



# **Homestead food production in Bangladesh: Its determinants and effect on household food security and nutrition among adult women**

**Final report**

**December 6, 2021**

*“This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of NIPN, Helen Keller International, Bangladesh and can in no way be taken to reflect the views of the European Union”*



**BILL & MELINDA  
GATES foundation**



## **Contributors:**

<sup>1</sup>Tasnuva Wahed (Co-ordinate all activities, perform dataset preparation and analysis, draft report writing, concept developing, literature review)

<sup>1</sup>Md. Ruhul Amin Talukder (Concept developing, feedback on analysis, editing the draft)

<sup>2</sup>Tahidul Islam (Feedback on analysis and whole draft)

<sup>1</sup>Chowdhury Abdullah Al Asif (Literature review, concept developing, dataset preparation, feedback on analysis and whole draft)

<sup>1</sup>Farzana Akter (Assist in analysis, literature review)

<sup>3</sup>Md. Akhter Imam (Feedback on analysis and whole draft)

<sup>1</sup>Wali Noman (Assist in method writing)

<sup>4</sup>Nigar Sultana (Literature review and support in policy findings)

<sup>1</sup>Rina Akhter (Literature review and support in implementation of the study)

<sup>1</sup>Md Shah Nawaz (Editing and feedback on whole draft)

<sup>4</sup>Md Asaduzzaman (Concept developing, feedback on analysis and whole draft)

<sup>1</sup> Rolf Klemm (Assist in analysis and review the whole document)

<sup>1</sup>Md Aminuzzaman Talukder (Concept developing, literature review, feedback on analysis and whole draft, editing)

<sup>1</sup>Helen Keller International, Bangladesh

<sup>2</sup>Bangladesh Bureau of Statistics

<sup>3</sup>Bangladesh National Nutrition Council

<sup>4</sup>Bangladesh Institute of Development studies

## Contents

<b>Executive summary</b> .....	5
<b>Chapter 1: Introduction</b> .....	8
1.1. Background .....	8
1.2. Evolution of homestead food production in Bangladesh .....	9
1.3. A literature review .....	12
1.4 Objectives and Policy Questions.....	15
<i>Objectives</i> .....	15
<i>Specific Policy questions</i> .....	16
1.5 Possible Factors Associated with HFP.....	16
<b>Chapter 2: Data and Method of Analysis</b> .....	18
2.1 Data sources .....	18
2.2 Brief methodology of FSNSP data collection.....	18
2.3 Screening of HFP variables .....	18
2.4 Final selection of FSNSP rounds for current analysis .....	19
Figure 2.1: Percentage distribution of HFP households by 16 FSNSP rounds .....	19
2.5. Creating sub-datasets .....	19
2.6 Operational definitions of variables .....	19
• Outcome variable:.....	19
Table 2.1: Definitions of dependent variables for objective 2 .....	20
• Independent variables .....	20
Table 2.2: List of independent variables for analyzing HFP incidence .....	20
2.7. Data analysis methods.....	23
• Analysis of factors associated with HFP .....	23
• Analysis of impact on food consumption and other indicators .....	23
2.8 Limitations of data .....	23
<b>Chapter 3: Results of Analysis</b> .....	25
3.1: Geographic incidence of HFP .....	25
Figure 3.1: Incidence of homestead food production in 2014 by different geographical locations in Bangladesh (Unweighted).....	25
3.2 Association of various background factors with HFP.....	26
• Association of socio-demographic characteristics with HFP.....	26
• Association of socio-economic characteristics with HFP.....	26
• Association of regional characteristics with HFP .....	27
• Association of FNSSP rounds of 2014 with HFP .....	27

Table 3.1: Association of socio-demographic and other characteristics with HFP households (unweighted) .....	27
3.3 Factors associated with HFP .....	29
Table 3.2: Results of multi-variate logistic regression analysis of incidence of HFP households (Unweighted) .....	30
3.4: Impact of HFP on Household FCS .....	32
Table 3.3 Adjusted Odd-ratios for acceptable FCS for background variable categories .....	33
before and after case control matching (Unweighted) .....	33
3.5: Impact of HFP on nutrition and food security indicators among women .....	35
• Socio-demographic characteristics of women.....	35
Table 3.4: Characteristics of adult reproductive aged women in households (19-49 years).....	35
• Relationship of HFP with women’s characteristics in households .....	36
• Association of women’s nutritional indicator outcomes with HFP .....	36
<b>Chapter 4: Discussion</b> .....	39
Strengths and limitations.....	39
Conclusion, recommendations and scope of future research .....	40
<b>Acknowledgement</b> .....	42
<b>References</b> .....	43
<b>Annexes</b> .....	46
Annex 1: Definitions/compositions of different vulnerable regions (48).....	46
Annex 2: Status of HFP in 16 rounds of FSNSP .....	47
Annex 3: Steps for creation of sub-data sets .....	48
Table: Steps of creating sub-datasets with sample size .....	48
Annex 4: Sample size and distribution of Non-HFP and HFP households after case control matching.....	49
Annex 5: Proportion of Sample Households Having Acceptable FCS by Various Categories ....	50
Annex 6: Association of socio-demographic and other characteristics with various nutritional indicators in households (percent) .....	52
Annex 7: Weighted result of multivariate logistic regression analysis of Household FCS and associated factors including women’s (19-49 years) characteristics .....	55
Annex 8: Weighted result of multi-variate logistic regression analysis on HFP and households with malnourished women 19 to 49 years old .....	59
Annex 9: Weighted result of multi-variate regression analysis on HFP and minimum dietary diversity (MDD-W) among women 19 to 49 years old .....	63
Annex 10: Weighted result of multi-variate regression analysis on HFP and household food security among women 19 to 49 years old .....	67

## Executive summary

Bangladesh is on track towards achieving nutritional status target of sustainable development goal (SDG) 2.2. While child nutritional advancement has been well-documented, women's nutritional advancement leave much more to be desired. Various studies indicate that nearly one-half of women either do not are either underweight or obese and do not consume adequately diversified diet. Thus, as yet there is more need to achieve in case of women, particularly adult women's nutrition. Homestead food production (HFP), based on prior evidence may play an important role on supplying foods rich in micronutrients which can contribute to improving household food security and nutrition of children, women and other individuals in the household. And indeed, HFP has been an important element in many of the relevant policies in Bangladesh and practices in Bangladesh. Particularly noteworthy is the HFP interventions through decades by Helen Keller International.

Homestead food production is a traditional practice for rural households in Bangladesh. Many kinds of homestead food production models have been developed and some have also been practiced by both government and non-government organizations in the country. Indeed, over time there had been an evolution of the working models based on evidences and field experiences particularly by Helen Keller International (HKI) since 1990 including adding animal sources of food, strong nutrition education component with SBCC, the **Essential Nutrition and Hygiene Actions** (ENA/EHA). Women were the focus for capacity and asset building in our homestead food production projects, something they rarely receive through traditional extension services. Research has shown this approach increases women's knowledge, productivity, and earnings – and therefore their status within the household. HKI continues to remain active in this field and evolving new models for intervention. The government of late also has taken a very large programme of Pushti Bagan (nutrition garden) all over Bangladesh. Despite such rich experiences in policy and practice, however, there are some gaps in knowledge.

One major gap is understanding what induces people to take up HFP? What are the facilitative factors or barriers to expansion of HFP activities? Secondly, while positive nutritional outcomes of HFP have been documented earlier, is this positive outcome related to HFP alone or there are other factors associated with it. Third, do women share in such nutritional benefits? If so, how much? This study has tried to answer some of these questions.

HFP has been defined for this analytical report as 'household raising both homestead gardening and small livestock/poultry'.

The policy questions that have been attempted to be answered are the following:

- What is the status of HFP in different divisions and Agro-ecological zones of Bangladesh?
- What are the factors or characteristics that influence or are associated with HFP practice in Bangladesh?
- What is the difference between HFP and non-HFP households on on household food consumption score (FCS) in Bangladesh?

- What is the difference between HFP and non-HFP households on household food consumption and food security among households having women
- What is the difference between HFP and non-HFP households among normal versus malnourished 19-49 years old women based on body mass index (BMI) in Bangladesh?

A secondary source of data for analysis was used based on data from National Food Security and Nutritional Surveillance Project (FSNSP) which were collected in three rounds in 2014. A total of 27,072 households (9024 in each round) data were collected and analyzed in several stages.

In the first stage, the extent of HFP in Bangladesh was examined by divisions and ecologically vulnerable areas. In the second stage, factors associated with HFP were identified based on descriptive statistics, Pearson's Chi-square test and binary logistic regression. Next we examined and analysed the outcome in terms of household food consumption score (FCS) with and without HFP. Lastly, we utilized women characteristics and their dietary and nutritional status variables to test difference and their significance related to women's nutrition indicators in outcomes between HFP and non-HFP households.

Of the sample households, 54.4% were raising both home gardening and livestock/poultry in 2014. By region (division and vulnerable areas) proportion of households with HFP varied from 30.2% to 62.9%. Farmers household heads, household construction type, large household size, ownership of homestead land and agriculture land, urban-rural status, administrative divisions were significant factors associated with HFP practice.

Further analysis showed that there was statistically significant positive impact of HFP on acceptable household food consumption score. The HFP households had higher chances of household food consumption, household food security, and lower chances of having malnutrition among women aged 10 to 49 years old. However, there was also a disconcerting finding that while even in households with high income which had lowered food insecurity and raised food consumption scores, women remain malnourished in high proportion. HFP thus may have a dampening effect on malnutrition of women to a certain degree.

HFP thus comes out to be a well-accepted practice which may further be supported through various models. It may be noted that the Government has already taken a move through development of various HFP models as well their implementation such as the *Pusti Bagans* (nutrition garden). Given that the country already has quite rich experience of intervention for supporting HFP in various forms, these experiences may be utilized in designing and implementing the new interventions by the Government.

However, for proper scaling up in terms of both quantity and quality of HFP production, there are several areas which need attention in both policy and practice. These include:

- Development and/or revision of a HFP implementation manual/guide:
- Selection of type of fruits and vegetables:
- Behaviour change communication
- Development of a marketing system for inputs including seeds and sapling and other inputs as well as surplus output

- Storage system for preservation of surplus food
  - Guidance regarding a multi-sectoral or a family approach:
  - Farmer choice issues
  - Government support for the poor HFP practitioners:
  - Future research in several less covered or areas and data collection accordingly
- In addition, a cost-benefit analysis around the nutrition outcome of the HFP intervention is recommended for policy advocacy.

# Chapter 1: Introduction

## 1.1. Background

Despite significant improvements, malnutrition still remains pervasive world-wide, particularly in low - income developing countries (1). Undernutrition is responsible for death of 45% of under-5 children in the world of which mostly occur in low- and middle-income countries (1). While there are many factors behind child undernutrition, women's nutritional status as mothers also have direct role in nutritional consequences for children. Women has equal rights to nutrition as any other human being and more so as their nutrition has direct bearings on nutrition of children whom they give birth too. Despite significant improvements, malnutrition among women of reproductive age, however, still remains pervasive world-wide with high prevalence of underweight, stunting, anaemia, vitamin A deficiency and iodine deficiency which also creates considerable problems both for the mother and for the healthy development of her infant. Poor maternal nutrition is a major cause of adverse pregnancy outcome, such as- high incidence of low birthweight of children and stillbirth (2). A major cause of nutritional deficiency of women is due to significant gaps between intake and requirements of micronutrients for reproductive aged women in poor setting (3). Homestead food production (HFP) in such a situation have been found to play a significant role to improve food security and nutritional status.

In Bangladesh which is on track toward achieving nutritional status target of sustainable development goal (SDG) 2.2 which is to reduce stunting prevalence among under-5 children by 40 % as well as to reduce wasting to <5% between 2012 and 2025, is not yet completely free from these malaise. Nor, are women yet in nutritionally much better condition. BDHS 2017-18 reported that only 56% of women aged 15-49 who are not pregnant and who have not had a birth in the 2 months before the survey had a normal body mass index (BMI) (BMI Between 18.5 and 24.9) (4). According to State of the Food Security and Nutrition in Bangladesh 2016 report, only 45% of the adult women (20-59 years) consumed adequate (five or more food groups of 10) diversified diets (5) which means that the rest 55% do not get such diversified diet. In such a situation, all weapons in the arsenal against malnutrition, based on rigorous evidence, must be employed particularly as Bangladesh aspires to be a developed country in two decades' time. Homestead food production (HFP) may play, in this context, an important role in supplying nutritious foods particularly micronutrients which ultimately contribute to improving household food security and nutrition of children, women and individuals. In this report we make a modest attempt to analyse and discuss the role of homestead gardening and food production in improving nutrition in families practicing such activities as well as background factors that facilitate or hinder such practices.

The report has 4 chapters which are structured in the following manner:

**Chapter 1** has four more sections apart from the present one. Section 2 takes stock of what is known about the role of HFP in Bangladesh and elsewhere. One of the issues that will be discussed is the concept and definition of HFP. As we shall see there is an array of definitions and practices. Furthermore, as in Bangladesh there is a long history and practice of HFP by people and related interventions, these experiences will also be briefly discussed. Section 3, provides a summary of the findings in relevant literature apart from whatever has been discussed in the context of Bangladesh in the preceding section. Based on the discussion in Sections 2 and 3, Section 4 will raise the policy questions that the present report will try to answer along with the specific objectives.



**Chapter 2** discusses the method of investigation and analysis as well as data issues.

The latter particularly has been discussed in detail for understanding the results of analysis properly which follow in **Chapter 3**. Particular note may be taken of the differences in results between households that practice only homestead crop production and those who are also in non-crop food production in homesteads.

**Chapter 4** discusses the results and their implications, particularly from policy point of view. Areas of future research are also pointed out.

## 1.2. Evolution of homestead food production in Bangladesh

The Asian continent and the Indian sub-continent as well as South-East Asia were the original place for HFP (6, 7). However, HFP had also been found in the tropical Pacific islands, the Caribbean, and tropical Latin America and Africa (6, 7).

In Bangladesh, Helen Keller Intl has been active in developing and implementing HFP models since 1988 when Vitamin A deficiency and consequently night blindness was very high (see **Box 1**). A pilot study in 1988-1990 following a scaled up study in 1990-1993 titled “The vitamin A home gardening and promotion of consumption for prevention of nutritional blindness” was conducted among 150 households and 1000 households respectively at ‘*Kaliagonj*’ union in Panchagaor district (8, 9) . It was found that even 3 years of since implementation of the project, over 50% of participants continued to garden according to the project model (8) . The NGO Gardening and Nutrition Education Surveillance Project (NGNESP) was implemented, afterwards, in 210 of the 460 subdistricts covering 860,000 households throughout Bangladesh from 1993 to 2003 (10, 11).

In following years, a number of HFP projects were implemented targeting hard to reach areas (summarized in Table 1.1). Through these projects, evolution of HFP had emerged as ‘from only homestead gardening (HG) in 1988 to homestead food production (HFP) comprising of HG and poultry, small livestock (eg., goats) in 2001 to enhanced homestead food production (EHFP) which includes Essential Nutrition Actions and Essential Hygiene Actions (ENA&EHA) approach, a combination of HG, poultry, livestock, infant’s breast feeding and behaviour communication change or BCC (Figure 1.1) (12).

### **Box 1: Home gardening and nutritional situation in Bangladesh in 1988**

- High Levels of Vitamin A Deficiency and night blindness.
- VAC Distribution was the only program in BD.
- Monotonous diets.
- HG is a traditional Practice but seasonal and Production is Limited.
- Traditionally, the main source, of calories, proteins, vitamins and minerals are plant sources, according to \*82- \*83 national Survey.
- Favorable for intensive horticulture production.
- Many households had underutilized land/ Space.

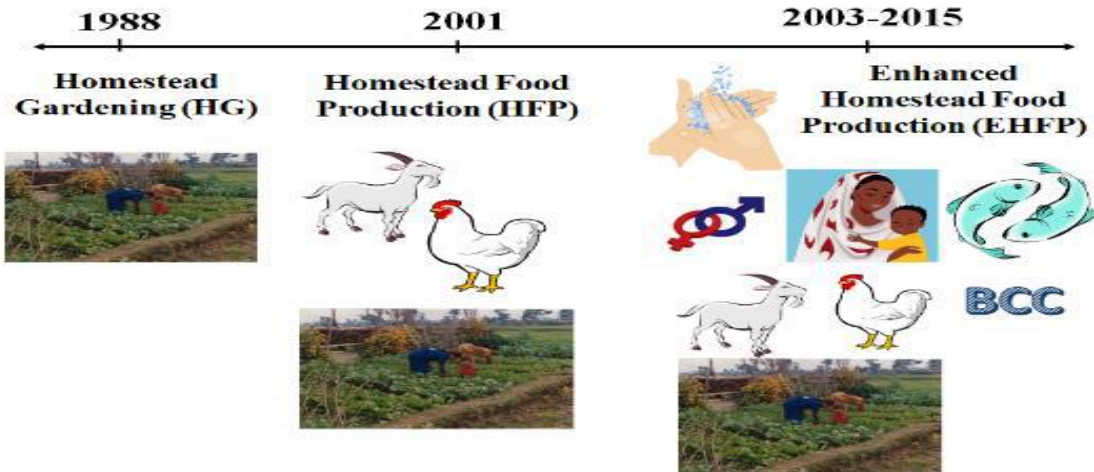
*Source:* Talukder, Zaman, *Homestead food production in Bangladesh: Determinants and impact on food security and nutrition*, a presentation made at a virtual Workshop in Dhaka on 7<sup>th</sup> July 2021.

