AGRICULTURE, NUTRITION, AND GENDER LINKAGES (ANGeL)

Baseline Study

Akhter U. Ahmed, Julie Ghostlaw, Md. Latiful Haque, Nusrat Z. Hossain, Aklima Parvin, Farha D. Sufian, and Salauddin Tauseef

International Food Policy Research Institute



USAID FROM THE AMERICAN PEOPLE

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

AGRICULTURE, NUTRITION, AND GENDER LINKAGES (ANGeL)

Baseline Study

Akhter U. Ahmed,[1] Julie Ghostlaw, Md. Latiful Haque, Nusrat Z. Hossain, Aklima Parvin, Farha D. Sufian, and Salauddin Tauseef

In collaboration with Data Analysis and Technical Assistance

International Food Policy Research Institute

Bangladesh Policy Research and Strategy Support Program

House 10A, Road 35, Gulshan 2, Dhaka 1212, Bangladesh

March 2017

[1]Akhter Ahmed (a.ahmed@cgiar.org) is the corresponding author for comments and queries.

Contents

Tables

Figures

Abbreviations

ANCOVA	Analysis of covariance
ANGeL	Agriculture, Nutrition, and Gender Linkages
APK	ANGeL Pushti Kormi
APSU	Agricultural Policy Support Unit
BADC	Bangladesh Agricultural Development Corporation
BCC	Behavior change communication
BIHS	Bangladesh Integrated Household Survey
BIRTAN	Bangladesh Institute of Research and Training on Applied Nutrition
BRRI	Bangladesh Rice Research Institute
DAE	Department of Agricultural Extension
DATA	Data Analysis and Technical Assistance
DBBL	Dutch Bangla Bank Limited
FPMU	Food Planning and Monitoring Unit
FTF	Feed the Future
GOB	Government of Bangladesh
HIES	Household Income and Expenditure Survey
HKI	Helen Keller International
IEC	Information, education, and communication
IFPRI	International Food Policy Research Institute
MOA	Ministry of Agriculture
mSTAR	Mobile Solutions Technical Assistance and Research Activity
NGO	Nongovernmental organization
PRSSP	Policy Research and Strategy Support Program
RCT	Randomized controlled trial
SAAO	Sub-assistant agriculture officer
TOT	Training of trainers
USAID	U.S. Agency for International Development
WEAI	Women's Empowerment in Agriculture Index
ZOI	Zone of Influence

Acknowledgments

We thank the Ministry of Agriculture, Government of the People's Republic of Bangladesh for its support and guidance toward the "Orienting Agriculture Toward Improved Nutrition and Women's Empowerment" Project, also known as "Agriculture, Nutrition, and Gender Linkages (ANGeL)." This report is an output of the ANGeL Project. We gratefully acknowledge the United States Agency for International Development (USAID) for funding this study through the Policy Research and Strategy Support Program (PRSSP) in Bangladesh under USAID Grant Number EEM-G-00-04-00013-00; and the Gender, Agriculture, and Assets Project – Phase 2 (GAAP2), supported by the Bill & Melinda Gates Foundation, and the Consortium Research Program on Agriculture for Nutrition and Health (A4NH).

Data for this report came from the 2016 ANGeL baseline survey, which was approved by the Bangladesh Ministry of Agriculture. We are grateful to the Ministry of Agriculture for approving this survey. We are especially grateful to Md. Toufiqul Alam, Additional Secretary, Ministry of Agriculture, ANGeL Project Director, and Research Director of the Agricultural Policy Support Unit of the Ministry of Agriculture for his excellent cooperation in implementing the survey. Masuma Yunus, Production Economist, Department of Agricultural Extension has also provided invaluable support throughout the project. Our special thanks go to the field-level officials of the Department of Agricultural Extension of the Ministry of Agriculture for their excellent cooperation in implementing the survey.

We acknowledge Helen Keller International's (HKI) partnership in the ANGeL Project, with special thanks to Meredith Jackson-deGraffenried, HKI Country Director.

At IFPRI, we thank the Director of the Poverty, Health, and Nutrition Division Marie Ruel for her overall guidance. We are very grateful to John Hoddinott, Purnima Menon, Agnes Quisumbing, and Shalini Roy for their invaluable contributions to the ANGeL baseline survey questionnaires. Moreover, we thank Md. Aminul Islam Khandaker for his support in coordinating and supervising the baseline survey. We thank Samita Kaiser for her help with the production of this report.

The study would not have been possible without the dedication and hard work of the survey enumerators and other staff from Data Analysis and Technical Assistance (DATA), a Bangladeshi consulting firm that carried out the 2016 ANGeL baseline survey under IFPRI supervision. We specially thank Zahidul Hassan, Mohammad Zobair, and Imrul Hassan.

1. INTRODUCTION

1.1 Background

Bangladesh has made commendable progress in domestic food production through public investments in agricultural research and extension, public and private investments in irrigation, and liberalization of agricultural input markets. In the early 1970s, Bangladesh was a food-deficit country with a population of about 75 million people. Today, the population has more than doubled, and the country is nearly self-sufficient in rice production, which has tripled over the past three decades.

However, Bangladesh's performance in improving child and maternal nutrition has been less satisfactory. Despite its success in reducing child stunting, the rate of stunting in Bangladesh (36 percent in 2014) remains high (NIPORT 2015). Bangladesh also continues to struggle with deficiencies in micronutrients such as iron, zinc, iodine, and vitamin A. Such deficiencies reflect poor diets that are rice-dominated, monotonous, and lacking diversity (Ahmed et al. 2013). Anemia (in part due to iron deficiency) is estimated to affect 26 percent of nonpregnant, non-lactating women, whereas 42 percent suffer from iodine deficiency. About 28 percent women of reproductive age are underweight (NIPORT 2015). In preschool children, the rates of anemia, iodine, and vitamin A deficiencies are 33 percent, 40 percent, and 20 percent, respectively (ICDDR,B 2013). Therefore, government policies and strategies underscore the importance of strengthening the linkage between agriculture and nutrition.

Agriculture provides a source of food and nutrients, contributes to income, and affects food prices. Exploring agriculture and nutrition linkages in Bangladesh using data from a multi-round district level panel, a study finds that rice yields are associated with earlier introduction of complementary foods to young children, as well as increases in their weight-for-height (Heady and Hoddinott 2016). Agriculture can also have effects on women's health, nutrition, empowerment and time allocation, which can have important consequences for their ability to care for family members. Given these links, agriculture has the potential to be a strong driver of nutrition. However, that potential is not being fully realized in Bangladesh because, traditionally, nutrition and agricultural policies have been uncoordinated.

Low status of women and gender gaps in health and education contribute to chronic child undernutrition (Smith et al. 2003) and food insecurity (von Grebmer et al. 2009), even when other determinants of food security, such as per capita incomes, improve. According to an IFPRI study, women are key actors within the food system, but are historically disempowered in Bangladesh in terms of leadership in the community, control of resources, and control of income (Sraboni, Quisumbing, and Ahmed 2014a). The lack of women's empowerment weakens the links between agriculture and nutrition. Despite increases in

women's participation in agriculture in Bangladesh in recent years (Asaduzzaman 2010), women face persistent obstacles, particularly due to social and economic constraints, which limit their further inclusion in agriculture. Women have limited control over agricultural assets, as well as limited mobility to go to markets to sell agricultural produce, often relying on husbands and sons to take produce to market.

1.2 Motivation for the Study

IFPRI research in Bangladesh, using data from a nationally representative household survey conducted by IFPRI, reveals that women's empowerment plays a key role in improving household food security and dietary diversity of children, women, and other household members (Sraboni et al. 2014b; Malapit et al. 2015). The study also shows that agricultural production diversity is associated with dietary diversity (Sraboni et al. 2014b). Further, IFPRI research in Bangladesh shows that nutrition behavior change communication (BCC) training imparted to women and men in rural households leads to significant improvements in child nutrition and complementary feeding practices (Ahmed et al. 2016; Menon et al. 2016).

Motivated by research-based evidence, IFPRI researchers developed a concept note to strengthen the agriculture-nutrition-gender nexus in Bangladesh and presented it to the Ministry of Agriculture (MOA), Government of the People's Republic of Bangladesh in June 2014. Based on the concept note, an inter-ministerial committee of the Government of Bangladesh approved a pilot research project entitled, "Orienting Agriculture Toward Improved Nutrition and Women's Empowerment", also known as "Agriculture, Nutrition, and Gender Linkages"(ANGeL), for implementation by the MOA, with technical assistance from IFPRI and Helen Keller International (HKI), and an evaluation led by IFPRI. The Minister of Agriculture officially launched the pilot project in October 2015. The project is jointly funded by the Government of Bangladesh and USAID.

