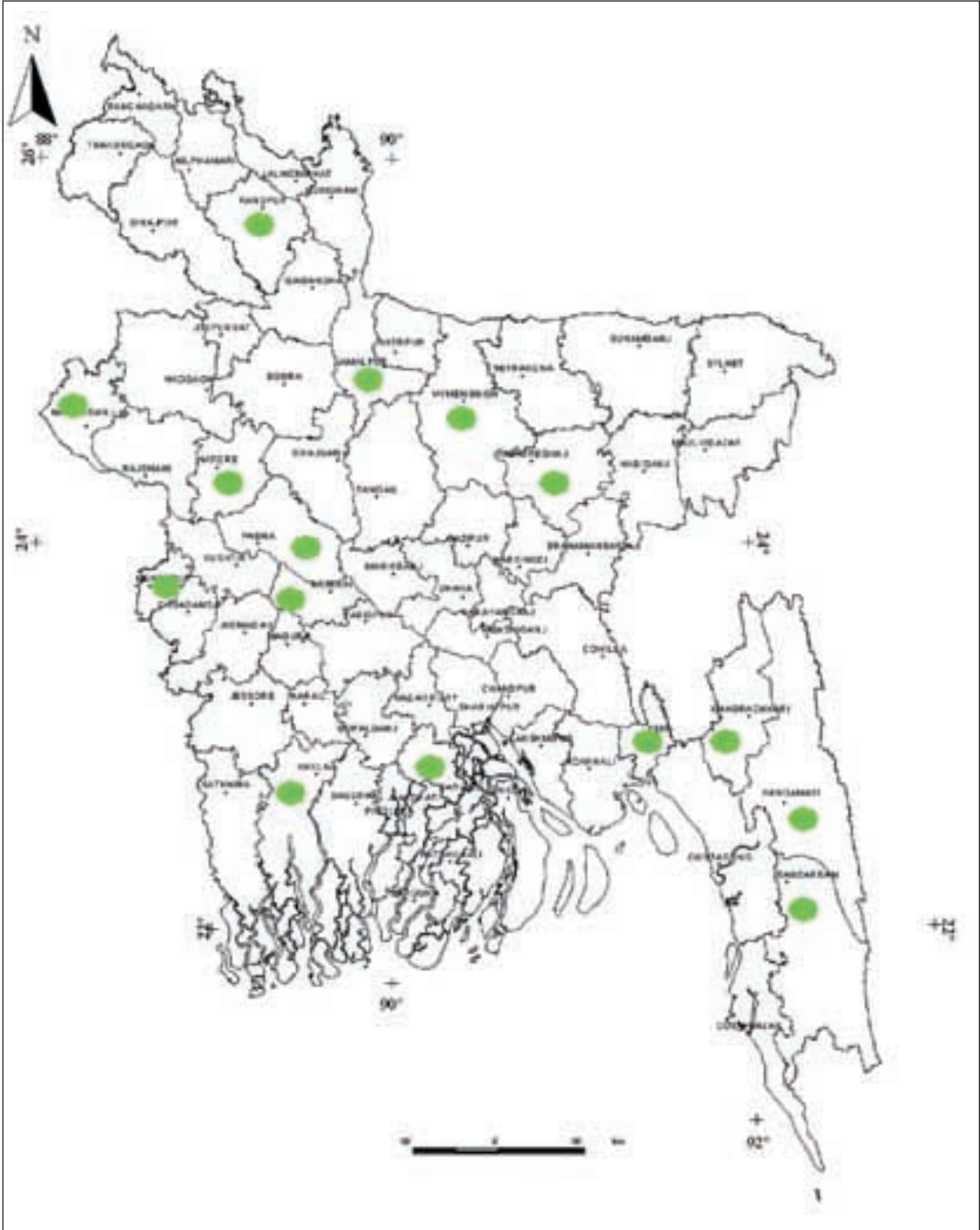


Figure 1. Map of Bangladesh showing Project Locations

## 4. DEVELOPMENT OF COMMUNITY-BASED NUTRITION EDUCATION PROGRAMMES

Training of various levels of functionaries for community nutrition programmes was an important tool in implementing and promoting the nutrition programme.