**Table 1.1: A list of HFP projects implemented by Helen Keller Intl. from 2003-2010**

<b>Years</b>	<b>Project Name</b>	<b>Area</b>	<b>HFP Beneficiary household</b>	<b>In text reference</b>
2003-2005	Improving nutrition and food security through homestead food production in the riverine islands and floodplains of Bangladesh	Northern Char	10,250	Char 1
2004-2009	Jibon-o-jibika (Life and Livelihood)	Southern Coastal Belt	26,840	JOJ
2005-2007	Improving nutrition and food security through homestead food production in the riverine islands and floodplains of Bangladesh (Phase 2)	Northern Char	10,250	Char 2
2005-2007	Chittagong Hill Tracts Homestead Food Production Project	Chittagong Hill Tracts	10,250	CHT-HFP
2008-2011	Development Initiatives for Sustainable Household Activities in Riverine Islands	Northern Char	10,425	DISHARI
2008-2010	Reconstruction, Economic Development and Livelihoods Project	Southern Coastal Belt	20,252	REAL
2017-2019	Sustainable Agriculture and Production Linked to Improve Nutrition Status, Resilience, and Gender Equality (SAPLING) project by Helen Keller Intl where women's minimum dietary diversity increased between fiscal year and fiscal			
2015-2022	Ending the Cycle of Under-Nutrition in Bangladesh - Suchana	Sylhet and Moulvibazar districts of Sylhet division	235,500 poor and very poor households	

Source: Talukder, Zaman, *Homestead food production in Bangladesh: Determinants and impact on food security and nutrition*, a presentation made at a virtual Workshop in Dhaka on 7<sup>th</sup> July 2021.

**Figure 1.1: Evolution of Homestead Food Production to “Enhanced”**



Source: Haselow NJ, Stormer A, Pries A. Evidence-based evolution of an integrated nutrition-focused agriculture approach to address the underlying determinants of stunting. *Maternal & Child Nutrition*. 2016;12:155–68.

International Food Policy Research Institute (IFFRI) implemented a project called ‘Strengthening Partnerships, Results and Innovations in Nutrition Globally (SPRING)’ (2012-2017) in which farmer nutrition schools were introduced providing a nine month/ 18 session training to the women about HFP, essential nutrition and hygiene actions (13). Also Integrated Homestead Farming was developed by the Government of Bangladesh, Food and Agriculture Organization of the United Nations (FAO) and the USAID (14). The effort of the Government of Bangladesh in developing HFP models is noteworthy. Bangladesh Agricultural Research Institute (BARI), for example, has developed several models for implementation in different agro-ecological settings of the country (15). More recently Ministry of Agriculture has also initiated a Pusti Bagan (Nutrition Garden) project and intends to establish 500 thousand such ‘bagans’ (gardens) nationwide (16). It may be noted here that the HFP models of the Government of Bangladesh include season wise, available homestead space wise variety of crops cultivation but do not include poultry/livestock rearing.

It appears that HFP has developed in scope and practice over time and follows no standard or established definition. Homestead gardening, an integral component of HFP, is referred to using several terms and definitions, such as- kitchen garden, home garden, homestead vegetables cultivation etc. According to Hoogerbrugge and Fresco, a home garden is “a small scale, supplementary food production system by and for household members that mimics the natural, multilayered ecosystem” (17). Ali defined it in 2005 as “*homestead gardening, in which families devote a portion of their homestead land to the cultivation of fruits and vegetables primarily for home consumption, is ubiquitous in Bangladesh*” (18).

A few specific features of HSG appear common such as ‘located near the residence’, ‘contains a high diversity of plants’, ‘garden production is a supplemental rather than a main source of family consumption or income’, ‘occupies a small area’, ‘it may be done with virtually no economic resources, using locally available planting materials, natural manures and indigenous methods of pest control’ (6, 7, 19). Helen Keller Intl defined HSG in three categories, as

traditional gardens which are *seasonal and are often maintained on scattered plots with a few traditional fruits and vegetables such as pumpkins and gourds*;

improved gardens that 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*); and developed gardens which are *maintained on fixed plots and produce a wide variety of fruits and vegetables that are available throughout the year (i.e. year-round)* (20).

### 1.3. A literature review

This section provides a literature review of the role of HFP in nutritional improvement in families practising HFP in some form or other. Before that, however, we need to clarify the definition of HFP for the purpose of this report, given the variety of definitions and connotations that abound as discussed above.

For the purpose of this report, we have defined HFP as ‘**raising both HSG with livestock/poultry by households**’ by reviewing the existing national policies described in **Table 1.2**.

**Table 1.2: Definitions/Concepts of HFP in Various National Policies**

Policies	Policy text
National Food and Nutrition Security Policy of Bangladesh (NFNSP) 2019 (21)	<p>✓ <i>Strategy 1.2 Scale up nutrition-sensitive diversification of food production</i>            There is clearly a case for increasing R&amp;D support for developing and disseminating improved technologies for boosting the production of nutrient-dense non-cereal crops, livestock and fisheries through nutrition-sensitive diversification of production systems. Such a diversification strategy must include support for both commercial production <b>and homestead production which are mostly consumed by the producing households</b>.            The following initiatives will be implemented under this strategy:</p> <p style="padding-left: 20px;">i. Promote diversification into horticultural, fisheries, livestock, poultry and dairy products with high nutrient and micronutrient content, <b>including homestead production, indigenous food and underutilized food sources</b></p> <p>✓ <i>Strategy 3.2 Enhance nutrition knowledge, promote good dietary practices and encourage consumption of safe and nutritious diets</i>            It is also important to ensure that commercial complementary food (including fortified food) are not promoted as a better option than <b>homestead</b> or locally available whole food for complementary feeding in order to meet recommended nutrient intake.</p> <p>✓ <i>Strategy 4.2. Improve disaster preparedness, responses, rehabilitation and mitigation</i>            ii. Support <b>home-based farming</b>, such as “<b>one house one farm</b>”, to enhance resilience and protect livestock and poultry resources during disaster periods</p>

Policies	Policy text
National Agriculture Policy 2018 (22)	mentioned as “ <i>cultivating vegetables and planting fruit trees all the year round in homestead land</i> ”
Bangladesh second country investment plan (CIP2) on nutrition-sensitive food system (2016-2020) (23)	included a policy indicator as “ <i>Poor households raising home gardening and backyard poultry in selected vulnerable districts</i> ”
National Nutrition Policy 2015 (24)	6.2.1 Encourage <b>coordinated homestead gardening and small-scale livestock and poultry rearing, at family level or collectively</b> , to in-crease the availability of diverse, safe and nutritious food
National Food Policy 2006 (25)	“ <i>sub-2.1.1. Special measures for disaster mitigation for agriculture under the Objective – 2: Increased purchasing power and access to food of the people....iii. homestead gardening, including fruits and vegetables farming, social forestry, livestock and backyard poultry in the homestead areas in the flood-free years</i> ”
National Agriculture Policy 1999 (26)	“ <i>Considering women's involvement in agriculture, the following programmes will be taken up for enhancing their role under the scope of the National Agriculture Policy: Agriculture related activities like post harvest operations, seed preservation, nursery business, jute stripping, vegetable cultivation, homestead gardening, floriculture, production of horticultural seeds, establishment and management of cottage industries based on locally produced agricultural commodities, etc. are very suitable for women</i> ”

Having adopted the definition of HFP, it was necessary to learn what is already known and what is the knowledge gap related to HFP for analysis and future actions. It has been found that over the decades a number of studies were conducted in Bangladesh and other parts of the world on different topics related to HFP (27, 28). Globally, HFP was found associated (positively or negatively) with improving food security (29), dietary diversity (29, 30), animal animal source food consumption (20), child growth (12), nutrition status of women including anemia (20, 31), prevention of Vitamin-A deficiency (31), retinol binding protein (RBP) concentrations of women (31), gardening and nutritional knowledge (32) and decreased fast food consumption (33). A few studies provided evidence that HFP had significant contribution in improving household income (20).

Several studies conducted in Bangladesh also tested the impact of HFP on different food security and nutrition related indicators. In a group of children aged 12-59 months who had not attended Vitamin A campaign but had HFP, night blindness was observed lower compared to those without HFP (20, 34). Quite obviously HFP had a very substantial role in declining night blindness. Results of HFP interventions by Helen Keller Intl (2005-2007) in hard to reach areas showed that among intervention participants (mothers of under-5 children), anemia rates had reduced from about 60% in baseline to 30% in end line while food frequency scores (FFS) had increased from 20% to 40% while (Talukder Z, *personal*

*communication*). Anemia prevalence and FFS, on the other hand, remained almost unchanged in control groups over baseline to end line time period

Not just nutritional impact, there may as well be socio-cultural changes. Baseline and end line results of “Making Markets Work for Women” project showed reduction in wasting rate among children under five years. This project also demonstrated that participants in HFP intervention programme were more likely to take joint decision by husband and wife on how household money is spent compared to the control group (35). A project titled “Jibon-O-Jibika (2004-2009)” contributed to reduce stunting (from 50% to 36%), wasting (from 28% to 16%) and underweight (50% to 36%) among HFP intervention participants between baseline and end line (36). Analysis of Difference in Difference using National Food Security Nutritional Surveillance Project (FNSNP) data of Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project of USAID showed improvement in minimum dietary diversity of women (5 or more out of 10 food groups) nationally (from 32% in 2012 to 36% in 2014), in SPRING areas (32% in 2012 to 45% in 2014) and in poorest SPRING areas (2012: 20% to 2014: 32%) (37). Similar results were also observed in Sustainable Agriculture and Production Linked to Improve Nutrition Status, Resilience, and Gender Equality (SAPLING) project by Helen Keller Intl where women’s minimum dietary diversity increased between fiscal year 2017 and fiscal year 2019 (38).

Besides above-mentioned project reports, there are some published literatures available on HFP practice in the context of Bangladesh. A few of these studies found relationship of HFP with vegetables consumption (39-42), animal food and liver consumption (20), child growth (12), underweight of women, anemia (20, 31), and night blindness for children and women (43), and improvement of household income (20, 42, 44). Some studies explored the type of vegetables (eg., tomato, radish, lalshak, brinjal, bottle gourd, chili, bean) and fruits they were cultivating in their home garden (44), total cultivable homestead land occupied (44), crops and fruits production (40, 41, 44), women participation in homestead vegetable cultivation (44) including cost-benefit analysis of traditional and developed vegetable gardening systems (45). Using the disability-adjusted life years (DALYs) approach, Schreinemachers et al showed that rural women's training in home gardening and nutrition in selected districts (Josshore, Barishal, Potuakhali, Faridpur) of Bangladesh would be cost-effective in reducing iron, vitamin A and zinc deficiencies (41).

By reviewing all the above published and unpublished documents, we have identified a few knowledge gaps in the area of HFP and food security and nutrition (FSN). These are as follows:

*First*, there is a lack of studies which show the status of HFP in different divisions and Agro-ecological areas of Bangladesh. This may be useful because different agro-ecological settings may influence what crops may be grown easily and which not and thus may influence the HFP related behaviour of households.

*Second*, little is known on the association of factors, particularly, social, demographic and economic, that influence HFP practice in the country.

*Third*, while certain nutritional impact issues were investigated, none of the HFP related projects estimated food consumption score (FCS) based on household food security and nutrition assessment (HFSNA) guideline (46). This is surprising given that one of the *raison d’etat* behind HFP is cited as ensuring diversity of consumption of food.

*Fourth*, although a few reports on projects calculated anemia prevalence, changes in Food Frequency Scores (FFS) and women's minimum dietary diversity, none of them analyzed impact of HFP on nutritional status of women based on body-mass-index (BMI). There is also only a handful of studies which estimated household food insecurity using household food insecurity access scale (HFIAS) among households having 19-49 years old women in Bangladesh. This study has tried to analyze these issues.

#### 1.4 Objectives and Policy Questions

Based on the literature review and the gaps that have been identified, the following objectives and specific policy questions have been chosen for analysis.

##### *Objectives*

There are basically 3 objectives behind the present study which are

- To assess the status of HFP in different regions/divisions and agro-ecological zones of Bangladesh
- To identify the determinants/associated factors/ characteristics of households that influence the HFP practice in Bangladesh
- To measure significant difference between HFP and non-HFP households on some selected food security and nutrition indicators assess



### *Specific Policy questions*

The policy questions, based on the objectives, that were proposed to be probed and analysed by NIPN in the present study are the following:

- What is the status of HFP in different divisions and agro-ecological zones of Bangladesh?
- What are the factors or characteristics that influence or are associated with HFP practice in Bangladesh?
- What is the difference in general between HFP and non-HFP households and its significance in terms of household food consumption score (FCS) in Bangladesh?
- What is the difference between HFP and non-HFP households and its significance in terms of household food consumption and food security in households with 18-49 years old women in Bangladesh?
- What is the difference between HFP and non-HFP households on nutritional status of women based on body mass index (BMI) among 18-49 years old women in Bangladesh?

It may be noted here that the specific policy questions are somewhat also influenced by availability of data from secondary sources as NIPN mandate does not allow collection of new primary data.

### **1.5 Possible Factors Associated with HFP**

We have already stated above that there is a dearth of studies explaining why or why not a household practise HFP. Thus as such there is little by way of theory. However, the conceptualization of HFP indicate the type of factors that may be associated with or facilitate HFP.

*First*, for HFP, one must have some homestead land and the more homestead land a household has, the likelihood of using that for HFP, including homestead gardening or keeping poultry and livestock, is greater.

*Second*, economic status of the household is likely to influence incidence of HSG/HFP. As HSG/HFP is thought to be more for domestic consumption from own production and thus likely to be more for subsistence purposes, those with lower economic capability either because of lower income or lower wealth status are likely to be more in HSG/HFP. On the other hand, pure subsistence is unlikely in these days. Some kind of market orientation is there in most cases. Thus, better economic status may facilitate HFP, particularly if livestock keeping is included as such activities necessitate certain levels of expenditure on the part of the household while returns are usually somewhat long term affair. Thus the actual relationship may go either way and thus becomes an empirical question.

Note that land holding is also a part of wealth but this also has another implication. Those with larger holding and cultivable land are likely to be better experienced in farming related issues and they probably also can better manage homestead gardening. Incidence of operational holding or rather farming as an occupation is therefore likely to be positively associated with HFP.



Housing condition is also considered as a sign of economic status. Those in fully brick-built houses are considered to be better off than in tin-roofed houses while those in kutcha (thatch-built or mud-walled) houses are thought to be least wealthy and thus more in need of subsistence and therefore more likely to practise HFP.

*Third*, it is generally believed that women are involved in HFP. More women there are in the household, therefore, may raise the likelihood of HFP. However, they also need to be somewhat experienced in seed preservation, planting and related activities. Number of adult women, rather than just the number of women, probably is more important for successful HFP/HSG.

*Fifth*, family size may have some influence as larger size indicates greater pressure for ensuring food. Also more hands mean better chance of giving attention to HFP. One may postulate, therefore, that larger family size, given other things constant, may positively influence the incidence of HFP.

Other demographic and social variables that have been included as factors associated with HFP are sex of household head, women's education, women's occupation and women's marital status. The possible relationship with HFP incidence is difficult to postulate in such cases.

The exact manner of measurements of these variables are described in the next chapter.

## Chapter 2: Data and Method of Analysis

### 2.1 Data sources

A National Food Security and Nutritional Surveillance Project (FSNSP) was implemented by the James P Grant School of Public Health, BRAC University (JPGSPH) in partnership with Helen Keller International (HKI) and Bangladesh Bureau of Statistics with the aim to track nationally representative estimates for food security and nutrition in Bangladesh (47). This project included three rounds of data collection every year over three seasons in Bangladesh: the post-*aman* harvest period (January-April); the monsoon season (May-August); and the post-*aus* harvest season (September-December) over the years July 2008 - June 2015. These FSNSP rounds were repeated cross-sectional surveys which collected data from different households in each round. NIPN obtained a total of 16 rounds of micro data for analysis for current research.

### 2.2 Brief methodology of FSNSP data collection

FSNSP used a three-stage sampling design for getting nationally representation of samples. For the first stage of sampling, the country was divided into 13 strata. The first six strata correspond to the six vulnerable surveillance zones: Costal belt, Eastern hills, Haor, Padma chars, Northern chars, Northwest and the remaining to the seven divisions of Bangladesh: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet.

In second stage, a set number of sub-districts (*upazilla*) were selected with replacement from each stratum. Thus, 12 sub-districts were selected in each round for each of the six ecological surveillance zones. A list of sub-districts under each vulnerable stratum is given in Annex 1. A total of 22 sub-districts were selected from other seven strata of divisions as follows: 8 upazila from Dhaka; 4 from Chittagong; 3 from Khulna; 2 each from Sylhet, Rangpur, and Rajshahi; and 1 from Barisal. All the sub-districts were selected by rotation into the sampling frame in order to reduce random variation in estimated between rounds.