1.3 The Baseline Report

As part of the evaluation of the ANGeL Project, IFPRI carried out a baseline survey of project participants and a comparison group of households just before the start of project interventions. This report presents the results of the ANGeL baseline survey. It is organized in nine sections. Section 2 describes the salient features of the ANGeL Project. Section 3 presents the progress of the ANGeL Project to date. Section 4 describes the baseline survey. Section 5 gives a profile of the survey households. Section 6 provides the land tenure status of sample households and findings on agricultural production and practices. Section 7 presents patterns of food consumption and nutrition. Section 8 provides findings on women's empowerment. Section 9 summarizes the main findings and provides conclusions.

2. DESCRIPTION OF THE ANGeL PROJECT

2.1 Project Objectives

The overall objective of the ANGeL pilot project is to identify actions and investments in agriculture that can leverage agricultural growth to improve nutrition, and to enhance women's empowerment in Bangladesh. In order to achieve this objective, the MOA and partners have designed a project that implements and evaluates the impact of three alternative intervention modalities and their combinations for promoting nutrition and gender sensitive agriculture. The modalities are:

1) *Agriculture Production:* Facilitating the production of the high-value food commodities that are rich in essential nutrients. The focus would be on diversifying agricultural production (fruits and vegetables; pulses; oilseeds; and poultry, dairy, fish, livestock).

2) *Nutrition Knowledge:* Conducting high-quality behavior change communication (BCC) training to improve nutrition knowledge of women and men.

3) *Gender Sensitization:* Undertaking gender sensitization activities that lead to the improvement in the status/empowerment of women and gender parity between women and men.

The specific objectives of the ANGeL Project's evaluation research are to measure the impact of the project's interventions on the following outcomes:

1. Farm household income
2. Agricultural production diversity
3. Dietary diversity of pre-school children, child-bearing-age women, all household members
4. infant and young child feeding practices
5. Intakes of calorie, protein, iron, zinc, and vitamin A
6. Nutritional status of pre-school children and child-bearing-age women
7. Women's empowerment and gender parity between adult male and female.

2.2 Impact Pathways

As part of the ANGeL Project's evaluation research, three impact pathways will examine the agriculture-nutrition-gender nexus:

1) *Food Production*: Food production affects nutrition through food availability, quality, and pricing of food; information about the nutritional value of food produced; and marketing—that is, how certain foods are being promoted for sale and consumption. Farm household's production practices can improve the diversity, nutrient quality, and quantity of foods available to the household year-round. Diversified and efficient commercial agriculture can provide a variety of foods with high nutrient content to urban and rural non-farm consumers at affordable prices. Soil quality,

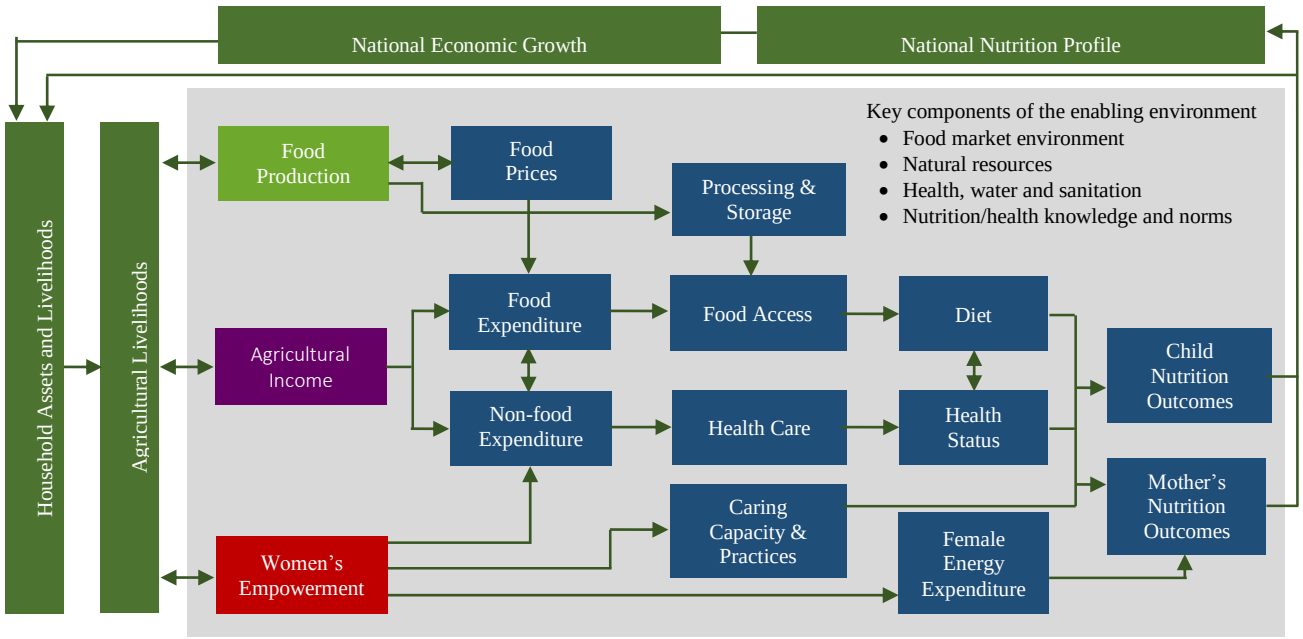
agricultural practices, and technologies such as biofortification, influence this pathway.

2) *Agricultural Income:* Overall, income and nutrition are related. Agriculture is an important source of income for agricultural workers as well as producers. Agricultural production and prices also influence consumers' purchasing power, as well as incomes of food processors and food value chain actors. Child nutrition is usually more adequate in wealthier households than in poorer ones. However, the correlation is not always as strong or inevitable as might be expected.

3) *Women's Empowerment:* The pathway from women's empowerment to improved nutrition is influenced by a number of factors, including social norms, knowledge, skills, and the shared power of decision-making within households.

Figure 2.1 illustrates the potential pathways from food production, agricultural income, and women's empowerment to improved nutritional status.

Figure 2.1 Steps toward improved nutrition: Food production, agricultural income, and women's empowerment pathways



Source: Herforth, A. and J. Harris 2014.

2.3 Evaluating Project Impact

For the evaluation research, IFPRI uses a cluster-randomized controlled trial (RCT) design using blocks of the Department of Agricultural Extension (DAE) of the MOA as clusters. The evaluation includes a sample of 160 blocks in 16 rural upazilas (sub-districts) out of the 484

rural upazilas in the country. The selected upazilas are agro-ecologically suitable for crop diversification and have good market connectivity. These upazilas belong to 16 districts in seven divisions of Bangladesh.[1] Table 2.1 provides the list of upazilas, districts, and divisions where the ANGeL Project is implemented. Figure 2.2 shows the locations of project upazilas on the map of Bangladesh.

The selected blocks were randomly assigned to five treatment arms and one control group. Random assignment of clusters (blocks) assures that, on average, farm households will have similar baseline characteristics across treatment and control groups. Such a design eliminates systematic differences between treatment and control households and minimizes the risk of bias in the impact estimates due to "selection effects" (Hidrobo et al. 2014).

A total of 4,000 farm households are selected, of which 3,125 farm households belong to the five treatment arms in 125 blocks, and 875 farm households belong to the control group in 35 blocks (see Section 4 for details on sampling).

The quantitative impact evaluation involves two rounds of comprehensive household surveys to collect data to fully address each of the seven objectives of the evaluation research. The first survey is designed to collect baseline information before starting the project interventions, and the endline survey will be conducted shortly after the second year of project activities are complete. The IFPRI research will use the longitudinal dataset produced from the two rounds of surveys to estimate impacts of the ANGeL Project.

There are two options to estimate impacts using the longitudinal dataset: (1) the difference-in-differences method—meaning, the difference between the change in the treatment group and the change in the control group at the end of the project; and (2) the analysis of covariance (ANCOVA) method, which allows a household's outcome at follow-up to depend on the same household's outcome at baseline, as well as on the household's treatment status and an error term (accounting for any omitted observable or unobservable factors). Given these two options, IFPRI has chosen to use the ANCOVA specification to estimate the impacts because in case of high variability and low autocorrelation of the data at baseline and follow up, ANCOVA estimates are preferred over difference-in-difference estimates (McKenzie 2010). Intuitively, if autocorrelation is low, then difference-in-difference estimates will overcorrect for baseline imbalances. ANCOVA estimates, on the other hand, will adjust for baseline imbalances according to the degree of correlation between baseline and follow-up, as the specification allows estimating autocorrelation rather than imposing it to be unity. The ANCOVA model is specified as follows:

$$Y_h = \propto + \beta T_h + \gamma Y_{h,base} + \varepsilon_h \ ,$$

[1] The administrative structure of Bangladesh consists of divisions, districts, upazilas, and unions, in decreasing order by size. There are 8 divisions, 64 districts, 484 upazilas, and 4,498 unions (all rural). There are 87,320 villages in rural Bangladesh.

where Y_h is the outcome of interest for farm household h at follow-up and $Y_{h,base}$ is the outcome of interest at baseline. T is an indicator for whether household h is in the treatment group (treatment = 1, control = 0), and β is the ANCOVA impact estimator. In other words, β represents the amount of change in outcome, *Y*, which is due to household h being assigned to the treatment group. To test whether the ANCOVA impact estimator is statistically different for the treatment group, one could conduct Wald tests of equality and report the p-values.