### 4.1. Capacity building through training

Three types of training courses were designed and offered to develop a critical mass of human resources to be both trainers and practitioners. Training of Trainer (TOT) courses on food-based nutrition strategies were conducted for DAE officers like HDTC in-charges, horticulture subject matter specialists (SMSs), Upazila Agriculture Officers (UAOs), Agriculture Extension Officers (AEOs) and instructors of Agricultural Training Institutes (ATIs). In-service training courses on nutrition and food processing were offered to Sub Assistant Agriculture Officers (SAAOs), Horticulture Overseers (HOs) and NGO officials.

While focusing on key food-based nutrition topics, the training aimed to sensitize HDTC and block-level officers to the use of horticultural food-based strategies for addressing malnutrition and promote appropriate dietary use of home grown horticultural produce among farmers.

In particular, technical inputs for horticulture-based food preparation and household-level processing were given through practical training at the HDTCs as well as in the field. Gaps identified in understanding practical food-based solutions to nutrition problems were also

**Table 2. Nutrition training for various levels of functionaries**

<i>Training course</i>	<i>Functionary</i>	<i>Main objective</i>
Food-based nutrition strategies	HDTC officers, Sub Assistant Agriculture Officers, SMS, SMO	Sensitization on food-based strategies to address malnutrition and promote appropriate dietary use of locally available/home-grown horticultural produce.
Food-based nutrition strategies	Schoolteachers	Strengthen and provide updates on nutrition throughout the life span and promote food-based activities using horticultural produce and other foods to increase vegetable and fruit consumption among adolescent girls; promote simple household-level food preparation and processing techniques for nutrition and food security.
Nutrition and household food processing	Sub Assistant Agriculture Officers, Horticulture Overseers	Increase nutritional awareness and promote food-based activities using horticultural produce to reduce malnutrition; promote simple household-level food processing techniques for long-term use and nutrition.
Community child caring; use of horticultural, complementary food	Women farmers	Provide complementary feeding guidelines and prepare horticulture-based complementary food.
Family health and nutrition	Women farmers	Give basic information on importance of a balanced diet along with use of horticultural crops; demonstrate correct cooking methods to reduce nutrient losses, appropriate food combinations for improved nutritive value, and personal and food hygiene practices.

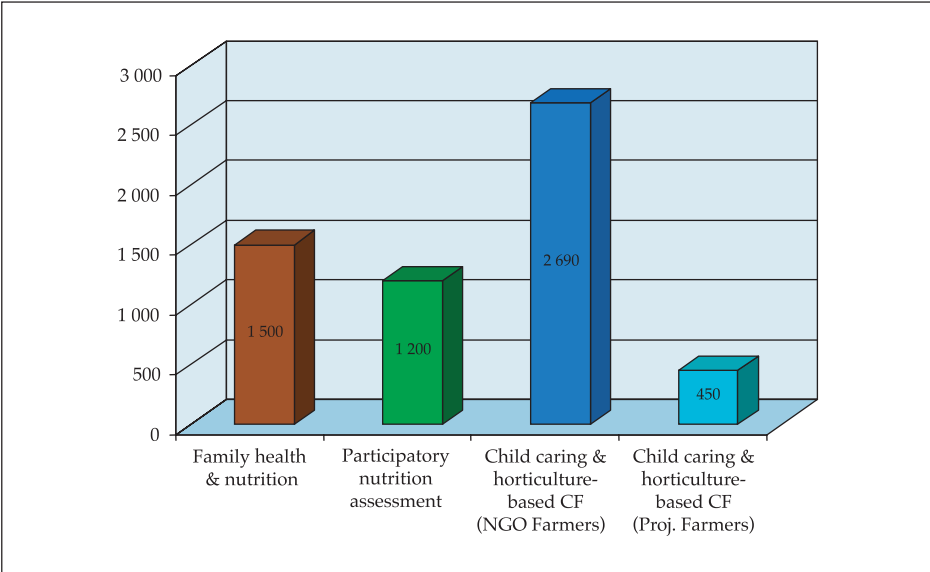
addressed during the training. This helped to update and build upon their nutrition knowledge and skills, which would enable them to appropriately implement the nutrition programme in the field.