At the third stage, the list of villages/*moholla* under each sub-district was collected which were broken into equal size and called a community. Four communities were chosen at random and without replacement from all the communities in each selected sub-district. A total of 24 households in each of four communities were finally selected using a systematic random sampling. For further details the reader is referred published FSNSP report in 2014 (48). Using the prevalence of seasonality in food deficit and inter-cluster correlation, the required sample size was calculated to be 9,024 households per round.

Data were collected by two modes, one was paper based questionnaires and other was proprietary survey software (Survey master v1 & v2, HKI) administered using commercially available personal digital assistants (PDAs) (Hewlett Packard, HP iPAQ 112, USA). To the extent possible, surveillance questionnaires and protocols employed by FSNSP are based on existing global standards as described in FSNSP website ([www.fsnsnp.net](http://www.fsnsnp.net)) (48).

### 2.3 Screening of HFP variables

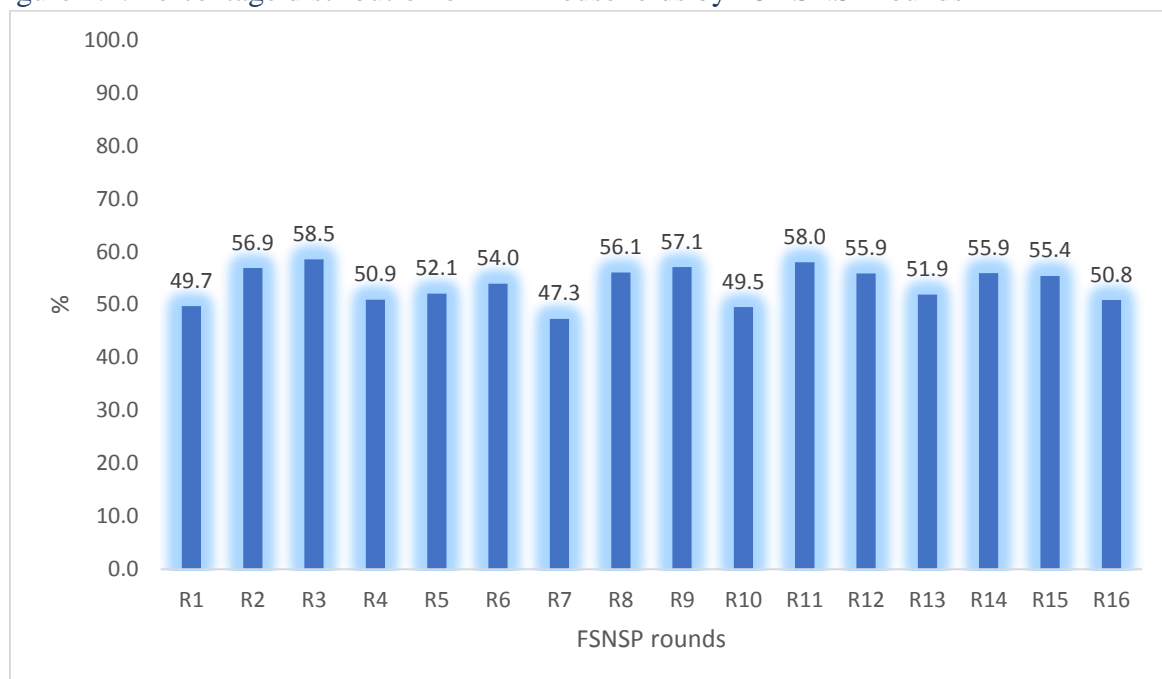
In the FSNSP questionnaire, there was no direct question regarding HFP. Therefore, we looked for sub-questions related to HFP and found two questions: one is on homestead gardening and other is on raising poultry/livestock. Regarding home gardening (HG), it was observed that one question “During the last 4 months did your households grow vegetables in a home garden?” was asked in all 16 rounds and found that HG was highest (69.5%) in 11<sup>th</sup>

round while lowest in first round (58.1%). Questions on poultry/livestock were available in all 16 round but were not asked in the same manner. The detailed table on data availability by types of related questions asked is shown in Annex 2.

#### 2.4 Final selection of FSNSP rounds for current analysis

As there were 16 rounds of data and the first two rounds were somewhat different from others, we had to make a choice as to which rounds of data to be analysed. As such as Figure 2.1 shows not much change or variation on incidence of homestead food production over 16 FSNSP rounds from January 2010 to January 2015 was observed. Also household having both home gardening and poultry/livestock or HFP was almost unchanged (49.7% in 1<sup>st</sup> round vs 50.8% in 16<sup>th</sup> round). Overall status of HFP varied within 47.3% - 58.5% with little definitive time pattern. We therefore decided to analyse data from the more recent rounds of year 2014 (rounds 13, 14 and 15) to assess the association and determinants of HFP as well as its impact on chosen nutritional indicators.

Figure 2.1: Percentage distribution of HFP households by 16 FSNSP rounds



#### 2.5. Creating sub-datasets

A total of three sub-datasets were created for analysis. The sub-dataset 1 was used for analysis of the first two policy questions namely to assess the status and to identify the factors associated with HFP in Bangladesh. Sub-dataset 2 was created to evaluate the difference between HFP vs non-HFP households on household food consumption. Finally, sub-dataset 3 was used to measure difference in normal vs malnourished women status between HFP and non-HFP households.. The details of creation of these data sets are described in Annex 3.

#### 2.6 Operational definitions of variables

- Outcome variable:

The main outcome variable, for the analysis of policy questions 1 and 2, was HFP which was defined as “households with homestead gardening plus raising livestock/poultry”. If a

household raised both home gardening and poultry/livestock, it was categorized as ‘yes’ while remaining households were considered as ‘no’ category.

For the analysis of impact on household food security (policy question 3), we used household food security score (FCS) as the outcome variable the definition of which has been shown in **Table 2.1**.

Policy questions 4 and 5 have been analysed using four indicators: household food consumption, nutritional status of women based on body mass index (BMI) and household food security according to Household Food Insecurity Access Scale (HFIAS).

**Table 2.1: Definitions of dependent variables for objective 2**

<b>Dependent Variable name</b>	<b>Categories</b>	<b>Definition/note</b>
FCS	Poor and borderline food consumption (HFSNA) (0-42 score) Acceptable food consumption (HFSNA)	We followed the HFSNA guideline (46) to calculate FCS score <sup>1</sup> . Then we prepared two categories: <ul style="list-style-type: none"> <li>• Households with 0-42 scores was defined as poor and borderline food consumption (HFSNA) and</li> <li>• households with &gt;42 to highest scores was acceptable food consumption (HFSNA) category</li> </ul>
Nutritional status of women based on body mass index (BMI)	Normal Malnourished	There was a pre-calculated variable with following categories: severely thin, moderately thin, mildly thin, Asian overweight, overweight, Asian obese, obese and normal. We recoded all these categories in two groups where normal as one group and all other categories as malnourished group
Household food security	Food secure Food insecure	HFIAS developed by the Food and Nutrition Technical Assistance project (FANTA) was used to calculate food secure and insecure households. HFIAS used 9 questions (49).

• **Independent variables**

For analysing factors that are associated with incidence of HFP as well as for explaining FCS we have used various independent variables. The list of such variables with categories and definitions is given in Table 2.2.

**Table 2.2: List of independent variables for analyzing HFP incidence**

<b>Variable name</b>	<b>Categories</b>	<b>Definition/note</b>
Sex of household head	Male Female	As available in data, no recoding done
Literacy status of household head (50)(50)(50)(49)	Illiterate Literate(50) Other	-No education to class six passed was considered as illiterate -Class seven and above formal education was considered as literate <sup>2</sup>

<sup>1</sup> Nine standard food groups and their current standard weights were used to calculate FCS which gave a summed total score ranging from 0 to 112. According to this HFSNA guideline, standardized cut-offs to categorize households into three categories were, 1=Poor consumption ( $\leq 28$ ); 2=Borderline consumption ( $>28-\leq 42$ ); 3=Acceptable consumption ( $>42$ ). As the households with poor consumption was found as low as 2.4%, we created a dichotomous variable by recategorizing these three categories into two as poor and borderline food consumption (0-42 score) (14.2%), and acceptable consumption ( $>42$  score) (85.8%).

<sup>2</sup> Studies indicated that 100% of persons completed seven or more years of schooling were literate in neighbor country India. As there is no study done in Bangladesh, we used this statistic to define literate and illiterate for our study

Variable name	Categories	Definition/note
		- Functional education or currently going to school or don't know were included in the 'other' category
Main occupation of household head	Unemployed/No income Farmer (Paddy & other than paddy) Daily labourer/household help/transport workers/Handicrafts Salaried worker/professional Businessman/petty businessman Others Businessman/Petty businessman Other	There were 20 categories available in data. We recategorized by observing frequencies and personal judgement
Per capita income in past one month	lowest Q1 Q2 Q3 Q4 Highest Q5	At first total household monthly income calculated by summing household income from agriculture, business, wages, salaries, vegetables & fruits, poultry & livestock, fish farming and others in the past one month. Then per capita income was calculated from total household monthly income divided by household size. Finally, five quintile of per capita income rank was calculated
Household size	<4 4 >4	As four is the average household size in the Bangladesh we use it as a cut-off point
Household construction type	Pacca Semi-pacca Tin Hut/other	<ul style="list-style-type: none"> <li>- Pacca defined if wall is pacca (made of cement &amp; bricks or stone with lime/cement) &amp; floor is pacca (ceramic tiles or cement &amp; bricks or mosaic) and roof is pacca (ceramic tiles or cement &amp; bricks)</li> <li>- Semi-pacca defined if wall is pacca &amp; floor is pacca and roof is made of tin</li> <li>- Tin defined as if wall and roof are made of tin</li> <li>- All other houses were categorized as hut/other</li> </ul>
Homestead land in decimal (category)	0 >0-7 >7	0 means households do not own but live on other people's land >0-7 means household has more than zero but less than seven decimal land

Variable name	Categories	Definition/note
		>7 means household had more than seven decimal land
Agriculture land owned in acre	0 acre .001 - 1 acre 1.01 - 2.5 acre 2.51 - 5 acre >5	Five categories were estimated by observing frequency distributions
Name of division	Rajshahi Khulna Barisal Dhaka Sylhet Chittagong Rangpur	<ul style="list-style-type: none"> <li>They are the administrative regions or divisions of Bangladesh.</li> <li>They are used as available in data, no recoding done</li> </ul>
Study area	Rural Municipality City Corporation	As available in data, no recoding done
Round of the year	1 <sup>st</sup> 2 <sup>nd</sup> 3 <sup>rd</sup>	1 <sup>st</sup> means Round 13 of FSNSP which was the first round in 2014 2 <sup>nd</sup> means Round 14 of FSNSP which was the second round in 2014 3 <sup>rd</sup> means Round 15 of FSNSP which was the third round in 2014
Total number of women in the household	1 2 ≥3	
Women age	10-19 20-29 30-49	Women age was categorized in three groups, as 10-19 years as adolescents, 20 to 29 years young adult women and 30 or more years old as relatively old women.
Women education	No education Partial primary Complete primary Above primary	
Women occupation	Unemployed Farmers/Poultry/ Livestock/Fish cultivation  Day labourers/ salaried/ professional workers or businessman or other	
Marital status of women	Married Unmarried Widow/divorced/ separated	

## 2.7. Data analysis methods

- Analysis of factors associated with HFP

Descriptive statistics were used to show the status of HFP by different regions of Bangladesh. Association of socio-demographic and other characteristics with HFP was analyzed using Pearson's Chi-square test. Finally, binary logistic regression analysis was done to identify factors associated with HFP. The result of logistic regression was shown using adjusted odd ratio (AOR) with 95% confidence interval (95% CI). Here to be noted, we used unweighted result of analysis for this as household weight variable was not available in the dataset.

- Analysis of impact on food consumption and other indicators

Before doing this analysis, we wanted to purge the effects of any selection bias in the sample. For this we used a case control method. The case-control matching procedure using SPSS was executed where division, main occupation of household head, per capita income in past one month, agriculture land in acres, household construction type, literacy status of household head, round of the year, household size group, study area and sex of household head were considered to identify one matched "control" (non-HFP) household for one "intervention" (HFP) household. The analysis were don using both case control and without case control to find out whether purging for possible selection bias results in better or worse or similarly acceptable FCS.

We used chi-square test, and binary logistic regression (eg., calculated unadjusted and adjusted Odd Ratio with 95% CI) for achieving the objective 2.

Weighted adjusted odds ratio with 95% CI was shown for objective-3.

## 2.8 Limitations of data

There are two types of limitation of the analysis used here. While interpreting some of the results, it would be good to keep these limitations in mind.

As we have seen 16 rounds of data were collected on a large number of households. One would have thought that at least for some of the information panel data would be collected. It was not and a good chance of understanding the changes over time had been lost and even between seasons within the same year.

Second, some of the data defied understanding. Take the example of farming as an occupation. Two types of farming have been identified, paddy farmers and non-paddy farmers. There is likely to be hardly any farmer who is cultivating paddy only or non-paddy crops only if this relates to field based farming. It is not also clear if these are two distinct groups or there is an overlap. Assuming that these do not overlap, we have merged the two groups together although we have found that the actual results do not differ much whether these are merged or not.

Third, the ecological vulnerable regions and administrative divisions certainly overlap., although the actuals samples may not. Therefore, it should have been made clear if households in an ecological area falling within a division is a distinct group from other households within the same division as these are shown separately. For lack of specific information, we take it that they are. If so, when we distinguish by division, this is only partial distinction and does not provide the full picture for the division and the conclusion on its basis may not be wholly correct.

Note also that the number of households shown under divisions are always far lower than those under the ecological zones. For example, while Chattogram division sample size (for all rounds) is 1152, that for Eastern Hills is 3456 i.e., 3 times or more (see Fig. 3.1 in next chapter). What impact such distributional situation creates for the over-all picture is difficult to assess.

Fourth, while such a large survey has been conducted for understanding nutritional issues and given that diversity of food from HSG/HFP has much to do with it, particularly for supply of micronutrients, the composition of crops and vegetables in the HSG could have been immensely useful. Unfortunately, this was wholly lacking.



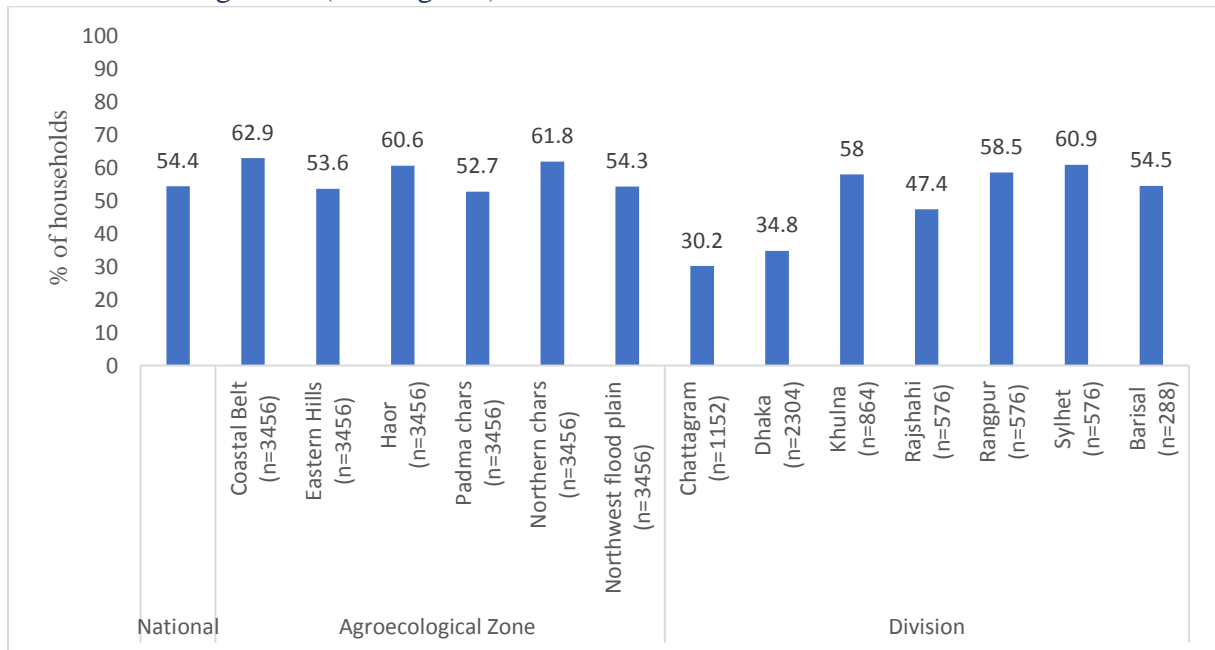
## Chapter 3: Results of Analysis

### 3.1: Geographic incidence of HFP

Figure 3.1 shows the incidence of households involved in HFP over regions, both by division and ecological vulnerability status. Overall, 54.4% of households were practicing HFP in 2014. One finds not much variation among the ecological vulnerable regions, from 52.7% in Padma *chars* (river islands) to 62.9 in the coastal belt. This limited variation may be contrasted with the apparent high variation among the division (presumably outside the ecologically vulnerable areas within the division). Among divisions, the lowest are in the two divisions of Chattogram (30.2%) and Dhaka (34.8%) which have the second and largest metropolitan area within the country where the opportunity for HFP is limited due to land availability problem. Contrast this for Chattogram with the percentage practicing HFP in the Eastern Hills, which is in all probability much of the eastern part of Chattogram Division in the Hill Tracts where the percentage of HFP households is found to be 53.6. Indeed if the Eastern Hills are all the Hill districts of Chattogram, the over-all percent for that division should come to 48% or so, a figure far above the figure shown for the division.