IFPRI will complement its impact evaluation of the ANGeL Project with operations research, which will provide program managers with information about the implementation process and operations. The process evaluation will use a mixed method (qualitative and quantitative) for collecting information. The process evaluation will be supplemented by project monitoring data to be routinely collected by IFPRI and its implementing partners.

The evaluation design has five treatment arms (T) and one control arm (C):

T1: Nutrition BCC-1 training delivered to women and men by Sub-Assistant Agriculture Officers (SAAO) from the DAE (mostly male)

T2: Nutrition BCC-2 training delivered to women and men by female community nutrition workers, referred to as "ANGeL *Pushti Kormi*" (APK), hired by the ANGeL project

T3: Agricultural Production training delivered to women and men by SAAOs

T4: Agricultural Production + Nutrition BCC training delivered to women and men by SAAOs

T5: Agricultural Production + Nutrition BCC training delivered to women and men by SAAOs + gender sensitization activities for women and men conducted by HKI

C: Control

The five treatment arms of the research represent the three alternative modalities of interventions of the project: agricultural production, nutrition knowledge, and gender sensitization. T4 combines the production and nutrition knowledge modalities, and T5 combines all three modalities.

Men are the primary buyers of food in rural Bangladesh, as women have limited mobility and are not generally permitted to go to the market unaccompanied. Educating both men and women about nutrition in the four treatment arms of ANGeL (T1, T2, T4 and T5) may lead to joint decisionmaking for smart purchasing of nutritious foods at the market, thereby improving overall nutrition in the family. This may also improve gender parity.

In Bangladesh, agricultural extension agents (SAAOs) of the DAE provide services mostly to male farmers to facilitate the adoption of agricultural technologies and modern agricultural production practices; women are seldom reached by the extension agents. In three

treatment arms of ANGeL (T3, T4 and T5), SAAOs will deliver extension messages and training to both women and men. The study will test the hypothesis that women's access to agricultural extension services would empower them in terms of sole or joint decisionmaking over farming and autonomy in agricultural production and marketing (for example, what inputs to buy, what crops to grow, what livestock to raise, what and how much produce to sell, etc.).

Since most SAAOs of the DAE are male, *does the gender of the trainer make a difference in the effectiveness of nutrition training*? T2 will address this research question. Women who completed at least secondary schooling are hired from each of the 25 blocks under T2 and HKI provides them with the same training on nutrition BCC methods.

2.4 Collaborative Approach to Project Implementation

IFPRI researchers in Bangladesh work closely with the officials of the Agricultural Policy Support Unit (APSU) of the MOA for building long-term analytical capacity within the Ministry. The APSU and the DAE jointly implement the ANGeL Project. Other agencies of the MOA— Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), and Bangladesh Agricultural Development Corporation (BADC)—provide support as needed to implement the project.

IFPRI researchers evaluate the impacts of the ANGeL Project on various outcomes. HKI developed the training manuals for diversified agricultural production in consultation with scientists from BARI and BRRI, and training manuals for nutrition BCC in consultation with BIRTAN scientists and IFPRI. HKI provides the necessary training of the trainers (SAAOs and APKs) on modern practices for producing high-nutritive value food commodities, nutrition BCC, and gender sensitization.

Mobile Solutions Technical Assistance and Research Activity (mSTAR), a USAID contractor, provides technical assistance in rolling out mobile money in development projects. This project gets this service at no cost to IFPRI or the Ministry of Agriculture. USAID funds mSTAR to support USAID implementing partners in Bangladesh.

2.5 Way Forward

After two years, the ANGeL experimental research will identify which interventions most effectively increase agricultural diversity, improve nutrition, and promote women's empowerment. The Ministry of Agriculture plans to use the research-based evidence to scale up the most effective interventions all over Bangladesh. In fact, ANGeL is the first ministry-led initiative that uses a rigorous impact evaluation, the randomized controlled trial, to develop an evidence base to design and implement a national program.

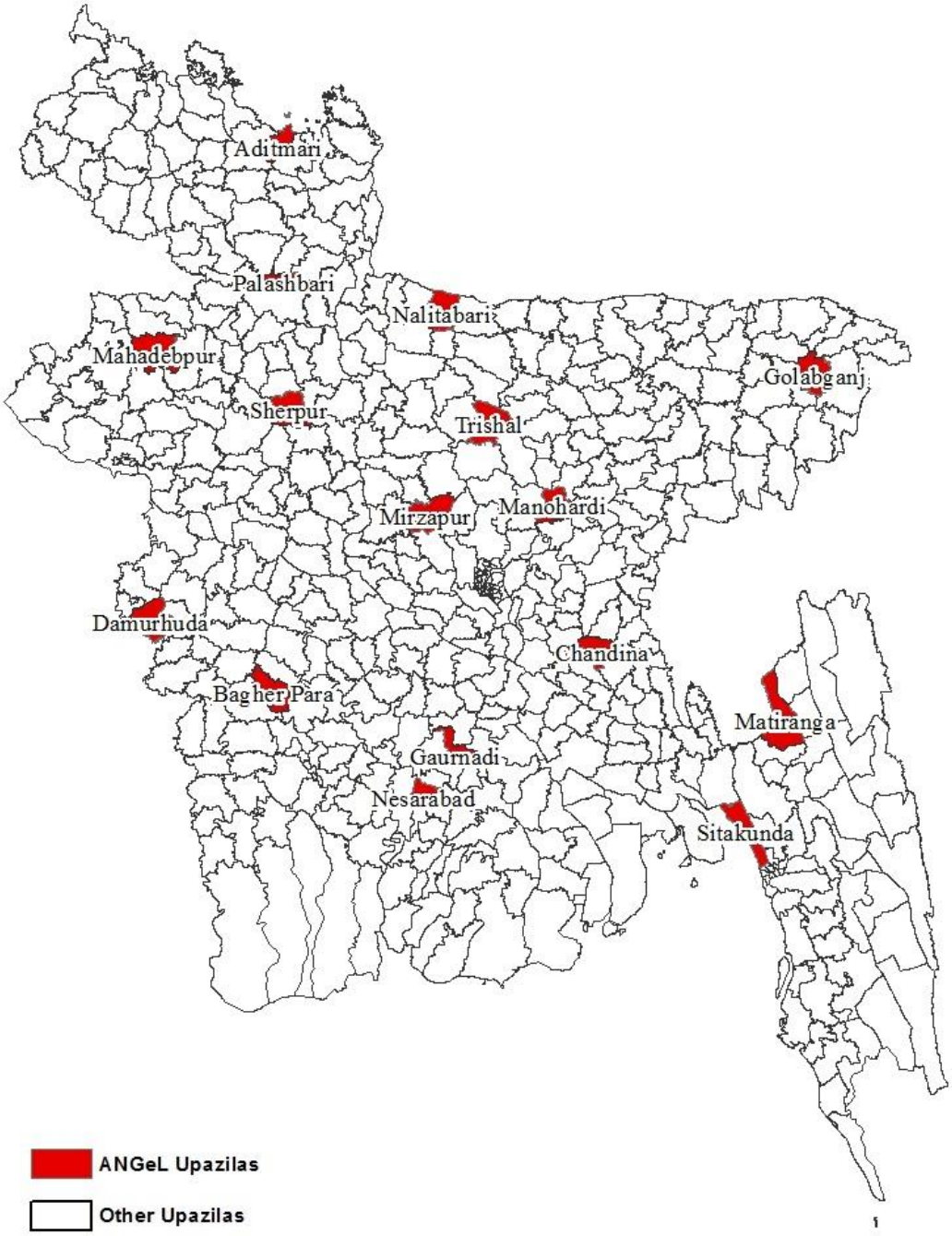
The project seeks to draw on the large, nationwide agricultural extension network that already exists in the country, and attempts to 'top-up' its current portfolio with nutrition activities and messages.

Table 2.1 List of upazilas purposively selected for the ANGeL Project

Division	District	Upazila
Dhaka	Narsingdi	Monohardi
Dhaka	Tangail	Mirzapur
Mymensingh	Mymensingh	Trishal
Mymensingh	Sherpur	Nalitabari
Chittagong	Comilla	Chandina
Chittagong	Chittagong	Sitakunda
Chittagong	Khagrachari	Matiranga
Rajshahi	Naogaon	Mahadebpur
Rajshahi	Bogra	Sherpur
Rangpur	Lalmonirhat	Aditmari
Rangpur	Gaibandha	Palashbari
Khulna	Jessore	Bagherpara
Khulna	Chuadanga	Damurhuda
Barisal	Pirojpur	Nesarabad
Barisal	Barisal	Gaurnadi
Sylhet	Sylhet	Golabganj

Source: Constructed by authors.