Nutrition curricula were developed for courses for all three levels of functionaries including HDTC officers, Subject Matter Specialists in horticulture, SAAOs and HOs (see Table 2). This was done by the project’s National Nutrition Education Specialist in collaboration with other National Experts and in close partnership with BANHRDB, a nodal nutrition training institution of the DAE. One TOT for HDTC officers and two in-service training programmes were conducted (see Table 3).

**Table 3. Training coverage for district level officials**

<i>Target group</i>	<i>TOT on food-based nutrition strategies</i>	<i>In-service training on food processing and nutrition</i>
Horticulturist, Assistant Horticulturist, Horticulture Development Officer, Assistant Horticulture Development Officer, Agriculture Officer, Subject Matter Specialist, Crop Protection Specialist, etc.	118	–
Sub Assistant Agriculture Officers, Horticulture Overseers	–	30
Total	118	30
<i>Grand total</i>	<i>148</i>	

Nutrition training courses were provided to men and women farmers under the project as well as NGO women farmers. Overseas study tours were also organized for DAE officials and women farmers, besides in-country study tours for farmers, farmers’ rallies, field day, exhibitions, workshops and seminars. A total of 8 390 farmers were trained in various nutrition courses (Figure 2).



**Figure 2. Farmers training in nutrition**

## 4.2. Participatory nutrition activity (PNA)

Participatory nutrition activities (PNA) activities were organized to assess the effectiveness and impact of the Nutrition Education Programme in promoting nutrition awareness and correct nutritional behaviour. The main PNA outcome was mobilization of farmers for independent

initiatives to improve their food and dietary pattern and enhance consumption of vegetables and fruits (Box 1).

### Box 1. PNA strategies with the farmers

- ❖ Bringing farmers together in an interactive discussion.
- ❖ Reviewing responses on knowledge gained through training and demonstrations.
- ❖ Eliciting farmers' views and ideas on the importance of horticultural food.
- ❖ Farmers' concept of food groups, cooking methods and preparation.
- ❖ Conduct of field-level games and cooking competitions.

Some responses and outcomes related to the PNA are given in Table 4. The two games used with the group included: (a) food vocabulary and (b) food sorting. Farmers too interest and participated actively in the games, grouping food types according to combinations habitually used in home recipes. These included rice and pulse for *khichuri*, puffed rice and jaggery for breakfast, spinach and potato in *shak bhaji*, sweet pumpkin and onion for *bhaji*, tomato and cucumber as salad.

This was used as the basis for working out a variety of nutritious food combinations which were discussed with the group. This contributed to their

understanding of correct food groupings that ensure dietary diversity and improve nutritional quality. For example, a combination of spinach, pulse or fish, potato and tomato was suggested to prepare *bhaji* instead of using only spinach and potato. The farmers also cited various examples, generating a wide choice of culturally suitable food combinations for nutritious recipes.

Hands-on-explorer (locally available) methods used to facilitate the demonstrations show encouraging results. Brain-storming sessions with women farmers on the use of common leafy vegetables and habitual food combinations, basic questions on handling, preparation and cooking of vegetables, reveal big gains in nutritional knowledge. All the women now reportedly wash vegetables thoroughly before cutting to prevent loss of vitamins. The women pointed out that they were using many project recipes and had increased consumption of vegetables since joining project activities.