Similarly contrast Rajshahi Division percentage (47.4) with those in the north western flood plains (most likely Tista flood plain and also the Bangali river areas) where the proportion of HFP households is 54.3 percent. What we want to hint at is that while inter-divisional differences are important from political and administrative point of view, probably it is the ecological setting in them which is more important from policy intervention point of view as HFP is already well-rooted in those places and farmers there are likely to be more receptive to incentives/support therein.

Figure 3.1: Incidence of homestead food production in 2014 by different geographical locations in Bangladesh (Unweighted)



Note: Upazilas under the vulnerable zones have been shown in Annex 1

### 3.2 Association of various background factors with HFP

We first report the results of analysis based on chi-sq tests. A summary is provided below of the results. For details, please see **Table 3.1**.

- Association of socio-demographic characteristics with HFP

Families headed by males had a slightly larger incidence compared to those headed by females. Household size apparently provides more impetus for HFP as those with family size lower than 4 had an incidence level of just above 48% while those with family size larger than 4 had an incidence of 59% indicating both the role of subsistence pressure and availability of working hands. Households with literate head (50.6%) were less likely to have HFP compared to those with illiterate heads (57.9%). Note that the other category which has the highest percentage of nearly 66% is a very small subsample of just above 100 households (Table 3.1).

- Association of socio-economic characteristics with HFP

Economic well-being apparently has a dampening effect on HFP practice. As per capita income rises, the incidence of HFP falls from nearly 63% in case of the lowest quintile to 48.8% for the highest one. If household's dwelling characteristics indicate its economic condition, a similar conclusion can be made in that those living in huts had more than just about 65% practising HFP compared to those living in better conditioned dwellings. Thus, for those in pacca or brick and cement built housing, the proportion falls to just 35% or so.

The above argument, however, does not apply so much when land holdings are considered directly or indirectly. Thus farmers compared to all others have the highest incidence at 71.2% the next highest proportion being for the unemployed and daily labourers at around 54%. For the latter we believe it is the subsistence pressure and lack of income or low income which forces them to practise HFP.

In any case, there was also significant increasing tendency for HFP when size of agriculture land ownership increases rising to as high as nearly 75% for those owning between 1 to 5 acres although falling slightly for those owning more than 5 acres. As stated earlier this very probably is linked to their technical skills in farming. Similarly, we find, there was a significant increasing incidence of HFP if size of homestead land ownership increases from 42% for those living in other people's land to as high as 71% for those with more than 7 decimals of land.

- Association between characteristics of women in households and HFP

Above we have seen that labour availability as may be proxied by household size has a positive influence on HFP practice. It appears that the influence gets stronger if the number of women rises. Families having only just one woman has an incidence of HFP of just around 50%. For those with 3 women or more this rises to above 61%. Very likely when there is just one woman in the family she has a lot of household chores to attend to and may not find much time for HFP. While this time availability issue may get somewhat loosened as number of women increases, it is the availability of teen-agers and young women which apparently matter most. This impression gets stronger when we find that households with unmarried women have the highest incidence of HFP at just about 60% while for widows it is much less probably because they have to be involved in some kind of direct economic activities for livelihood with limited time for HFP.

It is found that women's education has little influence on variation in incidence while their occupation has much stronger influence, particularly in households where women are involved in farming. Nearly three-quarters of households with women identifying themselves as farmers are involved in HFP. In other occupations or no occupation, it is far less.

- Association of regional characteristics with HFP

We have already expressed some reservation with the incidence figures for divisions. Given this, sixty percent or more of households in four divisions of Bangladesh namely Khulna, Barishal, Sylhet and Rangpur reported having HFP. Chattogram had the lowest incidence (but note our observation earlier) at just short of 41%. Somewhat higher proportions were observed for Dhaka and Rajshahi (around 53-54%). Not surprisingly, the rural households (60.7%) were substantially more likely to have HFP compared to urban are (at just about 26% or so).

- Association of FNSSP rounds of 2014 with HFP

While there apparently is not much of a variation among rounds as discussed earlier, yet the small differences are statistically significant. The proportion of households with HFP increased by 4% from first round (51.9%) to 2<sup>nd</sup> (55.9%) and 3<sup>rd</sup> round (55.4%). Very likely this is a reflection of seasonality in vegetable and fruit growing.

One point of note should be given here. In quite some cases, the variations are not much by categories. Yet, these are systematic and because of large sample size, are statistically significant at 1% probability. However, also note that the effects are likely to be confounded due to other factors correlated with the particular variable in question. One therefore need to analyse them in a multi-variate setting where the independent effects may be considered in a better manner. This has been done and discussed in the next section.

Table 3.1: Association of socio-demographic and other characteristics with HFP households (unweighted)

Characteristics	Households with HFP (%)		p value
	No	Yes	
<b>Regional characteristics</b>			
<b>Name of division</b>			
Rajshahi	46.6	53.4	<0.001
Khulna	36.1	63.9	
Barisal	34.8	65.2	
Dhaka	46.1	53.9	
Sylhet	39.2	60.8	
Chittagong	59.2	40.8	
Rangpur	40.2	59.8	
<b>Residence</b>			
Rural	39.3	60.7	<0.001
Urban	73.6	26.4	
<b>Household characteristics</b>			
<b>House type</b>			

Characteristics	Households with HFP (%)		p value
	No	Yes	
Pacca/semi-pacca	64.6	35.4	<0.001
Tin	41.4	58.6	
Hut/other	34.7	65.3	
<b>Household size</b>			
<4	52.0	48.0	<0.001
4	47.2	52.8	
>4	40.9	59.1	
<b>Household's per capita income in past one month</b>			
Lowest Q1	37.1	62.9	<0.001
Q2	41.7	58.3	
Q3	43.1	56.9	
Q4	48.2	51.8	
Highest Q5	51.2	48.8	
<b>Homestead land in decimal</b>			
0	58.4	41.6	<0.001
>0-7	49.1	50.9	
>7	28.8	71.2	
<b>Agriculture land in acres</b>			
0	55.1	44.9	<0.001
.001 – 1.00	31.6	68.4	
1.01 - 2.50	25.3	74.7	
2.51 – 5.00	25.3	74.7	
>5	26.6	73.4	
<i>Characteristics of household head</i>			
<b>Sex of household head</b>			
Male	44.1	55.9	<0.001
Female	46.3	53.7	
<b>Literacy status of household head</b>			
Illiterate	42.1	57.9	<0.001
literate	49.4	50.6	
Other	34.4	65.6	
<b>Main occupation of household head</b>			
Unemployed/No income	46.3	53.7	<0.001
Farmer (Paddy & Other than paddy)	28.8	71.2	
Daily labourer/household help/transport workers/Handicrafts	45.8	54.2	
Salaried worker/Professional	54.0	46.0	
Businessman/Petty businessman	51.5	48.5	
Other	61.6	38.4	

<i>Characteristics of reproductive aged women of households</i>			
<b>Total number of women in the household</b>			
1	49.6	50.4	<0.001
2	43.8	56.2	
<=3	38.8	61.2	
<b>Women age</b>			
10-19	38.8	61.2	<0.001
20-29	47.1	52.9	
30-49	43.8	56.2	
<b>Women education</b>			
No education	45.7	54.3	<0.001
Partial primary	43.6	56.4	
Complete primary	42.6	57.4	
Above primary	44.5	55.5	
<b>Women occupation</b>			
Unemployed	45.2	54.8	<0.001
Farmers/Poultry/ Livestock/Fish cultivation	25.1	74.9	
Day labourers/ Salaried/ professional workers or businessman or other	56.3	43.7	
<b>Marital status of women</b>			
Married	45.1	54.9	<0.001
Unmarried	41.0	59.0	
Widow/divorced/ separated	49.3	50.7	
<b>Other Characteristics</b>			
<b>FSNSP rounds in 2014</b>			
1 <sup>st</sup> round	55.8	44.2	<0.001
2 <sup>nd</sup> round	38.8	61.2	
3 <sup>rd</sup> round	41.1	58.9	

### 3.3 Factors associated with HFP

As all the independent variables were individually found to be significantly associated with HFP as discussed above, we entered all the variables in the adjusted model to identify factors associated with HFP. Note that we have not included women's characteristics as included in bi-variate table above basically for the reason that as women's employment in farming and their labour availability were also subsumed within and also proxied by household's employment status and labour availability, their inclusion very likely would result in high multicollinearity and insignificance.

Given the above caveat regarding women's issues, quite in contrast to the results discussed above when independent effects are considered, we find only the following (apart from region and rounds) to have significant effect (**Table 3.2**): occupation in farming, dwelling characteristics, house construction type, household size, agriculture land ownership, and homestead land ownership.

Farmer households were 1.49 time as much likely to have HFP compared to unemployed group.

Households living in houses made of tin and hut/other construction materials were 2.3 times and 2.4 times as much likely to have HFP compared to the than the semi-pacca/pacca dwelling households. Regarding household size, the highest AOR (1.53) was seen among largest group (>4 members) following second highest AOR (1.32) with the family size having 4 members than small size families (<4 members HH). The higher the agriculture land size, the higher the AOR compared to no ownership of agriculture land. If households owned more than seven decimal homestead land, the chances of HFP were 86% more comparing to no ownership of homestead land.

Dhaka (AOR: 0.75) and Chittagong (AOR: 0.79) were significantly less likely to have HFP compared to Rajshahi. Considering rural as a reference, urban households were only one-third as likely to raise HFP.

Compared to first FSNSP round conducted in January-April 2014, HFP was found to be reported 26% and 28% more during 2<sup>nd</sup> and third round respectively.

Table 3.2: Results of multi-variate logistic regression analysis of incidence of HFP households (Unweighted)

Variable categories	Adjusted OR
<b>Sex of household head</b>	
Male	1
Female	0.92
<b>Literacy status of household head</b>	
Illiterate	1
Literate	0.96
Other	1.36
<b>Main occupation of household head</b>	
Unemployed/No income	1
Farmer (Paddy & other than paddy)	1.49**
Daily labourer/household help/transport workers/Handicrafts	1.04
Salaried worker/professional	0.88
Businessman/petty businessman	0.94
Others	0.88
<b>Per capita income in past one month</b>	
lowest Q1	1
Q2	1.02
Q3	1.04
Q4	1.06
Highest Q5	0.97
<b>Homestead land in decimal</b>	
0	1
>0-7	1.01
>7	1.86***
<b>Agriculture land owned in acre</b>	
0 acre	1
.001 - 1 acre	1.87***
1.01 - 2.5 acre	2.52***
2.51 - 5 acre	2.50***

<b>Variable categories</b>	<b>Adjusted OR</b>
>5	2.65 <sup>**</sup>
<b>Household construction type</b>	
pacca/semi-pacca	1
Tin	2.33 <sup>**</sup>
hut/other	2.44 <sup>**</sup>
<b>Household size</b>	
<4	1
4	1.32 <sup>**</sup>
>4	1.53 <sup>**</sup>
<b>Name of division</b>	
Rajshahi	1
Khulna	1.23
Barisal	1.01 <sup>**</sup>
Dhaka	0.75 <sup>**</sup>
Sylhet	1.26 <sup>**</sup>
Chittagong	0.79 <sup>**</sup>
Rangpur	1.06
<b>Study area</b>	
Rural	1
Urban	0.33 <sup>**</sup>
<b>Round of the year</b>	
1 <sup>st</sup>	1
2 <sup>nd</sup>	1.26 <sup>**</sup>
3 <sup>rd</sup>	1.28 <sup>**</sup>
<b>-2 Log likelihood</b>	32759.756
<b>Nagelkerke R Square</b>	0.207
<b>Hosmer and Lemeshow Test (p value)</b>	0.002
<b>Overall Percentage</b>	66.0

Note: \* indicates <.05, \*\* indicates <.001

Our earlier hypothesis that it is either subsistence orientation (higher family size and also labour availability) or economic capacity as expressed through land ownership which may be a reflection of association with farming are the major factors that appear to be associated with incidence of HFP seems to be borne out. We now move to what impacts on nutritional well-being HFP has on the practicing households. First, the food consumption score (FCS).

### 3.4: Impact of HFP on Household FCS

As indicated earlier, we have used a case control matching method to purge the effects of confounding factors for determining the impact of HFP on FCS. After case control, the HFP and non-HFP cases were evenly distributed as shown in Annex 4.

Before getting to the results related to FCS, we need to consider the nature of factors that may have a relationship with it. Food may come from either own production (whether field-based or HFP-based) and/or the market. The latter is dependent very much on economic capacity which is either directly the household's income level or indirectly, the type of occupations which are better paying or the access to assets such as land which either results in availability through own production or access to marketed food through income. We, therefore, postulate that presence of such variables will result in higher FCS compared to others. On the other hand, however, as some of these variables are reinforcing each other, the case control may, therefore, result in lower proportion of households attaining acceptable FCS than in the no-case control method.

For understanding the results clearly we have provided them both before case controlling and after case controlling. Also note that both categorical analysis using ch-sq tests and multivariate logistics analysis have been done.

We first discuss the chi-sq based results first and then the logistic regression. The relevant table of chi-sq tests are in Annex 5. The table there shows the results of analysis both before and after case control.

First, we observe that both under no case-control and case control matching, proportions of households with acceptable FCS is somewhat higher among HFP households compared to non-HFP ones. The proportions are 87.4 (HFP) and 83 (non-HFP) for no case control and 79 (HFP) and 73 (non-HFP) for case control respectively. Thus, HFP households have higher proportions under both situations.

The table also shows other factors that are associated with acceptable FCS. We find that while farmers have high proportion of acceptable FCS, daily labourer households have even higher proportions under both no-case control and case-control methods. However, for income levels, higher incomes do have higher proportions of acceptable FCS under both methods although the case control proportions are lower. The similar situation obtains also for land holding although the no-case control and case control have somewhat different categorization. In general, the results are as expected. The only exception seems to be for sex of household category. For both before and after case control one finds no statistical difference between the male headed and female headed households

Now moving to the results under logistic regression, we find that under no-case control matching, HFP households were 1.29 as likely to have acceptable household food consumption compared to non-HFP households. However, when case control matching is effected, the adjusted odds-ratio rises sharply to 1.51. This clearly shows that when the confounding influence of other factors are purged, HFP has a much stronger role in FCS.



Table 3.3 Adjusted Odd-ratios for acceptable FCS for background variable categories before and after case control matching (Unweighted)

Variable categories	Before		After	
	N	Adjusted OR	n	Adjusted OR
<b>Type of households</b>				
Non-HFP	12344	1	899	1
HFP	14728	1.29**	899	1.51**
<b>Name of division</b>				
Rajshahi	3552	1	184	1
Khulna	2016	1.22*	58	1.62
Barisal	3072	0.91	166	0.71
Dhaka	6624	1.61**	554	1.88*
Sylhet	2400	1.58**	118	1.86
Chittagong	5184	0.99	392	0.90
Rangpur	4224	0.69**	326	0.49**
<b>Main occupation of household head</b>				
Unemployed	2741	1	80	1
Farmer (Paddy)	6417	0.92	108	1.01
Farmer (Other than paddy)	9438	0.62**	66	0.35*
Daily labourer/ household help/transport workers/Handicrafts	3075	0.87	1132	0.60
Salaried worker/Professional	5167	1.03	132	0.78
Businessman/Petty businessman	234	0.82	280	0.82
<b>Per capita income in past one month</b>				
lowest Q1	5402	1	398	1
Q2	5429	1.33**	454	1.83)**
Q3	5748	2.22**	466	2.37**
Q4	5073	3.81**	284	4.83**
Highest Q5	5420	6.15**	196	9.95**
<b>Agriculture land owned in acre<sup>@</sup></b>				
No land			1618	1
Have land			180	1.81*
0 acre	16723	1		
.001 - 1 acre	6920	1.69**		
1.01 - 2.5 acre	2263	3.29**		
2.51 - 5 acre	815	4.44**		
>5	351	4.80**		
<b>Household construction type<sup>@</sup></b>				
Pacca/semi-pacca	4399	1	56	1
Tin	12240	0.48**	1032	0.26
Hut/other	10433	0.33**	710	0.19
<b>Literacy status of household head</b>				
Illiterate	18953	1	1534	1
Literate	8018	1.34**	264	1.02

Variable categories	Before		After	
	N	Adjusted OR	n	Adjusted OR
Other	101	1.48)		
<b>FNSNP Round of the year</b>				
1 <sup>st</sup>	9024	1	706	1
2 <sup>nd</sup>	9024	1.54 <sup>**</sup>	522	1.56 <sup>**</sup>
3 <sup>rd</sup>	9024	1.16 <sup>**</sup>	570	1.11
<b>Household size group</b>				
<4	5418	1	374	1
4	7648	1.24 <sup>**</sup>	554	0.80
>4	14006	1.53 <sup>**</sup>	870	1.12
<b>Urban-rural<sup>@</sup></b>				
Rural	23256	1	1664	1
Urban	3816	1.33 <sup>**</sup>	134	2.39 <sup>*</sup>
<b>Homestead land in decimal</b>				
0	9104	1	996	1
>0-7	9219	1.24 <sup>**</sup>	626	1.06
>7	8749	1.38 <sup>**</sup>	176	1.22
<b>Sex of household head</b>				
Male	24639	1	1730	1
Female	2433	0.78 <sup>**</sup>		0.71

We have other factors in the logistics regression showing their influence on FCS. Considering only the case control matching analysis, we find that among occupations, income level has strong influence in that those in second quintile have 83% higher chance to have acceptable FCS compared to the lowest quintile. The results for the other quintiles (Q2, Q3, Q4 and Q5) are respectively 137%, 383% and 895% higher compared to the lowest income quintile. This very clearly shows the impact of income. There are few other such strong results.