Figure 2.2 Map of Bangladesh showing locations of 16 upazilas for the ANGeL project



3. PROGRESS OF THE ANGeL PROJECT

3.1 Formalizing the ANGeL Project Concept

Motivated by research findings from IFPRI's Bangladesh Integrated Household Survey (BIHS) data, IFPRI-PRSSP researchers developed and presented a concept note to the MOA in June 2014. Shortly thereafter, an interministerial committee approved the ANGeL Project for implementation across 16 districts.

The ANGeL Project was officially launched by the Minister, Ministry of Agriculture, on October 29, 2015 at the APSU. Various ministry officials and heads of MOA agencies attended, as well as USAID Mission Director and other USAID officials. Chief of Party of the Bangladesh Policy Research and Strategy Support Program (PRSSP) presented "Orienting Agriculture Toward Improved Nutrition and Women's Empowerment: Project Design," which reviewed the motivation, design, sampling, evaluation framework, and implementation process.

3.2 Baseline Survey

Training for survey enumerators and supervisors from Data Analysis and Technical Assistance (DATA), a Bangladeshi consulting firm, took place from October 11 – November 15, 2015. The baseline survey was administered on 4,000 households in 16 districts from November 16, 2015 – January 17, 2016. Section 4 describes ANGeL's baseline survey. Section 4 entitled "Baseline Survey Design and Data" features more detailed information on survey enumerator and supervisor training.

3.3 Training

3.3.1 Training materials

IFPRI collaborated closely with Helen Keller International (HKI) and APSU to develop field-level training packages for the agriculture production and nutrition BCC modules. Training packages include key messages, facilitator guidelines, festoons, and other visual aids (for example, food plates, food cards, and posters).

HKI's gender sensitization module, *Nurturing Connections*, is designed to complement nutrition and homestead agriculture production programming. *Nurturing Connections* uses a participatory approach, and its activities focus on challenging gender norms, building equality, and developing constructive communication skills. IFPRI and APSU worked with HKI to adjust the module to fit the project context.

In December 2016, IFPRI developed a brochure on key nutrition messages in Bangla to distribute to all treatment households and trainers.

3.3.2 Training of Trainers (TOT)

Under T2, 25 female community nutrition workers, known in the project as APKs, were selected to train households on nutrition BCC. All APKs completed high school, are married, and reside in the same union and preferably same block as training participants. Because government agriculture extension services are male-dominated, incorporating female community nutrition workers enables researchers to see whether the trainer's gender affects behavior change.

Government agriculture extension officials and APKs were trained as trainers from April 19 – May 31, 2016. Below are the TOT details for the respective treatment arms:

- 25 sub-assistant agriculture officers (SAAOs) from the DAE under T3 received agricultural production training from April 19 – 23, 2016.
- 24 SAAOs under T1 received nutrition BCC training from May 3 – 5, 2016.
- 26 SAAOs under T5 received agricultural production and nutrition BCC trainings from May 8 – 12, 2016.
- 25 SAAOs under T4 received agricultural production and nutrition BCC trainings from May 15 – 19, 2016.
- 25 APKs under T2 received nutrition BCC training from May 29 – 31, 2016.

All trainings were conducted in an MOA facility in Savar (outside Dhaka city) except APK training, which was conducted at the Rural Development Academy in Bogra, northern Bangladesh.

From November 14 – 28, 2016, HKI trained individuals they hired as trainers on the *Nurturing Connections* gender sensitization module at HKI's project office in Dhaka.

3.3.3 Field-level trainings

In August 2016, field-level trainings were launched for agriculture production and nutrition BCC. In December 2016, gender sensitization trainings were launched in 25 blocks under T5, which will continue through March 2017.

Main training challenges across all treatment arms include training absenteeism and training quality. Absentee rates varied across the five treatment arms, between 3—12 percent. Reasons for absenteeism include ad hoc contractual work of male participants, male participants were busy harvesting during the agriculture planting season, heavy rains during the monsoon season, lack of child care, travel time to reach training site, and some more affluent households are not as incentivized by training allowance to attend.

3.3.4 Refresher trainings

In August 2016, field-level trainings were launched for agriculture production and nutrition BCC. In December 2016, gender sensitization trainings were launched in 25 blocks under T5, which will continue through March 2017.

In January 2017, IFPRI and HKI organized refresher trainings for various treatment arms at Mushroom Development Institute, Savar, which aimed to review training content and improve training delivery. Below are the details for the refresher trainings:

- 25 APKs under T2 and 1 SAAO received refresher training from November 1–3, 2016.
- 25 SAAOs under T3 received agriculture production refresher training on January 19, 2017.
- 24 SAAOs under T4 received nutrition and agriculture production refresher training from January 22–23, 2017.
- 24 SAAOs under T5 received nutrition and agriculture production training from January 24 – 25, 2017.
- 25 SAAOs under T1 received nutrition refresher training on January 29, 2017.

IFPRI designed brochures on nutrition key messages to be used at the household-level to reinforce nutrition messages from trainings. IFPRI distributed the brochures at the refresher trainings to SAAOs under the treatment arms that deliver nutrition training (T1, T2, T4, and T5), who then distributed the resources to 2,450 farm households total.

3.4 Integrating Mobile Payments

Since February 2016, Mobile Solutions Technical Assistance and Research Activity (mSTAR) partnered with IFPRI in rolling out mobile money to pay training allowances to 3,125 ANGeL beneficiary (treatment) households across 16 districts. Specifically, mSTAR provided technical assistance to IFPRI helping to select a mobile financial service provider – in this case, Dutch Bangla Bank Limited (DBBL) – and later negotiating service fees and troubleshooting on the opening of corporate and beneficiary accounts. Additionally, mSTAR conducted a "mobile money 101" TOT to ANGeL staff (100 SAAOs and 25 APKs), which helped ANGeL trainers and DBBL agents work together to successfully activate household accounts at the village-level and advise rural households – some with minimal digital literacy – on how to practically use mobile money. mSTAR continues to provide ongoing support for issues around mobile money, as needed.

There were various challenges in rolling out digitized payments in the ANGeL Project. Trainers reported that some households did not have the necessary identification documents required to activate a mobile account (for example, birth certificate, chairman's certificate, national ID). Other trainers reported that DBBL agents at the field-level demanded fees for each mobile account opened under the ANGeL Project. Once accounts were activated, the digital financial literacy of some farm households has presented

problems. Mobile banking requires households to create PINs, but if the user forgets the PIN, the SIM gets blocked, requiring DBBL support. IFPRI, together with mSTAR and DBBL, provided much-needed project support to resolve these challenges.

By September 2016, 3,038 DBBL mobile banking accounts were successfully opened to disburse training allowances to farm households under the five treatment arms. To disburse payments, SAAOs and APKs verify training attendance, submit the attendance registers to APSU and IFPRI to authorize the release of payments centrally from DBBL. All households receive approximately Taka 200 per household per training.

In December 2016, mSTAR, with IFPRI and DAE's support, conducted a rapid survey of 100 households randomly selected across all 16 upazilas to better understand the mobile banking experiences of project beneficiaries within the ANGeL Project.

3.5 Monitoring

Government ownership and involvement are critical aspects of the ANGeL Project. Prior to the implementation of field-level trainings, various workshops were organized to familiarize subdistrict- and district-level government officials under the DAE with the ANGeL Project, and their respective monitoring roles and expectations.

On February 8, 2016, IFPRI and APSU jointly organized an orientation workshop to familiarize upazila- (that is, subdistrict) and district-level agricultural extension officials from the DAE on the project's operations in their respective project areas. Additionally, a project monitoring workshop was organized on June 5, 2016 for 13 subdistrict-level government officials from the DAE to review the monitoring roles and expectations immediately before field-level implementation. Chief of Party, IFPRI-PRSSP presented, "ANGeL Project Monitoring: Concept and Indicators."

Since field-level trainings were initiated in July 2016, continuous field-level monitoring has been conducted by IFPRI and government officials from APSU and the DAE. To effectively audit training quality, monitoring materials were developed such as attendance registers, field-level training work plans, and a monitoring checklist to consistently gauge training quality across all districts. Using these monitoring materials, the following upazilas were prioritized for field visits, primarily based on high absenteeism: Chandina, Nalitabari, Monohordi, Mirjapur, Trishal, Mohadveppur, Sherpur, and Golapganj.

Continuous field-level monitoring and constant communication between project partners have strengthened training delivery during the first few months of field-level implementation. For example, frequent monitoring noted that many SAAOs were being transferred out of their catchment area, which compromised training continuity. In response, a project steering committee meeting on September 6, 2016 chaired by the MOA Secretary enabled the project team to communicate directly with the Director General (DG),

DAE to request all DAE Deputy Directors to stop transferring ANGeL trainers during the project period. Additionally, government officials and IFPRI identified an urgent need to improve the training quality of select trainers, which resulted in refresher trainings, previously mentioned in Section 3.3.4.