**Table 4. Game on fruits and vegetables**

<i>Fruit</i>	<i>Reason for listing</i>	<i>Discussion points</i>	<i>Vegetable</i>	<i>Reason for preference</i>	<i>Discussion points</i>
Papaya	Grown in home garden (HG), popular in diet; vitamin A-rich	Rich source of vitamin A	Sweet pumpkin	Like it, popular in diet	All yellow and orange coloured vegetables are a good source of vitamin A
Blackberry	Available	Good source of vitamin C, and minerals like iron	Ridge gourd	Like it, available in summer	Adds bulk and variety to diet, used in “mixed vegetable soup” shown in food preparation demonstration
Mango	Grown in HG	Good source of vitamin A	<i>Lau shak</i> (gourd)	Seasonal availability and grown in HG; fruit and leaves used to make food; tender bottle gourd peels used for <i>bhaji</i> and chutneys; combined with fish, potato, onion and other ingredients	Rich in iron, vitamin A; good for eyesight
Apple	Like it and a good fruit	Not grown, have to buy; nutrition returns not commensurate with money spent	Cauliflower	Like it, available in winter	Provides bulk, variety, minerals and vitamins
Litchi	Grown		Cabbage	Eaten in season	Good source of vitamin A, fresh cabbage has vitamin C
Banana	Available	Good source of energy	<i>Lal shak</i> (local green)	Grown in HG, popular in diet	Good source of vitamin A, iron, calcium and folic acid (good for blood building)
Guava	Grown in HG	Vitamin C-rich; preferred to apple	<i>Data shak</i> (stem amaranth)	Prepare dish	Good source of minerals and vitamins
Grapes	Good fruit	Vitamin C-rich, but not grown in HG nor easily available	<i>Potol</i> (local vegetable)	Not prepared often	Gives variety and bulk
Oranges	Good fruit	Good source of vitamin C, have to buy	<i>Palang shak</i> (spinach)	Eat often	Good source of vitamin A, iron, calcium and folic acid (good for blood building)

**Table 4. Game on fruits and vegetables (continued)**

<i>Fruit</i>	<i>Reason for listing</i>	<i>Discussion points</i>	<i>Vegetable</i>	<i>Reason for preference</i>	<i>Discussion points</i>
Coconut	Know about it		Field beans	Eat in season	Gives some protein, used in many recipes, including soup
<i>Kamranga</i> (Star fruit)	Grown in HG	Good source of vitamin C	<i>Kolmi shak</i> (local green)	Eat occasionally	Good source of vitamin A, iron, calcium and folic acid (good for blood building)
<i>Atapal</i> (custard apple)	Know about it	Good source of vitamins and minerals	<i>Kochu shak</i> (local green)	Eat as <i>bhorta</i> (steamed or broiled, mashed, spiced preparation)	Excellent source of vitamin A, iron, calcium and folic acid (good for blood building)
Pomegranate	Know about it	Good source of vitamins and minerals	Drumstick leaves	Know about it	Excellent source of vitamin A, iron, calcium and folic acid (good for blood building)
<i>Nashpati</i> (Pear)	Know about it	Good source of vitamins and minerals	Tomato	Eat in season, added to <i>dal</i> in winter	Good source of vitamin C and has some vitamin A
Pomelo	Grows in Bangladesh	Good source of vitamin C	–	–	–
<i>Anaaras</i> (pineapple)	Know about it	Good source of vitamins and minerals	–	–	–

## 5. NUTRITION INFORMATION, EDUCATION AND COMMUNICATION

As part of the nutrition information, education and communication (NIEC) development process, a number of advocacy materials were prepared, printed and distributed to project beneficiaries and other stakeholders. This was done in collaboration with stakeholders at national, district and community levels taking into account farmers' needs as well as suggestions from project staff and management.

### 5.1. Training tools and materials

Appropriate training tools and materials were developed and tested through participatory education methods with community collaboration to ensure their applicability and effectiveness. The NIEC tools and materials utilized the participatory process for nutrition education activities for the farmers' training, demonstration and school nutrition programme (see Table 5).