Given these results, our next question is if HFP helps in raising the nutritional status of women. The answer we find is both yes and no as discussed in the next section.

### 3.5: Impact of HFP on nutrition and food security indicators among women

Women's nutrition is important because they have the same rights to nutrition as any other person and also because their nutrition is closely linked with child nutrition and health. This section shows the results of policy questions 4 and 5 under objective-3, that is, the impact of HFP on households with women aged 19-49 as well as their individual nutrition. Before such an analysis, we first discuss the situation that women are in the sample households.

- Socio-demographic characteristics of women

About 40.3% of the households had two women aged 19-49 years and 32% households had only one woman. Stratifying by age, 27.0% were adolescents, 29.4% were young adults and remaining 43.6% were in 30-49 years age groups. About 44.2% women had above primary education (more than 5 years of formal schooling) while 80.6% women were unemployed. About 73.3% women were married (Table 3.4)

Table 3.4: Characteristics of adult reproductive aged women in households (19-49 years)

	<u>Percent</u>
<u>Total number of women</u>	
1	38.9
2	39.0
>2	22.0
<u>Women's age (years)</u>	
19-24	22.6
25-34	40.2
35-49	37.2
<u>Women's education</u>	
No education	27.3
Primary incomplete	16.1
Primary complete	16.4
Above primary	40.2
<u>Women's occupation</u>	
Unemployed	76.2
Farmer (all types)	12.4
All others	11.4
<u>Marital status of women</u>	
Married	90.5
Unmarried	5.2

- Relationship of HFP with women's characteristics in households

This has already been discussed earlier. Just to reiterate, it has been found that availability of women labour, particularly young ones as well as women's experience in farming are major factors associated with incidence of HFP. Education has limited roles at best.

- Association of women's nutritional indicator outcomes with HFP

We first note that in those households where there are women, 10.7 percent households have poor and borderline FCS (max score 42). When the BMI of women are considered, 55.7 percent households are found to have one or more malnourished women. Yet, only 25 percent households are food insecure. The rest are food secure. This dichotomy is repeated when we look at the indicators more closely.

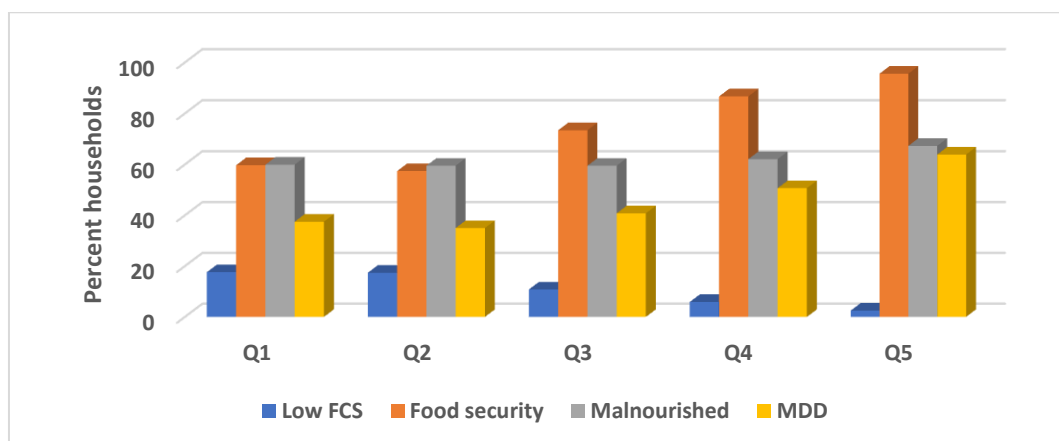
We refer to **Annex 6** for the results to be discussed below. The basic results (see the results under the Treatment variable rows) are as follows

- **Household food consumption:** HFP households (9.8%) had significantly lower poor and borderline food consumption compared to non-HFP households (12.9%) ( $p < 0.001$ ).
- **Nutritional status of women:** HFP households (52.9%) had lower malnourished women compared to non-HFP households (60.6%) ( $p < 0.001$ ).
- **Minimum dietary diversity of women (MDD-W):** MDD-W was higher among HFP households (45.6%) than non-HFP (43.4%) ( $p < 0.001$ ).
- **Food security:** Slightly more food secure households were found among those with HFP practice compared to that of non-HFP (75.7% vs 74.1%) ( $p < 0.001$ ).

Note that the table shows other household characteristics and there are certain interesting results and their significance for nutritional policy. Let us take the case of income which we had observed to have quite strong impact on FCS in households. The same is true here. The proportion of households with poor and border line consumption fall sharply and the obverse is also true that food security of the households increase from just under 58.2% food secure households for the lowest income quintile to just about 95.9% or practically all households. However, then look into the two middle columns showing women's nutrition situation in terms of proportion of households with malnourished women and minimum dietary diversity (MDD). We immediately see that the households nutritional fortune is not shared equally with women. Across the income quintiles, proportion of households with malnourished women in fact rise. Looking up at MDD, the picture gets better, however (**Fig. 3.1**).

Other characteristics such as land holding and homestead land ownership show similar dichotomy of households with good nutritional indicator but relatively less so for women in there. For land holding the picture is very similar to that for income. And even for women's education we find that households with women having better education are more malnourished than those with not so much educated women. The only saving grace seems to be for MDD. While we have no direct proof, we believe this is likely to be due to HFP which provides a good chance of growing various types of food.

**Fig. 3.1: Proportion of Households with Women, 19-49 years, by Nutritional Indicators by Income Quintiles**



When we try to look at independent effects of these variables and their categories on to households with women 19-49 years old, we find again the patterns as before in that while HFP have positive impact on nutrition, at least for women’s malnourishment, the picture is at worst, just the opposite when other factors like income and land holding are considered. Based on the detailed tables in Annex 7-10 we can state the results to be as under.

- Household food consumption:** HFP households had 1.36 to 1.66 times chances of having acceptable food consumption compared to non-HFP households depending on the model chosen Annex However, one also finds very strong positive relationship of FCS with income categories as before. Similar strong positive relationship is again observed for land holding. For homestead land, the positive relationship persists but is far less strong (Annex 7).
- Nutritional status (malnourishment) of women:** Adjusted odds ratio for HFP households with malnourished women of age 19-49 years varies from 0.73 to 0.85 compared to non-HFP households. This means that HFP households have up to 23% lower chance of having malnourished women in the specified age- group. When we look at the influence of income categories while statistically the results are significant, the odds ratios does not change much across groups except for the highest income quintile which has maximum of 34% more chance of having malnourished women. Somewhat similar results are obtained for land holding with the highest group having substantial higher chance of malnourished women. Homestead land appears to have limited impact. While for women’s characteristics, there does not seem to be any stable pattern, education seems to improve their lot as chances of proportion of households with malnourished women appear to go up in households with better educated women, although the pattern is not unidirectional (Annex 8). Thus we find again that while HFP appears to lower women’s chances of malnourishment, economic capacity is not a guarantee for women’s better nutrition.
- MDD of Women:** Chances of women of 19-49 years age having an MDD appears to brighten in HFP households which have an adjusted odds ratio up to 1.33 compared to non-HFP households. And in this case both income categories and land categories

show similar and stronger and higher chances of attaining MDD. The highest categories for income have adjusted odds ratio around 2.5 compared to the lowest category. For agricultural land, the highest category has an adjusted odds ration of 2.15. Among categories related to women's characteristics only education seems to have somewhat of a strong positive influence for raising MDD (Annex 9).

- **Household food security:** HFP households had 0.91 times less chances to have food insecurity than that of non-HFP ( $p < 0.001$ ) (Annex 10). For women of age 19-49??

## Chapter 4: Discussion

Raising home gardening and backyard poultry/livestock by the households as a strategy of improving food security and nutrition has been adopted in several policies in Bangladesh. Bangladesh also has some rich experiences of interventions in this area by various organization, particularly Helen Keller International since 1983. However, while there had been quite some analysis of the nutritional impact of home food production, HFP, (meaning homestead gardening along with livestock/poultry raising), there had been a dearth of analysis on factors associated with such practices. The current study, therefore, was undertaken to assess the status of HFP in the country, its regional and spatial variation, factors associated the practice and its nutritional impact, particularly those such as food consumption score, women's nutritional status etc which were not analysed before. The study used a secondary data source of some 27072 households.

### **In sum, the findings of the study indicate that**

- (a) HFP is widely practiced in the country, particularly of note is that there is only a little variation across ecologically vulnerable areas although by division there seems to be much more variation. This may imply that in vulnerable areas with livelihood uncertainty, HFP is a kind of supplier of last resort (for food). Note that there is anecdotal evidence that during the initial phase of pandemic when supply chains of food had broken down, people survived in many places due to HFP as supplier of food.
- (b) Many factors are associated with HFP. But both subsistence considerations and availability of land (agricultural or homestead) were important factors.
- (c) While it may not sound high, there is a not insubstantial impact of HFP on household attaining acceptable food consumption score. In fact, when the effects of confounding factors were purged, the impact has been seen to be higher.
- (d) Labour availability, particularly women labour availability as proxied by family size or number of women in the household appeared to have a positive effect on HFP practice.
- (e) Acceptable food consumption scores were also influenced heavily by economic capacity as proxied by level of income or access to land.
- (f) When the households with women were separately examined, the above findings, particularly positive impact of HFP on FCS was observed again. Additionally, it was found that HFP has similar positive impacts on reduction of households with malnutrition of women, raising food security and raising MDD of women.
- (g) There was a disconcerting finding, however. While HFP have positive impact on nutrition, at least for women's malnourishment, the picture is at worst, just the opposite when independent effect of other factors like income and land holding are considered. This implies that even in households with better means, HFP provides women therein the wherewithal for better nutrition.

### **Strengths and limitations**

We have already provided the rationale for the present study and also its limitations. To reiterate, to the best of our knowledge, this is the first report which has analysed the status, nationally along with regional variations as well as factors associated with HFP. It has also analysed some of the nutritional impacts which were either not done before or given less

attention such as FCS and malnutrition of women. The second good point is that while from a secondary source, the sample size was very large.

On the other hand, the limitation was that while large, and collected 3 times a year, not all relevant data such as types of plants cultivated were not available nor the same households sampled under different rounds missing a chance of far richer analysis with panel data. In fact related to HFP many other relevant information were missing such as seed source, market support etc and this was because the emphasis of the survey was not HFP but other issues. But the fact remains that we were unable to analyse such issue such as

- how many varieties of fruits and vegetables HFP households produce, whether it were all year round production or not;
- seed source, market support for both inputs and outputs;
- cooking practices;
- nutritional knowledge on vegetables and fruits;
- fish cultivation in the pond (either seasonal or perennial) in homestead area;
- vegetables and fruit production in household pond bank;
- time involvement of women members in HFP; and
- the barriers in raising both HSG and non-crop food such as those from livestock and poultry;

### Conclusion, recommendations and scope of future research

This study provided evidence that the HFP households had higher chances of household food consumption, food security and lower chances of having malnutrition among women, particularly reproductive age women which has implications for the nutrition of the children they bear. Looking at the proportion of households with HFP, it might be said that measures needed to be taken to raise HFP coverage as well as its quality (an issue which could not be studied due to lack of data) for supplying nutritious food. A few recommendations may therefore be suggested for such purposes.

***Adopting, Adapting and scaling up of existing effective interventions:*** There are already existing policies and effective interventions (e.g. enhanced homestead food production models, farmer school models, roof gardening models). However, national policy makers should take measures to implement these models and scale up in all areas by considering following few specific criteria during selection of households: occupation of household heads, house construction type, household size, homestead land ownership, agriculture land ownership, divisions, ecology of the chosen area.

- ***HFP implementation manual/guide:*** The available homestead gardening manual can help planning HSG by maximum use of space, techniques to be used, materials and steps should be taken for preparing, planting and maintain these gardens, including fertilizers and pesticides, soil fertility and pest management and seed selection and sources (51). Steps should be taken for continuous update/modification of manual on home garden model and poultry/livestock production.
- ***Selection of type of fruits and vegetables:*** Fruits and vegetables choice is important because of their nutrition content and variety as well as ease of care. Also various ecological settings have different kinds of stimulus or barriers to growth of plants. These



should also be communicated to farmers/households. The HFP manual may help in this regard by including such topics in detail in simple language.

- **Behaviour change communication (BCC):** BCC materials (eg., short video clip) regarding HFP should be distributed at schools and also to women in g. These materials can be circulated at individual level using social media.
- **Training:** Continuous awareness-building and trainings on HFP are essential for the sustainability.
- **Marketing system:** A marketing system should also be developed and included in the HFP programs so that the scope of earning money selling extra food produced can be created which will motivate people as well. People need to be connected with the market value chains for selling their surplus products in the markets for their livelihoods.
- **Storage system:** Storage system and capacity should be available so that if the crops couldn't be sold or consumed can be preserved properly for a longer period.
- **Multi-sectoral approach:** Engagement of various stakeholders to gain maximum output and benefit is needed. All different kind of actors, such as- GOs, NGOs, LG depts., private sector dealers and marketing agents for the development of technology recommendations, supply chains and marketing should work together for making HFP interventions successful. 'Village model farm' of 'Suchona' project by Helen Keller Intl. may be an example of such multi-sectoral approach which should be scale up all over the country.
- **Family approach:** Family approach targeting husbands and wives to implement HFP should be considered for better nutritional outcome. Evidence from a project called ANGeL by IFFRI found better results when husbands and wives both were brought in the training.
- **Farmer choice:** How different HFP models can be adopted in the local context keeping the farmers need in mind is an important point. Thus farmers' choice is needed to be understood. May be, program implementers are thinking about nutrition but they (farmers) are not thinking about nutrition; they are only thinking about the market. So it is needed to be balanced. In this regard, the farmers should be given several options which are suitable for them.
- **Government support for the poor:** There should be special discounted or free offer from Government on seed, fertilizer for the poor.
- **Future research:** Future national representative research considering robust methodological study design comprising of base line and end line data collection targeting intervention (HFP=HSG + backyard poultry/livestock rearing + fish cultivation in homestead area) and control (non-HFP) groups to understand the livelihood improvement has been strongly recommended.

Data collection for such future research should obtain information on type of vegetables and fruits production, year-round cultivation, seed source, market support, cooking pattern to restore nutrition and nutritional knowledge on vegetables and fruits including collection of blood sample from subjects to measure anemia, night blindness etc. How many households have stopped their household gardening after one or two rounds should be recorded as well. Measuring child growth and micronutrient status relating to HFP is also recommended.

In addition, a cost-benefit analysis around the nutrition outcome of the HFP intervention is recommended for policy advocacy. It is time to bring universities and research

organisations to take the lead in different regions and conduct experimentation simultaneously.

## **Acknowledgement**

NIPN, Bangladesh would like to thank all the stakeholders for their contribution in the analysis process and report writing. Regular feedback was received from Technical Director, NIPN and Senior Policy Advisor, NIPN. Inhouse meeting participants consisted of NIPN stakeholders from different public agencies, NIPN staff and a few core staff of HKI, Bangladesh participated in the discussion during dataset selection, variables choosing and shared their views, opinions and verified the results on a regular basis. The members of project management committee (PMC) and technical committee (TC) also provided their guidance from selecting the analysis procedure to writing the report. NIPN would also like to express its gratitude to the policy advisory committee (PAC) for identification, prioritization and endorsement of this topic for analysis and the final report. NIPN acknowledge the owner of FSNSP dataset (eg., James P Grant School of Public Health, BRAC University (JPGSPH), Helen Keller International (HKI) and Bangladesh Bureau of Statistics) for giving access to data. The NIPN is funded by the European Union, FCDO and BMGF.