On December 22, 2016, a meeting to review project progress was held at the DAE, Ministry of Agriculture, Khamarbari, Farm Gate, Dhaka. DG-DAE, Ministry of Agriculture, chaired the meeting, and Additional Secretary, Ministry of Agriculture and DG-APSU delivered the welcome speech. The meeting attracted high attendance, including 30 DAE officials. Chief of Party, IFPRI-PRSSP delivered a presentation on project progress. During the meeting, it was agreed that all ANGeL project materials would be shared to inform other DAE training programs.

3.6 Dissemination of ANGeL's activities

Since the project inception, IFPRI has raised awareness about ANGeL's project activities. Below are a few examples of IFPRI's dissemination of project activities:

- April 10, 2016 – "Designing Evidence-Based Agricultural Policy for Improved Nutrition," at the Technical Symposium for Nutrition-Sensitive Agriculture, jointly organized by BARC, FAO, HKI, WorldFish, and IFPRI.
- April 19, 2016 – "Progress on the *Agriculture, Nutrition, and Gender Linkages* Pilot Project," at USAID's Agriculture-Nutrition Linkages Working Group.
- September 6, 2016 – "*Agriculture, Nutrition, and Gender Linkages* (ANGeL) Project in Bangladesh: An Initiative by the Ministry of Agriculture," at the Nexus between Agriculture and Nutrition: the Bangladesh Case seminar, jointly organized by BRAC and the Leveraging Agriculture for Nutrition in South Asia (LANSA) Project.

3.7 Future Activities

ANGeL field-level trainings in agriculture production, nutrition BCC, and gender sensitization will continue across all 16 districts in rural Bangladesh. Government officials, IFPRI, and APSU will continue to conduct field visits to support trainers, and enable the project team to quickly formulate an action plan if training quality drops.

ANGeL baseline results will be compared with the endline survey in November 2017 – January 2018 to evaluate the impacts of the ANGeL Project on various outcomes.

4. BASELINE SURVEY DESIGN AND DATA

4.1 Baseline Survey

4.1.1 Survey Questionnaires

The ANGeL baseline survey questionnaires included modules that, together, provide an integrated data platform to answer the research questions. The questionnaire has two parts—one for female respondents and the other for male respondents. The modules of the questionnaires are listed below:

- Household demographic composition, education attainment, occupation and employment, and dwelling characteristics
- Acquisition of productive and consumption assets
- Detailed food and nonfood expenditures
- Individual level dietary intake data from 24-hour recall
- Health and morbidity, child care, water and sanitation
- Anthropometric measurements of children under age five and all household members
- Savings and loans
- Household food security indicators
- Women's status (mobility, work, earnings and expenses decisions, reproductive decisions, domestic violence, abuse and threats, women's assets at marriage and ownership/control of current assets)
- Shocks and coping strategies
- Data for measuring Women's Empowerment in Agriculture Index (WEAI)

4.1.2 Training

For implementing the baseline household survey, IFPRI contracted Data Analysis and Technical Assistance (DATA), a Bangladeshi consulting firm with expertise in conducting complex surveys and data analysis. DATA worked under the supervision and guidance of senior IFPRI researchers. DATA's capacity to conduct surveys that collect high-quality data was largely built by IFPRI over the past two decades.[2]

[2] DATA carried out all IFPRI surveys in Bangladesh, including more than 50 household surveys and several market, school, and other institutional surveys. In addition, DATA has conducted numerous surveys for various international organizations, such as the World Food Programme (WFP)-Bangladesh, the World Bank, the European Union, the U.S. Department of Agriculture, CARE-Bangladesh, World Vision-Bangladesh, the Population Council–New York, Save the Children (USA), Tufts University School of Nutrition Science and Policy, and the IRIS Center at the University of Maryland.

IFPRI researchers prepared a draft baseline survey questionnaire. The draft questionnaire was peer-reviewed and revised to address comments and suggestions. After pre-testing in the field, the baseline survey questionnaire was finalized.

For the baseline household survey, DATA provided experienced survey enumerators and supervisors to administer the survey; most of the enumerators and supervisors hold master's degrees in social science, nutrition, or home economics. From October 11–November 15, 2015, IFPRI researchers and DATA experts trained 96 experienced enumerators (48 female and 48 male) and 16 supervisors (2 female and 14 male). The survey enumerators' training consisted of a formal classroom component as well as closely monitored practice fieldwork. In the formal training, IFPRI researchers briefed the enumerators and supervisors on the objectives and methods of the survey, the sampling design, and the responsibilities of the enumerators. They were trained on how to carry out the interviews, including line-by-line explanation and interpretation of the questionnaires, the flow and skip- patterns, definitions, and explanations of how to handle unusual cases and when to contact the supervisor for assistance.

Field supervisors received additional training related to their supervisory and editing role. In particular, they were trained on the quality control process, cross checking, editing and coding of the questions, security and confidentiality issues, and the delivery of the completed questionnaires to the DATA office in Dhaka for simultaneous data entry.

The questionnaires were field tested in Belabo Upazila in Narsingdi District and Trishal Upazila in Mymensigh District. The field testing determined the appropriate distribution of questionnaire modules among the male and female questionnaires, identified problems with the questionnaires or additional rules that were needed to address difficult cases. The field testing resembled the actual implementation of the survey in order to test the full range of survey activities, including questionnaire completion, delivery, and data entry. An additional function of the field testing was to provide practical training to the enumerators in administering the questionnaire.

4.1.3 Survey Administration

DATA carried out the baseline household survey from November 16, 2015–January 30, 2016 under the supervision and guidance of IFPRI researchers. Going into the field, the teams of enumerators were equipped with a number of documents (for example, survey manual, serial numbered questionnaires, and identification cards), weight and height scales for anthropometric measurements, and GPS units for geo-referencing.[3] The APSU Research Director, Ministry of Agriculture, Government of Bangladesh issued letters of authorization to conduct the survey.

[3] Health O' Meter weighing scales and GPSs were imported from the USA for the household survey.

The enumerators conducted the interviews one-by-one and face-to-face with the respondents assigned to him or her. The enumerators were supervised by the field supervisors who accompanied them to the village. Each field supervisor was responsible with his/her defined region. All field staff reported their activities to their supervisors using a standard progress report form. Completed questionnaires were delivered to the DATA central office on a regular basis for further quality control and validation during data entry.

4.1.4 Quality Control

IFPRI and DATA worked diligently to ensure the quality of the baseline household survey data. In the field, survey supervisors routinely oversaw interviews conducted by enumerators, and verified all questionnaires completed by enumerators on a daily basis. If inconsistencies in responses were detected in completed questionnaires, then the supervisors visited the relevant respondents to find out the reasons and corrected the responses as needed. In addition, the supervisors made random checks of about 10 percent of the completed questionnaires by revisiting the sample households. IFPRI researchers made frequent field visits to supervise the fieldwork.

4.1.5 Data Entry and Cleaning

The data entry was carried out at the DATA office in Dhaka from January 31–March 27, 2016. DATA carried out data entry of the baseline survey using a specialized software (Microsoft Access) that was programmed to identify values that are out of range or inconsistent with other responses in the questionnaire. After cleaning, DATA delivered the baseline survey dataset to IFPRI on May 3, 2016.

4.2 Sampling Design

4.2.1 Sample Size Calculation

One important facet of designing an impact evaluation is to ensure that the sample size is sufficiently large for treatment impacts to be feasibly detected in the outcomes of interest. While increasing sample size requires devoting additional resources, having too small a sample is a serious danger that can undermine the purpose of undertaking the evaluation in the first place. In particular, if the sample is too small, even a substantial treatment impact in a key outcome may be indistinguishable from inherent variability in the outcome. In effect, the analysis may erroneously conclude there were no impacts when, in fact, there were.

Sample size calculations allow for formal analysis of which program design elements are strongest in detecting a specified minimum change in a given outcome. These calculations can also be used to consider implications of known limitations in study design. For example, if there are specific constraints on sample size (for practical/logistical reasons), the

minimum detectable effect in each outcome can be calculated, given the constraints. If the minimum detectable effect in a particular outcome is unreasonably large to expect as a treatment impact, this insight can then guide the choice of outcomes considered to be the focus of the study, which can in turn guide the research questions that are posed and shape the design of the survey questionnaire. To summarize—and to be clear on this point—sample size calculations do not indicate what the sample size must be. Rather, they indicate what magnitude of effects we can reasonably expect to observe, given the design of the intervention.

4.2.1.1 Sample Size Calculations for the ANGeL Evaluation

For a minimum sample size calculation, researchers need to consider several factors: (1) the outcomes that are of the greatest interest to program managers and policymakers; (2) the minimum size of change in those outcomes that program managers would like to observe; (3) the degree of variability in those outcomes; (4) the extent to which there is correlation in outcomes within localities; (5) the desired level of statistical power; and (6) the level of desired statistical significance. Sample sizes increase inversely with the size of change that the evaluation is attempting to uncover; greater variability in outcomes; increased correlation of outcomes; and higher statistical power.