**Table 5. NIEC materials**

<i>Education tools</i>	<i>Theme</i>	<i>Target users</i>	<i>Language</i>
Training manual	Food-based nutrition	District officers and Sub Assistant Agriculture Officers	English
Nutrition extension booklet	Vegetables and fruits for better nutrition	District, <i>upazila</i> and extension personnel	English, Bangla
Farmers' training notes	Family health and nutrition	Farmers	English
Recipe booklet	Vegetables, fruit and spice-based recipes	Extension personnel, practitioners, farmers	Bangla, English
Booklets	Correct cooking and combinations of vegetables and fruits	Extension personnel & farmers	Bangla
Pictorial recipe extension folder	Horticulture-based recipes for better nutrition	Extension personnel & farmers, schoolteachers and students	English
Complementary food	Horticulture-based complementary food for better nutrition	Extension personnel, mothers, farmers, care-takers, adolescent girls	Bangla
Posters on nutritive value of vegetables	Comparative nutrient composition of fruits	Extension personnel, farmers, schoolteachers, students	Bangla
School nutrition diary	Nutrition messages and planning	School students	Bangla
School nutrition transparencies	Nutrition for the adolescent (Food groups; Food Pyramid)	Schoolteachers and HDTC officers	Bangla
Festoons for display at HDTCs	Nutritional importance of vegetables and fruits	Farmers, extension personnel	Bangla

## 5.2. Dissemination and effectiveness of NIEC materials

Positive feedback was obtained on the value of NIEC materials from users including ten field-level functionaries<sup>15</sup> and 30 farmers in four HDTC-covered villages (see Table 6).

**Table 6. Field responses on NIEC materials**

<i>Type of material</i>	<i>Target user</i>	<i>Response</i>
<b><i>Booklets (Bangla)</i></b> ❖ Correct cooking and combinations of vegetables and fruits ❖ Use of vegetables and fruits in complementary foods	SAAO, farmers	Informative, useful for training, user-friendly; literate women farmers asked for more copies  Literate mothers of small children found it very useful and referred to it; requested more copies
<b><i>Brochure (Bangla)</i></b> ❖ Vegetables and fruits to reduce malnutrition	HDTC officers, SAAO	Useful in training; should have larger print size and more pictures and graphics
<b><i>Flip Chart (Bangla)</i></b> ❖ Preparation of horticulture-based complementary food	Farmers, SAAO	Very useful for training and demonstration; clear messages and greatly demanded by mothers and young children
<b><i>Posters (Bangla)</i></b> ❖ Nutritious fruits ❖ Foods for healthy blood ❖ Fruits and vegetables for healthy blood ❖ Nutritive value of vegetables ❖ Nutritive value of fruits	Farmers, SAAO	Very useful for training and demonstration; 'Foods and Fruits and Vegetables for Healthy-Blood' posters have valuable information; can also be calendar-type visual aid; 'Nutritious fruits' poster needs more pictures of different fruits
<b><i>School nutrition modules and transparencies (Bangla)</i></b> ❖ Nutrition and diet for adolescents	Rural school students	Very useful, well-accepted by teachers; highly practical; recipes much appreciated; constant requests by schools for copies
<b><i>Pictorial recipe flip file (English)</i></b> ❖ Horticulture-based recipes for better nutrition	HDTC officers, SAAO, teachers, students	Well-accepted by HTDC officers, SAAO, schoolteachers; logical sequence of recipes; useful concept of quantities and measures; farmers and teachers showed interest in colour pictures; schools and HDTCs asked for copies
<b><i>Recipe book (Bangla)</i></b> ❖ Horticulture-based recipes for better nutrition	HDTC officers, SAAO, teachers	Practical recipes that can be easily made at home; acceptable; farmers and teachers showed much interest in colour photographs; requests for copies
<b><i>Booklet (English)</i></b> ❖ Vegetables and fruits for better nutrition	HDTC officers, teachers, policy-makers, national stakeholders	Very informative, practical, easy to understand; demand for more copies; need for Bangla translation

<sup>15</sup> Including HDTC officers and Sub Assistant Agriculture Officer from Feni, Kishoreganj, Natore and Barisal.



The HDTC officers indicated that the NIEC materials had helped strengthen training for better delivery and easy understanding of the participants. It had also been very handy at household and family levels because of the practical utility of these materials. The Sub Assistant Agriculture Officers and Horticulture Overseers reported that the materials provided user-friendly information linking functions of nutrients through food as well as horticulture-based food, and highlighted ways to increase their consumption.

Many farmers asked for additional NIEC materials to give to their neighbouring households and other community members. Schoolteachers, members of the school management involved in the SNP and students also asked for the school nutrition modules for their guidance.