## References

1. World Health Organization. Malnutrition 2020 [Available from: <https://www.who.int/news-room/fact-sheets/detail/malnutrition>].
2. World Health Organization. Too many babies are born too small 2019 [Available from: <https://www.who.int/news/item/16-05-2019-too-many-babies-are-born-too-small>].
3. Emergency Nutrition Network (ENN). Maternal Nutrition In Emergencies: Summary of the state of play and key gaps. Emergency Nutrition Network (ENN), INSPIRE Consortium Humanitarian policy for action, European Commission; 2013.
4. National Institute of Population Research and Training, The DHS Program. Bangladesh Demographic and Health Survey 2017-18  
Dhaka, Bangladesh: National Institute of Population Research and Training, Medical Education and Family Welfare Division, Ministry of Health and Family Welfare, Dhaka, Bangladesh and The DHS Program, ICF, Rockville, Maryland, USA; 2020.
5. James P Grant School of Public Health, National Nutrition Services. State of food security and nutrition in Bangladesh. Dhaka, Bangladesh: James P Grant School of Public Health and National Nutrition Services; 2016.
6. Marsh R. Building on Traditional Gardening to Improve Household Food Security. Food and Agriculture Organization; 1998. Contract No.: Food, Nutrition and Agriculture No. 22.
7. Mitchell R, Hanstad T. Small homegarden plots and sustainable livelihoods for the poor. USA: Food and Agriculture Organization of the United Nations; 2004. Contract No.: LSP Working Paper 11.
8. Helen Keller International. The vitamin A home gardening and promotion of consumption for prevention of nutritional blindness. 1988-1993.
9. Taher A, Talukder A, Bushamuka VN, Sarkar NR, Bushamuka VN, Hall A, et al. Homestead gardening for combating vitamin A deficiency: the Helen Keller International, Bangladesh experience 2002 [Available from: [https://www.researchgate.net/publication/265149275\\_Homestead\\_gardening\\_for\\_combating\\_vitamin\\_A\\_deficiency\\_the\\_Helen\\_Keller\\_International\\_Bangladesh\\_experience/stats](https://www.researchgate.net/publication/265149275_Homestead_gardening_for_combating_vitamin_A_deficiency_the_Helen_Keller_International_Bangladesh_experience/stats)].
10. Helen Keller International. National Gardening and Nutrition Surveillance project. Dhaka, Bangladesh: Helen Keller International, Institute of Public Health Nutrition (IPHN); 1993-2003.
11. Iannotti L, Cunningham K, Ruel M. Improving Diet Quality and Micronutrient Nutrition: Homestead Food Production in Bangladesh. Dhaka, Bangladesh: International Food Policy Research Institute (IFPRI), 2020 Vision Initiative; 2009.
12. Haselow NJ, Stormer A, Pries A. Evidence-based evolution of an integrated nutrition-focused agriculture approach to address the underlying determinants of stunting. *Maternal & Child Nutrition*. 2016;12:155–68.
13. Strengthening Partnerships R, and Innovations in Nutrition Globally (SPRING) project,. Trends in Homestead Food Production and Nutrition Outcomes in the Feed the Future Zone of Influence, Bangladesh: An Impact Assessment of SPRING Interventions (2012–2016). Arlington, VA: SPRING, JSI Research & Training Institute, Inc.; 2018.
14. Government of Bangladesh, USAID, Food and Agriculture Organization of the United Nations. Integrated homestead farm Dhaka, Bangladesh [Available from: [http://www.fao.org/fileadmin/user\\_upload/nutrition/docs/education/resources/by\\_country/Bangladesh/Key\\_Messages\\_English.pdf](http://www.fao.org/fileadmin/user_upload/nutrition/docs/education/resources/by_country/Bangladesh/Key_Messages_English.pdf)].
15. Bangladesh Agricultural Research Institute (BARI). Homestead models.
16. Star Business Report. Tk 438cr project to set up 5 lakh nutrition gardens. *The Daily Star*. 2021 25 July 2021.
17. Hoogerbrugge I, Fresco LO. Homegarden systems: Agricultural characteristics and challenges. Wageningen, The Netherlands: International Institute for Environment and Development; 1993.

18. Pinto AD, Seymour G, Bryan E, Bhandari P. Women's Empowerment and Crop Diversification in Bangladesh A Possible Pathway to Climate Change Adaptation and Better Nutrition. Dhaka, Bangladesh: International food policy research institute (IFFRI); 2019.
19. Leslie B. Home Gardening in International Development: What the Literature Shows. Washington (USA) The League for International Food Education (LIFE); 1985.
20. Talukder A, Haselow NJ, Osei AK, Villate E, Reario D, Kroeun H, et al. 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). *Field Actions Science Reports*. 2010(1):1-9.
21. Ministry of Food, Government of Bangladesh. National Food and Nutrition Security Policy of Bangladesh (NFNSP). Dhaka, Bangladesh; 2019.
22. Ministry of Agriculture, Government of People Republic of Bangladesh. National agriculture policy 2018. Dhaka, Bangladesh: Ministry of Agriculture, Government of People Republic of Bangladesh  
2018.
23. Food Planning and Monitoring Unit (FPMU), Ministry of Food, Government of the Peoples Republic of Bangladesh. Bangladesh second country investment plan nutrition-sensitive food system (2016-2020). Dhaka, Bangladesh: FPMU, Ministry of Food.
24. Government of Bangladesh. National Nutrition Policy 2015 Dhaka, Bangladesh; 2015.
25. Ministry of Food and Disaster Management. National Food Policy 2006. Dhaka, Bangladesh: Ministry of Food and Disaster Management; 2006.
26. Ministry of Agriculture, Government of People Republic of Bangladesh. National agriculture policy Dhaka, Bangladesh: Ministry of Agriculture, Government of People Republic of Bangladesh  
1999.
27. Haider BA, Bhutta ZA. Web appendix 16 – Dietary diversification strategies including home gardening, livestock farming and dietary modifications. *Lancet*. 2008;371:417–40.
28. Galhena DH, Freed R, Maredia KM. Home gardens: a promising approach to enhance household food security and wellbeing. *Agriculture & food security*. 2013;2(1):8.
29. Rammohan A, Pritchard B, Dibley M. Home gardens as a predictor of enhanced dietary diversity and food security in rural Myanmar. *BMC Public Health*. 2019;19:1145.
30. Birdi TJ, Shah SU. Implementing perennial kitchen garden model to improve diet diversity in Melghat, India. *Global journal of health science*. 2016;8(4):10.
31. Michaux KD, Hou K, Karakochuk CD, Whitfield KC, Ly2 S, Verbowski V, et al. Effect of enhanced homestead food production on anaemia among Cambodian women and children: A cluster randomized controlled trial. *Maternal & Child Nutrition*. 2018;15(S3):e12757.
32. Davis JN, Martinez LC, Spruijt-Metz D, Gatto NM. LA Sprouts: A 12-week gardening, nutrition, and cooking randomized control trial improves determinants of dietary behaviors. *Journal of Nutrition Education and Behavior*. 2016;48(1):2-11. e1.
33. Palar K, Hufstedler EL, Hernandez K, Chang A, Ferguson L, Lozano R, et al. Nutrition and health improvements after participation in an urban home garden program. *Journal of nutrition education and behavior*. 2019;51(9):1037-46.
34. Talukder Z. Increased availability of vitamin A and other MN rich foods and their consumption. *Food Nutr Bull*. 2000;21:165-72.
35. Helen Keller International. Making Market Work for Women (M2W2)-Project Completion Report. 2015.
36. Helen Keller International. Final Evaluation Report, jibon O Jibika, A Title-II program of USAID. 2019.
37. Helen Keller International. Monitoring report of SPRING project. 2015.
38. Helen Keller International. SAPLING project. 2016-2021.

39. Ferdous Z, Datta A, Anal AK, Anwar M, Khand ASMMR. Development of home garden model for year round production and consumption for improving resource-poor household food security in Bangladesh. *NJAS - Wageningen Journal of Life Sciences*. 2016;78:103-10.
40. Talukder A, Kiess L, Huq N, Pee Sd, Darnton-Hill I, Bloem MW. Increasing the production and consumption of vitamin A-rich fruits and vegetables: Lessons learned in taking the Bangladesh homestead gardening programme to a national scale. *Food and Nutrition Bulletin*. 2000;21(2):165-72.
41. Schreinemachers P, Patalagsa MA, Uddin N. Impact and cost-effectiveness of women's training in home gardening and nutrition in Bangladesh. *Journal of Development Effectiveness*. 2016;8(4):473-88.
42. Bushamuka VN, de Pee S, Talukder A, Kiess L, Panagides D, Taher A, et al. Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. *Food and nutrition bulletin*. 2005;26(1):17-25.
43. Campbell AA, Akhter N, Sun K, Pee Sd, Kraemer K, Moench-Pfanner R, et al. Relationship of homestead food production with night blindness among children below 5 years of age in Bangladesh. *Public Health Nutrition*. 2011;14(9):1627-31.
44. Al-Mamun MH, Bashar HMK, Islam MS, Howlader MHK, Hasan MS. A case study on homestead vegetables cultivation: Food security and income. *Int J Sustain Crop Prod*. 2010;5(1):05-10.
45. Asaduzzaman M, Naseem A, Singla R. Benefit-Cost Assessment of Different Homestead Vegetable Gardening on Improving Household Food and Nutrition Security in Rural Bangladesh. *Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting; Pittsburgh, Pennsylvania 2011*. p. 1-25.
46. Bangladesh Bureau of Statistics (BBS), World Food Programme (WFP), Institute for Public Health and Nutrition (IPHN), United Nations' Children's Fund (UNICEF). *Bangladesh Household Food Security and Nutrition Assessment Report 2009 (HFSNA)*. New York, New York, USA & Rome, Italy: Institute of Public Health Nutrition, Ministry of Health and Family Welfare, United Nations Children's Fund, United Nations World Food Programme; 2009.
47. Iannotti L, Cunningham K, Ruel M. Improving Diet Quality and Micronutrient Nutrition: Homestead Food Production in Bangladesh. *International Food Policy Research Institute (IFPRI)*; 2009. Contract No.: 00928.
48. Helen Keller International (HKI), James P Grant School of Public Health (JPGSPH). *State of Food Security and Nutrition in Bangladesh 2014*. Dhaka, Bangladesh: HKI and JPGSPH; 2016.
49. Coates J, Swindale A, Bilinsky P. *Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide (v.3)*. Washington, DC: FHI 360/FANTA; 2007.
50. Huebler F. Years of schooling and literacy, part 2: *International Education Statistics; 2006* [Available from: [https://huebler.blogspot.com/2006/12/years-of-schooling-and-literacy-part-2.html?fbclid=IwAR0YxP\\_tUPyDXTaka6PijEL2Dht3OD-w0RQMddZuzHakYb3RiD\\_w9v5VbPE](https://huebler.blogspot.com/2006/12/years-of-schooling-and-literacy-part-2.html?fbclid=IwAR0YxP_tUPyDXTaka6PijEL2Dht3OD-w0RQMddZuzHakYb3RiD_w9v5VbPE)].
51. Weimer A. *Homestead Gardening: A Manual for Program Managers, Implementers, and Practitioners*. Baltimore, MD 21201 USA: Catholic Relief Services; 2008.

## Annexes

### Annex 1: Definitions/compositions of different vulnerable regions (48)

<b>Vulnerable regions</b>	<b>Sub-districts (organised by district)</b>
Coastal belt	Bagerhat (Bagerhat Sadar, Kachua, Mongla, Morrelganj, Rampal, Sarankhola); Barguna (All 5 upazilas); Barisal (Babuganj, Bakerganj, Banaripara, Barisal Sadar, Hizla, Mehendiganj, Muladi); Bhola(All 7 upazilas); Chandpur (Haimchar); Chittagong (Sandwip); Feni (Sonagazi); Jhalakhati (All 4 upazilas); Khulna (Batiaghata, Dacope, Dumuria, Koyra, Paikgachha); Lakshmipur (Kamalnagar, Lakshmipur Sadar, Ramgati, Roypur); Noakhali (Companiganj, Hatiya, Kabirhat, Noakhali Sadar, Subarnachar); Patuakhali (All 8 upazilas); Pirojpur (All 7 upazilas); Satkhira (Assasuni, Debhata, Kaliganj, Satkhira Sadar, Shyamnagar, Tala)
Eastern hills	Bandarban (All 7 upazilas); Chittagong (Banshkhal, Chandanaish, Fatikchhari, Lohagara, Mirsharai, Rangunia, Satkania); Cox's Bazar (Chakaria, Cox's Bazar Sadar, Maheshkhali, Pekua, Ramu, Teknaf, Ukhia); Khagrachhari (All 8 upazilas); Rangamati (All 10 upazila)
Haor	Brahmanbaria (Bijoyagar, Nasirnagar, Sarail); Habiganj (Ajmiriganj, Bahubal, Baniachong, Habiganj Sadar, Lakhai, Madhabpur, Nabiganj); Kishoreganj (Austagram, Bajitpur, Hossainpur, Itna, Karimganj, Katiadi, Kishoreganj Sadar, Kuliar Char, Mithamain, Nikli, Tarail); Maulvibazar (Maulvibazar Sadar, Rajnagar); Netrokona (Atpara, Barhatta, Durgapur, Kalmakanda, Kendua, Khaliajuri, Madan, Mohanganj); Sunamganj (All 11 upazilas); Sylhet (Balaganj, Bishwanath, Companiganj, Gowainghat, Sylhet Sadar)
Padma chars	Chandpur (Chandpur Sadar, Matlab Dakshin); Chapai Nawabgonj (Chapai Nawabganj Sadar, Shibganj); Dhaka (Dohar, Nawabganj); Faridpur (Char Bhadrans, Faridpur Sadar, Nagarkanda, Sadarpur); Kushtia (All 6 upazilas); Madaripur (Shib Char); Manikgonj (Harirampur, Shibalaya); Munshigonj (Lohajang, Munshiganj Sadar, Sreenagar, Tongibari); Natore (Lalpur); Pabna (Ishwardi, Pabna Sadar, Sujaganar); Rajbari (All 4 upazilas); Rajshahi (Bagha, Chorghat, Godagari); Shariatpur (Bhedarganj, Damudya, Gosairhat, Naria, Zanjira)
Northern chars	Bogra (Dhunat, Sariakandi, Sonatola); Gaibandha (Fulchari, Gaibandha Sadar, Saghata, Sundarganj); Jamalpur (Bakshiganj, Dewanganj, Islampur, Madarganj, Melandaha, Sarishabari); Kurigram (All 9 upazilas); Lalmonirhat (All 5 upazilas); Manikgonj (Daulatpur); Nilphamari (Dimla, Jaldhaka, Kishoreganj); Pabna (Bera); Rangpur (Gangachara, Kaunia, Pirgachha); Sirajganj (Belkuchi, Chauhali, Kazipur, Shahjadpur, Sirajganj Sadar); Tangail (Bhuapur, Delduar, Gopalpur, Kalihati, Nagarpur, Tangail Sadar)
Northwest	Bogra (Adamdighi, Bogra Sadar, Dhupchanchia, Gabtali, Kahaloo, Nandigram, Shajahanpur, Sherpur, Shibganj); Chapai Nawabgonj (Bholahat, Gomastapur, Nachole); Dinajpur (Biral, Birampur, Birganj, Chiribandar, Dinajpur Sadar, Fulbari, Ghoraghat, Hakimpur, Kaharole, Khansama, Nowabganj, Parbatipur); Gaibandha (Gobindaganj, Palashbari, Sadullapur); Joypurhat (All 5 upazilas); Naogaon (All 11 upazilas); Nilphamari (Domar, Nilphamari Sadar, Saidpur); Panchagarh (Boda, Debiganj); Rajshahi (Baghmara, Durgapur, Mohanpur, Tanore); Rangpur (Badarganj, Mitha Pukur, Pirganj, Rangpur Sadar, Taraganj)

Annex 2: Status of HFP in 16 rounds of FSNSP

Characteristics	Round(%)															
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16
<b>Is your household involved in agricultural production?</b>																
No	504	462	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yes	496	538	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>i) Crop production</b>																
<b>Do you have a developed homestead garden<sup>®</sup> (R1)? Do you have a homestead garden? <sup>*</sup>(R2)</b>																
No	<sup>®</sup> 45.2	<sup>*</sup> 42.7	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Yes	<sup>®</sup> 54.8	<sup>*</sup> 57.3	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>If yes, did you grow vegetables seasonally or all year round?</b>																
Seasonally	560	<sup>*</sup> 54.7	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Year round	440	<sup>*</sup> 45.3	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>During the last 4 months did your household grow vegetables in a homestead garden?</b>																
No	419	383	338	41.7	41.0	38.1	38.1	333	336	40.7	30.5	35.7	38.3	33.6	34.5	39.8
Yes	58.1	61.7	66.2	58.3	59.0	61.9	61.9	66.7	66.4	59.3	69.5	64.3	61.7	66.4	65.5	60.2
<b>What was the use of vegetable produced in your homestead garden in the last four months?</b>																
Family Consumption	95.7	84.8	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sell	139	12.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Neighbors/Gift	158	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Neighbors/Gift/Given to others	X	28.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Not harvested	62	15.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>ii) Livestock or poultry production</b>																
<b>Does your household have livestock or poultry? If yes, how many?</b>																
Cow	51.4	43.8	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cow/ Buffalo	X	X	39.3	41.4	43.2	43.4	43.4	43.3	41.8	40.5	42.6	42.6	40.6	39.9	38.3	38.1
Sheep	2.2	1.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sheep/goat/pig	X	X	21.0	26.9	28.9	27.6	27.6	24.8	26.5	23.1	25.5	26.3	25.1	25.3	23.5	22.8
Goat	25.5	25.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chicken	81.5	72.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chicken/Duck/geese	X	X	74.1	66.2	69.4	67.2	67.2	61.0	64.5	59.7	63.4	67.6	60.2	64.1	66.0	63.8
Duck/Geese	41.0	42.4	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Others	7.4	5.0	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.4	0.2	0.2	0.1	0.3

Note: 'X' means no data available on this variable in the respective round



### Annex 3: Steps for creation of sub-data sets

Three steps were taken to make the datasets as following:

- ✓ **Step 1:** At first, we prepared a sub-dataset contained variables with inclusion and exclusion criteria for different dependent variables mentioned in table at the end of this description. This First step was applicable for general objective 1 and 2 (policy questions 1 and 2).
  