In the context of the ANGeL Project evaluation, the calculations should take into account that the evaluation followed a randomized designed, not at the level of households, but at the block (cluster) level. In sample size calculations for cluster-randomized studies, not only the number of households and the number of clusters matter, but also the inherent similarity of households within a cluster. The measure that captures this similarity for each outcome is referred to as its "intracluster correlation" – that is, in the absence of any treatment, a measure of the extent to which the outcome varies across households within a cluster relative to how much it varies across clusters.

The value of the intracluster correlation for any outcome is likely to depend on the context of the data. Since it is necessary to conduct sample size calculations prior to collecting the data, the accepted approach to estimating intracluster correlations for sample size calculations is to use values calculated from existing comparable datasets.

For the ANGeL evaluation, we used parameters derived from the nationally representative Bangladesh Integrated Household Survey (BIHS) conducted by IFPRI in 2011/2012. We use per capita daily calorie availability and the WEAI score as the outcome indicators.

We followed the standard practice of finding the sample size that gives an 80 percent chance (the "power of the test") of rejecting the null hypothesis of zero change in outcome indicators at the 0.05 level of significance.

To detect a minimum, statistically significant increase in per capita calorie availability of 12 percent between treatment and control groups, a minimum sample size of 25 clusters (blocks) and 473 households for each of the 5 treatment arms and the control are required. For women's empowerment in agriculture as an outcome indicator, 25 clusters and 500 households are required to detect a 10 percent increase in empowerment. For the ANGeL impact evaluation, we used 25 clusters/blocks and 625 farm households for each treatment arm and 35 clusters and 875 farm households for the control group. Thus, each cluster included 25 households.

4.2.2 ANGeL Sampling Design

The cluster-randomized evaluation method (using blocks of the DAE as clusters) for ANGeL uses a sample of intervention blocks belonging to each of the five treatment groups and a sample of non-intervention blocks belonging to the control group. The sampling process for the treatment and the control groups includes the following steps:

- For the ANGeL project, we purposively selected 16 rural upazilas (sub-districts) from all 484 rural upazilas in the country that are agro-ecologically suitable for crop diversification and have good market connectivity.

- There are 525 blocks in the 16 selected upazilas (33 blocks per upazila on average). From the list of all blocks, we randomly selected 10 blocks from each of the 16 upazilas (160 blocks selected).

- We randomly assigned 160 blocks to the five treatment arms and one control group of the RCT as follows:
    - 25 blocks to each of the 5 treatment arms (25 x 5 = 125 blocks), and 35 blocks to the control group.

- We randomly selected one village from each block, then conducted a 100 percent census of households in each of the 160 selected villages. Thereafter, we listed all farm households with at least one child under 24 months from the village census lists.

- We randomly selected 25 farm households for each of the 160 blocks from village census lists of farm households with at least one child under 24 months, which gives:

    - 625 farm households for each of the 5 treatment arms (25 farmers x 25 blocks) and 875 farm households (25 farmers x 35 blocks) for the control group.
    - 3,125 farm households belong to the 5 treatment arms (625 x 5) in 125 blocks; and 875 farm households belong to the control group in 35 blocks. Therefore, we selected a total of 4,000 farm households for the quantitative impact evaluation.

5. PROFILE OF SURVEY HOUSEHOLDS

5.1 Household Characteristics

Table 5.1 shows household characteristics of the ANGeL sample. The average household size is 5.5. The dependency ratio is the ratio (expressed as a percentage) of the number of people in the household ages 0-14 and above 60 to the number of working age household members (15-60 years). The dependency ratio does not vary significantly across treatment arms, ranging between 96.0 to 102.4 percent. The average dependency ratio in the ANGeL sample (98.1 percent) is higher than the 2011/12 BIHS national rural average (94.4 percent), which means that adults of working age in the ANGeL sample have more children to support than the national rural average. This is probably because the ANGeL sample selection criteria required sample households to have at least one child under 24 months (Ahmed et al. 2013).

Although 65 percent of households own cultivable land less than half an acre, farming is by far the most common occupation of the household head across all households (62 percent), followed by business and trade (10 percent).

Males and females older than age 15 have an average of 5.1 years of schooling compared to the 2011/12 BIHS national rural average of 4.3 years for males and 3.9 years for females (Ahmed et al. 2013). Adult males and females with no schooling make up 28.5 and 28.4 percent of the sample, respectively. This suggests comparable educational achievement between adult male and female household heads.

Only about 5 percent of households with primary school-age children do not send their children to school; however, 32 percent of households with secondary school-age children (ages 12-18) do not send their children to school.

5.2 Expenditure

This study uses consumption expenditures as the principal indicator of household welfare, and uses per capita expenditure as a proxy for income for two reasons. First, expenditures are likely to reflect permanent income and, hence, are a good indicator of consumption behavior (Friedman 1957). Second, data on expenditures are generally more reliable and stable than income data. Since expenditures are intended to serve as a proxy for income, the terms "expenditure" and "income" are used interchangeably.

The measure of total consumption expenditure is quite extensive and draws upon responses to several sections of the household survey. In brief, consumption is measured as the sum of total food consumption and total nonfood (nondurable and durable) expenses. Expenditures on individual consumption items were aggregated to construct total expenditures.

Quantities of goods produced by the household for home consumption were valued at the average unit market prices of commodities.

Table 5.2 provides estimates of the per capita monthly consumption expenditure of sample households, as well as their budget share of expenditure on different items. We have not included the use value of the tangible assets due to data constraints. Monthly per capita expenditure is around Taka 3,000, most of which is spent on food (59.4 percent), followed by fuel and house rent (6.3 and 5.7 percent, respectively).[4]

5.3 Ownership of Household Assets

Table 5.3 shows household asset ownership. Among the selected assets in the analysis, ownership of mobile phones is the most prevalent (94 percent), which was decisive in rolling out mobile phone banking to treatment households for disbursing training allowances. This finding also indicates that delivering agricultural extension messages to farmers via mobile phones holds great promise. Overall, new information and knowledge are critical inputs for improved agricultural practices and marketing of agricultural products.

Electric fan is the second dominant household asset among the sample (68.7 percent), with ownership lower in T2 where solar panel ownership is higher compared to other treatment arms. About 34 percent of all households have color televisions.

5.4 Access to Electricity and Dwelling Characteristics

Table 5.4 provides information on electricity and dwelling types of surveyed households. In addition to being an indicator of wealth, an electricity connection has important beneficial impacts on education, communication, and general lifestyle; thus, it is encouraging that 72 percent of sampled households have electricity. This is consistent across all treatment arms except T2, where 18.7 percent of households have solar energy panels (Table 5.3).

According to Table 5.4, about 75 percent of households have permanent wall structures, which consist of tin, brick, and cement. Nonpermanent materials include bamboo, mud, jute sticks, plastic sheets, and thatch. Out of all households, most roofs use tin (47.6 percent), followed by concrete/brick (24.5 percent).

[4] The official exchange rate for the Taka (Tk), the currency of Bangladesh, was Tk 79.25 per US$1.00 on March 29, 2017.

Table 5.1 Characteristics of survey households

Item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
Household size (number)	5.6	5.3	5.3	5.7	5.4	5.5	5.5
Dependency ratio* (percent)	96.1	98.0	96.0	102.4	95.5	99.7	98.1
Primary school-age children (6-11 years) who do not go to school (percent)	4.4	4.2	6.4	4.9	3.4	5.4	4.8
Secondary-school-age children (12-18 years) who do not go to school (percent)	32.1	28.6	37.8	31.0	34.3	28.8	31.9
Years of schooling, male household head	4.6	4.4	4.4	3.9	4.6	4.5	4.4
Years of schooling, wife of household head	4.9	5.1	5.1	4.2	4.9	4.9	4.9
Years of schooling, adult male aged 15 and above	5.4	5.0	5.1	4.7	5.2	5.1	5.1
Years of schooling, adult female aged 15 and above	5.2	5.2	5.4	4.7	5.2	5.1	5.1
No schooling, adult male (percent)	25.5	26.8	29.4	32.1	26.0	30.1	28.5
No schooling, adult female (percent)	27.6	26.0	27.4	32.4	27.6	29.2	28.4
Female-headed household (percent)	3.8	3.4	3.8	4.3	5.3	3.3	4.0
Less than 0.5 acre of cultivable land owned (percent)	59.7	67.8	65.1	69.1	68.2	62.5	65.2
Principal occupation of household head (percent)							
Agricultural day laborer	7.7	10.4	8.2	8.5	10.2	4.7	8.1
Nonagricultural day labor	2.9	4.2	2.2	2.7	6.6	3.0	3.6
Salaried	2.2	3.0	3.7	4.5	2.9	4.2	3.5
Self employed	10.4	6.1	7.5	6.9	8.0	7.7	7.8
Rickshaw/van puller	3.0	1.4	2.1	1.6	2.2	3.0	2.3
Business/trade	11.2	9.1	10.4	9.1	12.0	9.8	10.3
Production business	0.6	0.8	0.2	0.2	0.3	0.0	0.3
Livestock-related work	0.2	0.0	0.5	0.0	0.0	0.1	0.1
Farming	60.0	63.0	63.8	64.0	55.8	66.1	62.4
Non-earning occupations	1.8	1.8	1.4	2.6	1.9	1.5	1.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2016 ANGeL Baseline Survey, IFPRI.

*Dependency ratio=number of dependents (under age 15 or over 60 years of age) divided by number of working age people (15 – 60 years).

[1]Treatment arms:

T1: Nutrition BCC training delivered to women and men by agricultural extension agents from the DAE

T2: Nutrition BCC training delivered to women and men by local community women hired by the project

T3: Agricultural production training delivered to men and women

T4: Agricultural production training delivered to men and women + BCC training

T5: Agricultural production training delivered to men and women + BCC training + gender sensitization to women and men

Table 5.2 Per capita monthly consumption expenditure

Item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
Monthly per capita total expenditure (taka)	2,910	2,793	3,053	3,037	3,016	2,987	2,967
Monthly per capita food expenditure (taka)	1,802	1,684	1,825	1,885	1,828	1,752	1,793
Monthly per capita nonfood expenditure (taka)	1,108	1,110	1,228	1,152	1,188	1,235	1,174
Budget share of expenditures (percent)							
Food	61.0	59.0	59.0	61.1	59.6	58.0	59.4
Fuel and lighting	6.3	5.8	6.1	6.4	6.9	6.5	6.3
Personal care	1.6	1.7	1.8	1.8	1.6	1.7	1.7
Cleaning material	1.4	1.5	1.5	1.6	1.5	1.5	1.5
Transport and communication	5.4	5.0	6.0	5.1	5.1	6.2	5.5
Adult clothing	3.3	3.3	3.3	3.3	3.2	3.5	3.3
Children clothing	1.0	1.1	1.0	1.1	1.1	1.1	1.1
Other clothing	0.9	0.9	0.8	0.9	0.9	0.9	0.9
Footwear	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Beddings	0.5	0.5	0.5	0.4	0.4	0.5	0.5
Other household expense	0.1	0.1	0.2	0.1	0.1	0.2	0.1
Medical treatment for male	2.0	2.5	2.4	2.3	2.0	2.3	2.2
Medical treatment for female	3.5	4.4	3.7	3.1	3.8	3.9	3.7
Education for male	0.7	0.7	0.6	0.7	0.8	0.8	0.7
Education for female	0.7	0.7	0.8	0.7	0.7	0.7	0.7
Remittances sent	0.4	0.4	0.3	0.4	0.3	0.1	0.3
Gifts given	0.4	0.4	0.4	0.3	0.3	0.5	0.4
Kurbani/milad	2.0	2.0	2.3	1.8	1.9	2.3	2.1
Entertainment	0.7	0.9	0.7	0.6	0.6	0.7	0.7
Legal fees	0.5	0.5	0.7	0.4	0.7	0.4	0.5
Utensils	0.1	0.1	0.1	0.2	0.1	0.1	0.1
Furniture repair	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Personal items (bag, watch)	0.4	0.4	0.5	0.4	0.4	0.3	0.4
Lighting (bulb, etc.)	0.1	0.2	0.1	0.1	0.1	0.1	0.1
House rent	5.2	5.8	5.6	5.5	5.7	6.4	5.7
Total	100	100	100	100	100	100	100

Source: 2016 ANGeL Baseline Survey, IFPRI.

[1]See footnote of Table 5.1 for description of treatment arms.

Table 5.3 Household asset ownership

Asset	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
				(percent)			
Electric fan	69.4	56.4	70.7	71.8	70.7	72.0	68.7
Radio	1.3	0.8	0.8	1.1	0.5	0.9	0.9
Audio cassette/CD player	1.2	1.3	2.3	3.4	1.5	2.8	2.1
Television (B/W)	3.6	5.2	5.1	3.8	4.0	3.4	4.1
Television (color)	36.9	25.1	35.1	34.0	32.5	36.7	33.6
Sewing machine	8.2	7.9	9.2	7.0	7.4	8.2	8.0
Bicycle	35.1	33.6	42.8	33.7	31.1	44.8	37.4
Rickshaw	1.2	0.5	0.8	0.8	1.3	1.2	1.0
Boat	4.1	5.2	1.1	1.1	2.5	1.2	2.5
Engine boat	1.2	0.5	0.5	0.0	0.2	0.2	0.4
Motorcycle	6.6	6.1	9.3	5.7	4.1	7.3	6.6
Mobile phone set	95.9	93.0	93.8	93.8	95.9	92.3	94.0
Fishing net	42.3	39.5	42.5	33.6	28.8	39.8	37.9
Solar energy panel	8.7	18.7	7.9	8.3	8.4	9.1	10.1

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 5.4 Electricity and structure of dwelling

Characteristics	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
				(percent)			
Household has electricity	70.4	59.5	73.6	72.2	79.2	75.5	72.0
Structure of walls[a]							
Permanent	84.0	69.8	73.8	68.8	74.1	77.1	74.8
Nonpermanent	16.0	30.2	26.2	31.2	25.9	22.9	25.3
Roofing material							
Concrete/brick	26.1	21.8	26.1	21.9	22.7	27.1	24.5
Tin	53.6	44.3	45.9	46.4	47.2	47.9	47.6
Thatching	10.4	6.4	8.0	13.3	20.2	11.8	11.7
Other	9.9	27.5	20.0	18.4	9.9	13.3	16.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2016 ANGeL Baseline Survey, IFPRI.
[a] Permanent materials include field bricks, concrete, wood, and tin sheets.
[1]See footnote of Table 5.1 for description of treatment arms.

5.5 Types of Latrines

Table 5.5 shows the type of latrine used by sample farm households. The most common latrine for all arms except T4 is sanitary (water-sealed) latrines, which is used by 40 percent of the sample. *Pucca* (permanent) latrines are the second most common type of latrine, with the rate of use varying from 41.1 percent in T5 to 28.9 percent in the control group. Open defecation rate (4.4 percent) is slightly higher in this sample for most arms than the national average of 3.7 percent (Ahmed et al. 2013).

Table 5.5 Types of latrines

Item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
				(percent)			
None (open field)	2.7	5.0	4.6	3.5	4.6	5.5	4.4
Kutcha (fixed place)	10.4	20.0	15.0	19.2	12.0	14.3	15.1
*Pucca (*unsealed)	37.3	32.0	32.0	40.5	41.1	28.9	34.9
Sanitary without flush	48.3	40.5	47.2	34.6	41.1	48.3	43.7
Sanitary with flush	1.3	1.8	1.0	1.6	1.1	2.6	1.6
Community latrine	0.0	0.3	0.0	0.3	0.0	0.1	0.1
Other	0.0	0.5	0.2	0.3	0.0	0.2	0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2016 ANGeL Baseline Survey.

[1]See footnote of Table 5.1 for description of treatment arms.

6. AGRICULTURAL PRODUCTION AND PRACTICES

6.1 Land Tenure Arrangements and Farm Size Groups

6.1.1 Land Tenancy

Table 6.1 presents the land tenure arrangement of the sample households. About 37 percent of the ANGeL sample farm households are pure tenants – that is, they do not own any cultivable land. About 31 percent of sample farmers cultivate only their own land. The proportion of mixed-tenant farmers—those who cultivate their own land and also take land in as sharecroppers and/or leaseholders—is 32 percent.

The dominant land-tenure arrangement among the sample households is sharecropping, where the crop produced is shared between the cultivator and the landowner in different proportions that have been agreed upon prior to cultivation. About 50 percent of the farmers are sharecroppers. This group of sharecroppers includes those who do not own any cultivable land (that is, "pure tenant"), as well as those who own land and sharecrop other people's land. About 14 percent of the farmers have cash-lease arrangements either as pure tenants or as those with their own land plus cash-leased land. The proportion of farmers operating both sharecropped and cash-leased land (either as tenants or landowners) is about 5 percent (calculated from data in Table 6.1).