- ✓ **Step 2:** Step two was applicable only for policy question 3 under general objective 3 which applied case-control matching that is a useful tool to reduce selection bias when analyzing the impact of a program, for example, HFP for current analysis. The problem of selection bias occurs when intervention households might have certain characteristics which are different from those who do not participate in those interventions. Case control matching tool helps to match on confounding variables to account for pre-existing differences. It checked the similarities between intervention and control participants before analyzing outcome. Therefore, we created a variable with following two categories: intervention households (HFP or household raised both home gardening and poultry/livestock) and control households (non-HFP or neither had home garden nor raising livestock or poultry). Thus we executed case-control matching procedure using SPSS where division, main occupation of household head, per capita income in past one month, agriculture land in acres, household construction type, literacy status of household head, round of the year, household size group, study area, sex of household head were considered to identify one matched control household for one intervention household. Final number of samples for different analysis had been shown in After the case control matching, the similar characteristics of HFP and control Non-HFP had been shown in table in Annex 4.
  
- ✓ **Step 3:** FSNP had collected data regarding dietary pattern and nutritional status of 19-49 years aged women. To obtain overall objective 3, we merged women characteristics and their dietary and nutritional status variables (eg. total number of women in the household, women age, women education, women occupation and policy questions 4 and 5, marital status of women, nutritional status based on BMI and food insecurity based on HFIAS) with the existing dataset which was prepared at step 1. A total of 25290 women data were matched after merging variables. Among them, education information of 2568 cases and sampling weight of 47 women were found missing. After excluding these missing cases, we had a final sample size of 22722.

Table: Steps of creating sub-datasets with sample size

Sub-dataset No	1	2
Objectives	Identifying determinants	Impact on FCS
Dependent variables	HFP	FCS
<b>Step 1:</b> Considered variables related to inclusion and/or exclusion criteria by different dependent variables		
<b>Criteria</b>		
Household raising either only home gardening or only livestock/poultry	Included	Not included
Household raising both home gardening and livestock/ poultry (HFP households)	Included	Included
Non-HFP or households raising neither	Included	Included



Sub-dataset No	1	2
Objectives	Identifying determinants	Impact on FCS
Dependent variables	HFP	FCS
home gardening nor livestock/ poultry		
<b>Number of households found based on these criteria</b>	<b>27072</b>	<b>18849</b>
<b>Step 2: Case-control matching</b>		
Variables entered for matching	Not applicable	Ddivision, main occupation of household head, per capita income in past one month, agriculture land in acres, homestead land in acres, household construction type, literacy status of household head, round of the year, household size group, study area, sex of household head
<b>Final sample size</b>	<b>27072</b>	<b>1798</b>

Annex 4: Sample size and distribution of Non-HFP and HFP households after case control matching

Characteristics	n	Non-HFP (%)	HFP (%)	p value
<b>Division</b>				
Rajshahi	184	50.0	50.0	p>0.05
Khulna	58	50.0	50.0	
Barisal	166	50.0	50.0	
Dhaka	554	50.0	50.0	
Sylhet	118	50.0	50.0	
Chittagong	392	50.0	50.0	
Rangpur	326	50.0	50.0	
<b>Main occupation of household head</b>				
Unemployed	80	50.0	50.0	p>0.05
Farmer (Paddy)	108	50.0	50.0	
Farmer (Other than paddy)	66	50.0	50.0	
Daily labourer/household help/transport workers/Handicrafts	1132	50.0	50.0	
Salaried worker/Professional	132	50.0	50.0	
Businessman/Petty businessman	280	50.0	50.0	
<b>Per capita income in past one month</b>				
Lowest Q1	398	50.0	50.0	p<0.05
Q2	454	50.0	50.0	
Q3	466	50.0	50.0	
Q4	284	50.0	50.0	
Highest Q5	196	50.0	50.0	
<b>Agriculture land in acres</b>				
0 acre	1618	50.0	50.0	p<0.05
.001 - 1 acre	160	50.0	50.0	

Characteristics	n	Non-HFP (%)	HFP (%)	p value
1.01 - 2.5 acre	16	50.0	50.0	
>5	4	50.0	50.0	
<b>Household construction type</b>				
Pacca	24	50.0	50.0	p<0.05
Semi-pacca	32	50.0	50.0	
Tin	1032	50.0	50.0	
Hut/other	710	50.0	50.0	
<b>Literacy status of household head</b>				
Illiterate	1534	50.0	50.0	p<0.05
Literate	264	50.0	50.0	
<b>Round of the year</b>				
1	706	50.0	50.0	p<0.05
2	522	50.0	50.0	
3	570	50.0	50.0	
<b>Household size group</b>				
<4	374	50.0	50.0	p<0.05
4	554	50.0	50.0	
>4	870	50.0	50.0	
<b>Study area</b>				
Rural	1664	50.0	50.0	p<0.05
Municipality	114	50.0	50.0	
City Corporation	20	50.0	50.0	
<b>Homestead land in decimal</b>				
0	996	50.0	50.0	p<0.05
>0-7	626	50.0	50.0	
>7	176	50.0	50.0	
<b>Sex of household head</b>				
Male	1730	50.0	50.0	p<0.05
Female	68	50.0	50.0	

Annex 5: Proportion of Sample Households Having Acceptable FCS by Various Categories  
(p values refer to probability of chi-sq values)

Variable categories	Before case control			After case control		
	N	Percent	p value	N	Percent	p value
<b>Type of households</b>						
Control (Non-HFP)	12344	83.9	<0.001	899	73.2	.002
Intervention (HFP)	14728	87.4		899	79.4	
<b>Name of division</b>						
Rajshahi	3552	85.2	<0.001	184	76.6	.001
Khulna	2016	87.5		58	84.5	
Barisal	3072	86.1		166	72.9	
Dhaka	6624	91.9		554	89.0	
Sylhet	2400	88.8		118	84.7	

Variable categories	Before case control			After case control		
	N	Percent	p value	N	Percent	p value
Chittagong	5184	82.7		392	71.2	
Rangpur	4224	77.8		326	58.0	
<b>Main occupation of household head</b>						
Unemployed	2741	89.2	<0.001	80	85.0	.001
Farmer (Paddy)	6417	87.2		108	79.6	
Farmer (Other than paddy)	9438	79.0		66	57.6	
Daily labourer/ household help/transport workers/Handicrafts	3075	91.2		1132	72.7	
Salaried worker/Professional	5167	91.3		132	85.6	
Businessman/Petty businessman	234	88.9		280	87.1	
<b>Per capita income in past one month</b>						
Q1 (lowest)	5402	76.5	<0.001	398	60.8	.001
Q2	5429	78.0		454	70.9	
Q3	5748	86.0		466	78.5	
Q4	5073	92.3		284	89.4	
Q5 (highest)	5420	96.5		196	95.9	
<b>Agriculture land owned in acre<sup>@</sup></b>						
No land				1618	74.9	.001
Have land				180	88.9	
0 acre	16723	81.5	<0.001			
.001 - 1 acre	6920	90.9				
1.01 - 2.5 acre	2263	95.9				
2.51 - 5 acre	815	97.4				
>5	351	98.3				
<b>Household construction type<sup>@</sup></b>						
Pacca/semi-pacca	4399	96.6	<0.001	56	98.2	.001
Tin	12240	86.9		1032	80.5	
Hut/other	10433	79.9		710	68.5	
<b>Literacy status of household head</b>						
Illiterate	18953	83.4	<0.001	1534	74.9	.001
Literate	8018	91.3		264	84.5	
<b>FSNSP Round of the year</b>						
1 <sup>st</sup>	9024	83.5	<0.001	706	72.9	.018
2 <sup>nd</sup>	9024	88.1		522	79.7	
3 <sup>rd</sup>	9024	85.8		570	77.4	
<b>Household size group</b>						
<4	5418	83.4	<0.001	374	77.0	.006
4	7648	84.6		554	71.7	
>4	14006	87.4		870	79.0	
<b>Urban-rural<sup>@</sup></b>						
Rural	23256	84.7	<0.001	1664	75.1	.001
Urban	3816	92.2		134	91.8	

Variable categories	Before case control			After case control		
	N	Percent	p value	N	Percent	p value
<b>Homestead land in decimal</b>						
0	9104	79.4	<0.001	996	72.5	.001
>0-7	9219	86.4		626	79.7	
>7	8749	91.8		176	85.8	
<b>Sex of household head</b>						
Male	24639	85.8	0.611	1730	76.2	.747
Female	2433	85.5		68	77.9	

Annex 6: Association of socio-demographic and other characteristics with various nutritional indicators in households (percent)

Characteristics	FCS (%)		Nutritional status of women (%)		MDD (%)		Household food security® (%)	
	Poor and Borderline food consumption (HFSNA) (0-42 score)	p-value	Malnourished	p-value	Yes	p-value	Food secure	p-value
<b>Treatment variable</b>								
<b>Households with raising both homestead garden and livestock or poultry</b>								
No	12.9	.000	60.6	.000	43.4	.000	74.1	.000
Yes	9.8		52.9		45.6		75.7	
<b>Confounding variables</b>								
<b>Regional characteristics</b>								
<b>Name of division</b>								
Rajshahi	14.4	.000	57.2	.000	37.5	.000	78.8	.000
Khulna	11.0		58.5		46.9		78.1	
Barisal	13.5		53.1		32.6		67.5	
Dhaka	6.9		58.2		54.2		79.9	
Sylhet	8.4		54.6		43.2		69.2	
Chittagong	6.3		60.9		52.1		80.5	
Rangpur	21.6		49.2		31.2		78.8	
<b>Residence</b>								
Rural	12.1	.000	54.5	.000	42.3	.000	73.9	.000
Urban	6.2		67.3		57.6		81.2	
<b>Household characteristics</b>								
<b>House type</b>								
Pacca/semi-pacca	2.4	.000	68.1	.000	65.0	.000	92.0	.000
Tin	12.6		52.1		38.4		69.4	
Hut/other	15.2		54.5		39.4		71.2	
<b>Household size</b>								
<4	14.9	.000	57.3	.000	40.5	.000	75.5	.000
4	12.6		58.8		44.5		74.6	



Characteristics	FCS (%)		Nutritional status of women (%)		MDD (%)		Household food security <sup>6@</sup> (%)	
	Poor and Borderline food consumption (HFSNA) (0-42 score)	p-value	Malnourished	p-value	Yes	p-value	Food secure	p-value
<b>Women age</b>								
19-24	9.2	.000	50.4	.000	48.3	.000	80.9	.000
25-34	11.9		55.7		42.6		72.2	
35-49	11.6		60.9		44.5		74.3	
<b>Women education</b>								
No education	18.0	.000	52.0	.000	32.2	.000	61.7	.000
Partial primary	13.6		53.5		36.5		67.4	
Complete primary	10.0		57.5		43.6		74.0	
Above primary	6.1		60.1		56.6		87.4	
<b>Women occupation</b>								
Unemployed	10.6	.000	56.5	.000	44.5	.000	76.4	.000
Farmers/ Poultry/ Livestock/ Fish cultivation	11.3		52.5		43.2		73.7	
Day labourers /Salaried/ professional workers or businessman or other	14.8		59.7		46.9		66.9	
<b>Marital status of women</b>								
Married	11.1	.000	56.9	.000	44.0	.000	75.1	.000
Unmarried	5.2		48.1		56.5		84.5	
Widow/divorced/separated	21.3		56.4		43.2		61.7	
<b>Other Characteristics</b>								
<b>FSNSP rounds in 2014</b>								
1 <sup>st</sup> round	12.7	.000	56.9	.000	41.2	.000	74.0	.000
2 <sup>nd</sup> round	8.9		57.4		57.6		76.4	
3 <sup>rd</sup> round	12.9		54.7		31.0		74.0	

<sup>6@</sup>Food security was measured according to household food insecurity and access scale (HFIAS)

Annex 7: Weighted result of multivariate logistic regression analysis of Household FCS and associated factors including women's (19-49 years) characteristics

Characteristics	n (unweigh ted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>HFP (households with both home garden and livestock or poultry)</b>							
No	8423	1	1	1	1	1	1
Yes	10009	1.36**	1.66**	1.49**	1.49**	1.46**	1.43**
<b>Name of division</b>							
Rajshahi	2582	-	1	1	1	1	1
Khulna	1453	-	1.37**	1.20**	1.21**	1.20**	1.20**
Barisal	2109	-	1.14**	1.01**	1.02**	0.94**	0.97**
Dhaka	4575	-	2.45**	2.06**	2.08**	2.07**	2.06**
Sylhet	1518	-	1.80**	1.71**	1.79**	1.81**	1.80**
Chittagong	3160	-	2.41**	2.16**	2.04**	2.04**	2.16**
Rangpur	3035	-	0.62**	0.71**	0.72**	0.72**	0.74**
<b>Residence</b>							
Rural	15775	-	1	1	1	1	1
Urban	2657	-	2.27**	1.36**	1.39**	1.39**	1.32**
<b>Household characteristics</b>							
<b>House type</b>							
Pacca/semi-pacca	2934	-	-	1	1	1	1
Tin	8438	-	-	0.33**	0.36**	0.39**	0.37**
Hut/other	7060	-	-	0.28**	0.31**	0.33**	0.31**
<b>Household size</b>							

Characteristics	n (unweigh ted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<4	3640	-	-	1	1	1	1
4	5490	-	-	1.42**	1.39**	1.31**	1.33**
>4	9302	-	-	1.90**	1.84**	1.71**	1.75**
<b>Household per capita income in past one month</b>							
Lowest Q1	3699	-	-	1	1	1	1
Q2	3814	-	-	1.29**	1.35**	1.32**	1.33**
Q3	3934	-	-	2.10**	2.11**	2.04**	2.04**
Q4	3355	-	-	3.79**	3.69**	3.41**	3.57**
Highest Q5	3630	-	-	7.10**	6.60**	6.04**	6.26**
<b>Homestead land in decimal</b>							
0	6308	-	-	1	1	1	1
1>0-7	6423	-	-	1.07**	1.08**	1.13**	1.11**
>7	5701	-	-	1.20**	1.16**	1.17**	1.18**
<b>Agriculture land in acre</b>							
0	11568	-	-	1	1	1	1
.001 – 1.00	4626	-	-	1.74**	1.62**	1.54**	1.51**
1.01 - 2.5	1473	-	-	4.81**	4.18**	3.86**	3.76**
2.51 - 5	550	-	-	3.01**	2.59**	2.30**	2.25**
>5	215	-	-	4.19**	3.82**	3.16**	3.16**
<b>Characteristics of Household head</b>							
<b>Sex of household head</b>							
Male	16786	-	-	-	1	1	1
Female	1646	-	-	-	0.80**	0.97**	0.97**
<b>Literacy status of household head</b>							
Illiterate	13105	-	-	-	1	1	1



Characteristics	n (unweigh ted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Literate	5264	-	-	-	1.42**	1.29**	1.32**
Other	63	-	-	-	1.27**	1.16**	1.13**
<b>Main occupation of household head</b>							
Unemployed/No income	1813	-	-	-	1	1	1
Farmer (Paddy & Other than paddy)	4162	-	-	-	1.03**	1.12**	1.10**
Daily labourer/household help/transport workers/Handicrafts	6640	-	-	-	0.68**	0.77**	0.75**
Salaried worker/Professional	2089	-	-	-	0.84**	0.94**	0.97**
Businessman/Petty businessman	3577	-	-	-	1.11**	1.27**	1.29**
other	151	-	-	-	0.67**	0.80**	0.80**
<b>Characteristics of reproductive aged women of households</b>							
<b>Total number of women in a household</b>							
1	11007	-	-	-	-	1	1
2	5486	-	-	-	-	1.16**	1.15**
>=3	1939	-	-	-	-	1.22**	1.21**
<b>Women age</b>							
19-24	4550	-	-	-	-	1	1
25-34	7756	-	-	-	-	1.28**	0.90**
35-49	6126	-	-	-	-	1.69**	0.84**
<b>Women education</b>							
No education	5545	-	-	-	-	1	1
Partial primary	3139	-	-	-	-	1.31**	1.29**

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Complete primary	2980	-	-	-	-	1.57**	1.57**
Above primary	6768	-	-	-	-	1.76**	1.69**
<b>Women occupation</b>							
Unemployed	13376	-	-	-	-	1	1
Farmers/Poultry/ Livestock/Fish cultivation	2823	-	-	-	-	1.10**	1.12**
Day labourers/Salaried/professional workers or businessman or other	2233	-	-	-	-	0.84**	0.84**
<b>Marital status of women</b>							
Married	17047	-	-	-	-	1	1
Unmarried	684	-	-	-	-	0.97**	0.97**
Widow/divorced/separated	701	-	-	-	-	0.63**	0.62**
<b>Other characteristics</b>							
<b>FSNSP rounds in 2014</b>							
1 <sup>st</sup> round	6257	-	-	-	-	-	1
2 <sup>nd</sup> round	6167	-	-	-	-	-	1.74
3 <sup>rd</sup> round	6008	-	-	-	-	-	1.09
<b>Overall percentage correct</b>		88.8	88.8	88.9	88.9	89.0	89.1
<b>Hosmer and Lemeshow Test (p value)</b>		-	0.000	0.000	0.000	0.000	0.000
<b>Nagelkerke R Square</b>		0.005	0.068	0.202	0.213	0.227	0.236
<b>-2 Log likelihood</b>		1145472901.847	1091894589.945	973089466.489	962843878.701	950169294.804	941989132.227

Note: \*\* refers > .001 & \* refers < .05

Annex 8: Weighted result of multi-variate logistic regression analysis on HFP and households with malnourished women 19 to 49 years old

Characteristics	n (unweigh ted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>HFP (households with both home garden and livestock or poultry)</b>							
No	8423	1	1	1	1	1	1
Yes	10009	0.73**	0.80**	0.84**	0.85**	0.84**	0.84**
<b>Name of division</b>							
Rajshahi	2582	-	1	1	1	1	1
Khulna	1453	-	1.12**	1.05**	1.06**	1.05**	1.05**
Barisal	2109	-	0.93**	1.04**	1.03**	0.99**	1.00**
Dhaka	4575	-	1.08**	1.12**	1.13**	1.12**	1.12**
Sylhet	1518	-	0.92**	0.90**	0.93**	0.95**	0.95**
Chittagong	3160	-	1.06**	1.07**	1.07**	1.05**	1.07**
Rangpur	3035	-	0.76**	0.82**	0.82**	0.82**	0.83**
<b>Residence</b>							
Rural	15775	-	1	1	1	1	1
Urban	2657	-	1.57**	1.34**	1.32**	1.31**	1.30**
<b>Household characteristics</b>							
<b>House type</b>							
Pacca/semi-pacca	2934	-	-	1	1	1	1
Tin	8438	-	-	0.63**	0.66**	0.69**	0.69**
Hut/other	7060	-	-	0.73**	0.76**	0.80**	0.79**
<b>Household size</b>							
<4	3640	-	-	1	1	1	1

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
4	5490	-	-	1.12**	1.10**	1.07**	1.07**
>4	9302	-	-	0.99**	0.99**	0.96**	0.96**
<b>Household per capita income in past one month</b>							
Lowest Q1	3699	-	-	1	1	1	1
Q2	3814	-	-	1.01**	1.00**	1.02**	1.02**
Q3	3934	-	-	0.96**	0.95**	0.96**	0.96**
Q4	3355	-	-	1.13**	1.09**	1.11**	1.11**
Highest Q5	3630	-	-	1.34**	1.28**	1.27**	1.28**
<b>Homestead land in decimal</b>							
0	6308	-	-	1	1	1	1
1>0-7	6423	-	-	1.02**	1.01**	0.98**	0.98**
>7	5701	-	-	0.97**	0.96**	0.94**	0.94**
<b>Agriculture land in acre</b>							
0	11568	-	-	1	1	1	1
.001 – 1.00	4626	-	-	1.04**	1.03**	1.00**	0.99**
1.01 - 2.5	1473	-	-	1.05**	1.03**	1.01**	1.00**
2.51 - 5	550	-	-	0.92**	0.91**	0.91**	0.91**
>5	215	-	-	1.33**	1.31**	1.29**	1.29**
<b>Characteristics of Household head</b>							
<b>Sex of household head</b>							
Male	16786	-	-	-	1	1	1
Female	1646	-	-	-	1.02**	1.00**	1.00**
<b>Literacy status of household head</b>							
Illiterate	13105	-	-	-	1	1	1
Literate	5264	-	-	-	1.14**	1.08**	1.08**

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Other	63	-	-	-	0.98**	1.02**	1.01**
<b>Main occupation of household head</b>							
Unemployed/No income	1813	-	-	-	1	1	1
Farmer (Paddy & Other than paddy)	4162	-	-	-	1.10**	1.10**	1.10**
Daily labourer/household help/transport workers/Handicrafts	6640	-	-	-	1.10**	1.11**	1.11**
Salaried worker/Professional	2089	-	-	-	1.51**	1.50**	1.51**
Businessman/Petty businessman	3577	-	-	-	1.09**	1.07**	1.07**
other	151	-	-	-	1.05**	1.08**	1.09**
<i>Characteristics of reproductive aged women of households</i>							
<b>Total number of women in a household</b>							
1	11007	-	-	-	-	1	1
2	5486	-	-	-	-	1.07**	1.06**
>=3	1939	-	-	-	-	1.03**	1.03**
<b>Women age</b>							
19-24	4550	-	-	-	-	1	1
25-34	7756	-	-	-	-	1.20**	1.28**
35-49	6126	-	-	-	-	1.64**	1.69**
<b>Women education</b>							
No education	5545	-	-	-	-	1	1
Partial primary	3139	-	-	-	-	1.12**	1.12**
Complete primary	2980	-	-	-	-	1.29**	1.29**
Above primary	6768	-	-	-	-	1.35**	1.34**

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>Women occupation</b>							
Unemployed	13376	-	-	-	-	1	1
Farmers/Poultry/ Livestock/Fish cultivation	2823	-	-	-	-	0.93**	0.94**
Day labourers/Salaried/professional workers or businessman or other	2233	-	-	-	-	1.07**	1.07**
<b>Marital status of women</b>							
Married	17047	-	-	-	-	1	1
Unmarried	684	-	-	-	-	0.68**	0.68**
Widow/divorced/separated	701	-	-	-	-	1.00**	0.99**
<i>Other characteristics</i>							
<b>FSNSP rounds in 2014</b>							
1 <sup>st</sup> round	6257	-	-	-	-	-	1
2 <sup>nd</sup> round	6167	-	-	-	-	-	1.12**
3 <sup>rd</sup> round	6008	-	-	-	-	-	1.01**
<b>Overall percentage correct</b>		56.4	56.8	57.6	57.5	58.4	58.5
<b>Hosmer and Lemeshow Test (p value)</b>		0.000	0.000	0.000	0.000	0.000	0.000
<b>Nagelkerke R Square</b>		0.008	0.021	0.039	0.044	0.057	0.058
<b>-2 Log likelihood</b>		2234797837.533	2218482576.994	2196537097.468	2189514222.786	2173736807.843	2172630456.866

Note: \*\* refers > .001 & \* refers < .05

Annex 9: Weighted result of multi-variate regression analysis on HFP and minimum dietary diversity (MDD-W) among women 19 to 49 years old

Characteristics	n (unweigh ted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>HFP (households with both home garden and livestock or poultry)</b>							
No	8423	1	1	1	1	1	1
Yes	10009	1.09**	1.33**	1.33**	1.35**	1.33**	1.33**
<b>Name of division</b>							
Rajshahi	2582	-	1	1	1	1	1
Khulna	1453	-	1.53**	1.35**	1.37**	1.37**	1.52**
Barisal	2109	-	0.88**	0.96**	0.95**	0.90**	0.99**
Dhaka	4575	-	2.12**	2.20**	2.19**	2.21**	2.30**
Sylhet	1518	-	1.27**	1.15**	1.16**	1.19**	1.22**
Chittagong	3160	-	1.71**	1.70**	1.63**	1.65**	2.04**
Rangpur	3035	-	0.78**	0.92**	0.94**	0.94**	1.00**
<b>Residence</b>							
Rural	15775	-	1	1	1	1	1
Urban	2657	-	2.03**	1.49**	1.47**	1.43**	1.41**
<b>Household characteristics</b>							
<b>House type</b>							
Pacca/semi-pacca	2934	-	-	1	1	1	1
Tin	8438	-	-	0.47**	0.50**	0.54**	0.53**
Hut/other	7060	-	-	0.56**	0.60**	0.63**	0.57**
<b>Household size</b>							
<4	3640	-	-	1	1	1	1
4	5490	-	-	1.30**	1.29**	1.28**	1.23**
>4	9302	-	-	1.39**	1.37**	1.34**	1.34**
<b>Household per capita income in past one month</b>							

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Lowest Q1	3699	-	-	1	1	1	1
Q2	3814	-	-	0.95**	0.98**	0.98**	1.00**
Q3	3934	-	-	1.23**	1.24**	1.23**	1.23**
Q4	3355	-	-	1.80**	1.76**	1.70**	1.82**
Highest Q5	3630	-	-	2.55**	2.44**	2.27**	2.54**
<b>Homestead land in decimal</b>							
0	6308	-	-	1	1	1	1
1>0-7	6423	-	-	0.93**	0.92**	0.93**	0.89**
>7	5701	-	-	1.09**	1.06**	1.03**	1.03**
<b>Agriculture land in acre</b>							
0	11568	-	-	1	1	1	1
.001 – 1.00	4626	-	-	1.32**	1.25**	1.20**	1.17**
1.01 - 2.5	1473	-	-	1.99**	1.82**	1.68**	1.61**
2.51 - 5	550	-	-	1.52**	1.39**	1.26**	1.27**
>5	215	-	-	2.15**	2.03**	1.88**	2.07**
<b><i>Characteristics of Household head</i></b>							
<b>Sex of household head</b>							
Male	16786	-	-	-	1	1	1
Female	1646	-	-	-	0.89**	0.82**	0.80**
<b>Literacy status of household head</b>							
Illiterate	13105	-	-	-	1	1	1
Literate	5264	-	-	-	1.21**	1.09**	1.10**
Other	63	-	-	-	1.00**	0.97**	0.87**
<b>Main occupation of household head</b>							
Unemployed/No income	1813	-	-	-	1	1	1



Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Farmer (Paddy & Other than paddy)	4162	-	-	-	0.84**	0.81**	0.74**
Daily labourer/household help/transport workers/Handicrafts	6640	-	-	-	0.62**	0.62**	0.62**
Salaried worker/Professional	2089	-	-	-	0.92**	0.87**	0.87**
Businessman/Petty businessman	3577	-	-	-	0.80**	0.79**	0.79**
other	151	-	-	-	0.62**	0.61**	0.62**
<i>Characteristics of reproductive aged women of households</i>							
<b>Total number of women in a household</b>							
1	11007	-	-	-	-	1	1
2	5486	-	-	-	-	1.10**	1.11**
>=3	1939	-	-	-	-	1.09**	1.09**
<b>Women age</b>							
19-24	4550	-	-	-	-	1	1
25-34	7756	-	-	-	-	0.94**	0.93**
35-49	6126	-	-	-	-	1.00**	0.98**
<b>Women education</b>							
No education	5545	-	-	-	-	1	1
Partial primary	3139	-	-	-	-	1.19**	1.19**
Complete primary	2980	-	-	-	-	1.47**	1.50**
Above primary	6768	-	-	-	-	1.86**	1.78**
<b>Women occupation</b>							
Unemployed	13376	-	-	-	-	1	1

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Farmers/Poultry/ Livestock/Fish cultivation	2823	-	-	-	-	1.18**	1.26**
Day labourers/Salaried/professional workers or businessman or other	2233	-	-	-	-	1.17**	1.20**
<b>Marital status of women</b>							
Married	17047	-	-	-	-	1	1
Unmarried	684	-	-	-	-	0.96**	0.92**
Widow/divorced/separated	701	-	-	-	-	1.27**	1.26**
<i>Other characteristics</i>							
<b>FSNSP rounds in 2014</b>							
1 <sup>st</sup> round	6257	-	-	-	-	-	1
2 <sup>nd</sup> round	6167	-	-	-	-	-	2.41**
3 <sup>rd</sup> round	6008	-	-	-	-	-	0.70**
<b>Overall percentage correct</b>		55.4	60.3	65.7	66.2	66.9	69.3
<b>Hosmer and Lemeshow Test (p value)</b>		-	0.000	0.000	0.000	0.000	0.000
<b>Nagelkerke R Square</b>		0.001	0.063	0.164	0.174	0.189	0.253
<b>-2 Log likelihood</b>		2251611007.529	2173761187.088	2037851832.446	2024736943.159	2003418203.219	1909721447.278

Note: \*\* refers > .001 & \* refers < .05

Annex 10: Weighted result of multi-variate regression analysis on HFP and household food security among women 19 to 49 years old

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>HFP (households with both home garden and livestock or poultry)</b>							
No	8423	1	1	1	1	1	1
Yes	10009	0.92**	0.81**	0.89**	0.89**	0.89**	0.91**
<b>Name of division</b>							
Rajshahi	2582	-	1	1	1	1	1
Khulna	1453	-	1.03**	1.28**	1.29**	1.36**	1.39**
Barisal	2109	-	1.72**	1.93**	1.97**	2.18**	2.18**
Dhaka	4575	-	0.90**	0.98**	0.99**	0.99**	1.00**
Sylhet	1518	-	1.66**	1.92**	1.86**	1.80**	1.83**
Chittagong	3160	-	0.93**	0.98**	1.07**	1.03**	1.00**
Rangpur	3035	-	2.27**	2.03**	1.96**	2.01**	2.02**
<b>Residence</b>							
Rural	15775	-	1	1	1	1	1
Urban	2657	-	0.65**	1.13**	1.10**	1.12**	1.14**
<b>Household characteristics</b>							
<b>House type</b>							
Pacca/semi-pacca	2934	-	-	1	1	1	1
Tin	8438	-	-	2.64**	2.47**	2.30**	2.42**
Hut/other	7060	-	-	2.31**	2.12**	1.99**	2.10**
<b>Household size</b>							
<4	3640	-	-	1	1	1	1
4	5490	-	-	0.87**	0.90**	0.88**	0.87**

Characteristics	n (unweigh ted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
>4	9302	-	-	0.79**	0.83**	0.74**	0.73**
<b>Household per capita income in past one month</b>							
Lowest Q1	3699	-	-	1	1	1	1
Q2	3814	-	-	0.79**	0.73**	0.74**	0.73**
Q3	3934	-	-	0.39**	0.37**	0.37**	0.37**
Q4	3355	-	-	0.17**	0.17**	0.18**	0.17**
Highest Q5	3630	-	-	0.07**	0.08**	0.08**	0.08**
<b>Homestead land in decimal</b>							
0	6308	-	-	1	1	1	1
1>0-7	6423	-	-	0.99**	0.99**	0.93**	0.93**
>7	5701	-	-	0.72**	0.75**	0.74**	0.74**
<b>Agriculture land in acre</b>							
0	11568	-	-	1	1	1	1
.001 – 1.00	4626	-	-	0.50**	0.55**	0.56**	0.57**
1.01 - 2.5	1473	-	-	0.19**	0.22**	0.24**	0.24**
2.51 - 5	550	-	-	0.06**	0.07**	0.08**	0.08**
>5	215	-	-	0.11**	0.13**	0.14**	0.15**
<b>Characteristics of Household head</b>							
<b>Sex of household head</b>							
Male	16786	-	-	-	1	1	1
Female	1646	-	-	-	1.15**	0.97**	0.96**
<b>Literacy status of household head</b>							
Illiterate	13105	-	-	-	1	1	1
Literate	5264	-	-	-	0.90**	1.01**	1.02**
Other	63	-	-	-	0.85**	0.90**	0.89**

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>Main occupation of household head</b>							
Unemployed/No income	1813	-	-	-	1	1	1
Farmer (Paddy & Other than paddy)	4162	-	-	-	0.88**	0.81**	0.80**
Daily labourer/household help/transport workers/Handicrafts	6640	-	-	-	1.91**	1.69**	1.67**
Salaried worker/Professional	2089	-	-	-	0.92**	0.83**	0.82**
Businessman/Petty businessman	3577	-	-	-	0.85**	0.75**	0.75**
other	151	-	-	-	0.71**	0.60**	0.59**
<b>Characteristics of reproductive aged women of households</b>							
<b>Total number of women in a household</b>							
1	11007	-	-	-	-	1	1
2	5486	-	-	-	-	1.08**	1.08**
>=3	1939	-	-	-	-	1.48**	1.50**
<b>Women age</b>							
19-24	4550	-	-	-	-	1	1
25-34	7756	-	-	-	-	1.24**	1.24**
35-49	6126	-	-	-	-	1.20**	1.21**
<b>Women education</b>							
No education	5545	-	-	-	-	1	1
Partial primary	3139	-	-	-	-	0.83**	0.84**
Complete primary	2980	-	-	-	-	0.67**	0.68**
Above primary	6768	-	-	-	-	0.44**	0.45**

Characteristics	n (unweighted)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
<b>Women occupation</b>							
Unemployed	13376	-	-	-	-	1	1
Farmers/Poultry/ Livestock/Fish cultivation	2823	-	-	-	-	1.08**	1.08**
Day labourers/Salaried/professional workers or businessman or other	2233	-	-	-	-	1.59**	1.58**
<b>Marital status of women</b>							
Married	17047	-	-	-	-	1	1
Unmarried	684	-	-	-	-	1.23**	1.23**
Widow/divorced/separated	701	-	-	-	-	1.32**	1.33**
<b>Other characteristics</b>							
<b>FSNSP rounds in 2014</b>							
1 <sup>st</sup> round	6257	-	-	-	-	-	1
2 <sup>nd</sup> round	6167	-	-	-	-	-	0.74**
3 <sup>rd</sup> round	6008	-	-	-	-	-	0.80**
<b>Overall percentage correct</b>		75.0	75.0	78.0	78.6	79.5	79.4
<b>Hosmer and Lemeshow Test (p value)</b>		-	0.000	0.000	0.000	0.000	0.000
<b>Nagelkerke R Square</b>		0.000	0.042	0.307	0.331	0.358	0.360
<b>-2 Log likelihood</b>		1843178027.677	1796651279.834	1463521405.945	1429518839.939	1389906763.731	1386661763.409

Note: \*\* refers > .001 & \* refers < .05