Table 6.1 Land tenure arrangement

	Treatment arms[1]						
Item	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
				(percent)			
Pure tenant	30.7	39.5	37.1	39.2	39.0	35.3	36.7
Sharecropping	81.3	65.2	87.1	70.9	61.1	75.4	73.2
Cash lease	12.5	27.1	6.9	20.1	31.2	14.9	18.9
Both	6.3	7.7	6.0	9.0	7.8	9.7	7.9
Own land only	35.8	27.2	30.4	31.6	28.8	31.9	31.0
Mixed tenant (own land + land taken in)	33.4	33.3	32.5	29.2	32.2	32.8	32.3
Sharecropping	69.4	60.6	72.9	72.5	60.7	80.8	70.2
Cash lease	21.5	29.8	18.7	16.5	31.3	15.3	21.9
Both	9.1	9.6	8.4	11.0	8.0	3.8	8.0

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.1.2 Farm Size Groups

Table 6.2 shows the distribution of farm households according to their operated farm size, divided into marginal (operating less than 0.5 acres of land); (2) small (operating 0.5 to 1.49 acres of land); (3) medium (operating 1.5 to 2.49 acres of land); and (4) large (operating 2.5 acres or more land). The four farm size groups match the cut-off points of the six operated farm size groups presented in the 2010 Household Income and Expenditure Survey (HIES) report of the Bangladesh Bureau of Statistics (BBS 2011) by aggregating the smallest two

HIES farm size groups under the marginal farm category and the largest two groups under the large farm category (Ahmed et al. 2013).

Almost half of the farm households belong to the small farmer group, followed by marginal farmers at 30 percent. Only 12 and 8 percent households are medium and large famers, respectively.

Table 6.2 Farm size groups

	Treatment arms[1]						
Farm size group	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
				(percent)			
Marginal farmer (<0.5 acres)	31.5	32.0	27.5	31.0	32.5	28.9	30.5
Small farmer (0.5-1.49 acres)	44.2	48.0	51.7	49.9	51.2	51.0	49.4
Medium farmer (1.5-2.49 acres)	14.2	11.5	11.7	11.4	11.4	12.6	12.2
Large farmer (≥2.5 acres)	10.1	8.5	9.1	7.7	5.0	7.5	8.0

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.2 Patterns of Crops Grown

Table 6.3 shows the share of individual crops on total cropped land by treatment arms and control group. Overall, rice dominates the share of cropped land (82 percent), followed by vegetables (5 percent). The share of rice in the ANGeL sample is higher than the 2011/12 BIHS national rural average of 77 percent (Ahmed et al. 2013), indicating a lower level of crop diversity in the ANGeL sample compared to the national average incidence.

6.2.1 Crop Diversity

Table 6.4 shows the extent of crop diversity, calculated using the area-based Simpson Diversity Index,[5] for the different arms of the ANGeL study. Average crop diversification for the ANGeL sample (19 percent) is low compared to the national average of 24 percent, as found from the BIHS 2011/12 data. This is reflective of the higher share of cultivable land devoted to paddy in the ANGeL sample – 82 percent – compared to the 2011/12 BIHS national rural average of 77 percent.

[5]The Simpson diversification index is calculated as $SDI = 1 - \sum_{i=1}^{n} P_i^2$, where P_i is the proportionate area of the ith crop in gross cropped area. Thus, if the proportion of one crop is large then the value of the index is low, which indicates that diversification is low.

Table 6.3 Percent of total cropped area under these crops

Crop	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(percent)						
Aus local	7.0	3.4	0.3	1.7	4.9	1.8	3.1
Aus (HYV+Hybrid)	3.0	5.6	2.5	6.4	7.4	4.0	4.8
B. Aman local	1.4	1.2	0.3	0.4	2.7	1.4	1.2
T. Aman local	6.0	6.2	4.2	2.1	4.5	2.4	4.1
T. Aman (HYV+Hybrid)	28.4	31.7	36.3	38.1	28.1	37.3	33.6
Boro (HYV)	30.8	29.5	38.1	26.8	27.1	34.7	31.4
Boro (Hybrid)	7.6	3.6	3.6	4.2	3.1	2.4	4.0
Wheat	0.3	0.6	0.4	0.5	0.6	0.4	0.4
Maize	0.8	3.5	1.3	1.3	2.3	0.9	1.6
Jute	2.6	1.8	1.5	2.3	2.5	2.2	2.2
Pulses[a]	1.6	0.5	1.0	2.9	2.1	2.9	1.9
Oilseeds[b]	1.4	1.5	0.9	1.5	1.5	1.3	1.3
Spices[c]	0.2	0.5	0.5	0.6	0.6	0.5	0.5
Non-leafy vegetables[d]	2.8	3.4	3.0	8.4	9.0	3.8	5.0
Leafy vegetables[e]	0.2	0.3	0.3	0.4	0.4	0.3	0.3
Bananas	1.4	2.0	1.1	0.1	1.9	0.6	1.1
Potatoes	1.1	1.6	1.0	0.8	0.2	1.3	1.0
Sweet potato	0.1	0.0	0.1	0.0	0.0	0.2	0.1
Sugarcane	0.1	0.1	0.0	0.2	0.3	0.2	0.2
Tobacco	1.6	1.7	1.1	0.5	0.3	0.2	0.9
Betel leaf	1.3	0.6	2.2	0.5	0.2	0.7	0.9
Other crops	0.3	0.8	0.2	0.4	0.5	0.7	0.5

Source: 2016 ANGeL Baseline Survey, IFPRI.

[a]Pulses include lentil, mung, blackgram, chickpea, fieldpea, and other pulses.

[b]Oilseeds include soybean, sesame, mustard, groundnut, and other oilseeds.

[c]Spices include chili, garlic. turmeric, and coriander.

[d]Non-leafy vegetables include onions, eggplant, *potol*, okra, bitter gourd, arum, cucumber, cowpea, *danta*, green banana, cauliflower, water gourd, sweet gourd, tomato, radish, turnip, *kakrol*, bean, cabbage.

[e]Leafy vegetables include Indian spinach, spinach, *lalshak*.

[1]See footnote of Table 5.1 for description of treatment arms.

Table 6.4 Simpson diversification index for the ANGeL sample of farm households

Treatment arms[1] and control	Simpson Diversification Index (0-1)	
	Mean	Standard Deviation
T1	0.16	0.24
T2	0.19	0.25
T3	0.15	0.22
T4	0.21	0.27
T5	0.21	0.26
Control	0.19	0.24
All	0.19	0.25

Source: 2016 ANGeL Baseline Survey, IFPRI.

[1]See footnote of Table 5.1 for description of treatment arms.

Table 6.5 shows the result of the F-tests for significance of difference in Simpson Diversification Index between treatment arms and control, which suggests that not all the

arms are balanced across the ANGeL survey households. This is expected since cropping patterns are very different in different parts of Bangladesh, with some regions more concentrated in one crop compared to others due to agroecological and other differences.

Table 6.5 Simpson Diversification Index baseline balancing test across intervention arms and control

Treatment arms[1]	F-statistic	p-value
T1=T2	4.42	0.04
T1=T3	0.39	0.53
T1=T4	13.08	0.00
T1=T5	14.02	0.00
T1=Control	5.76	0.02
T2=T3	7.46	0.01
T2=T4	2.29	0.13
T2=T5	2.70	0.10
T2=Control	0.02	0.90
T3=T4	18.03	0.00
T3=T5	19.12	0.00
T3=Control	9.48	0.00
T4=T5	0.02	0.90
T4=Control	2.27	0.13
T5=Control	2.70	0.10

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.3 Use of Inputs for Crop Production

6.3.1 Irrigation

Table 6.6 and 6.7 summarize the source and method of irrigation for HYV and hybrid boro rice cultivation. Nearly 79 percent of farmers who produce boro rice use groundwater irrigation compared to only 19 percent who use surface water. About 49 percent of the boro rice producers use shallow tubewells, and only 29 percent and 17 percent use deep tubewells and low lift pumps, respectively.

Table 6.6 Source of irrigation for HYV/hybrid boro rice cultivation

	Treatment arms[1]						
Source of irrigation	T1	T2	T3	T4	T5	Control	All
	(percent of farmers)						
Rainfed	0.2	4.5	0.6	2.3	3.1	0.4	1.7
Surface water	29.2	12.3	13.2	22.8	19.8	17.4	18.8
Groundwater	70.4	83.6	85.7	75.4	77.3	80.9	79.3
Groundwater and surface water	0.4	0.5	0.8	0.0	0.5	1.2	0.6

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 6.7 Method of irrigation for HYV/hybrid boro rice cultivation

Irrigation method	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(percent of farmers)						
Shallow tubewell	40.6	42.4	57.9	41.8	59.1	50.6	49.0
Deep tubewell	27.7	41.4	25.9	32.5	19.0	27.5	28.9
Low lift pump	27.7	9.9	11.5	21.4	18.2	14.9	16.9
Treadle/rower pump	0.0	0.0	0.0	1.6	0.0	0.7	0.4
Axial flow pump	0.2	0.0	0.0	0.0	0.0	1.8	0.5
Manual	0.9	0.2	0.4	1.0	0.0	0.5	0.5
Multiple methods	2.9	6.1	4.3	1.8	3.8	4.0	3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.3.2 Fertilizer Use

Table 6.8 presents the use of four major fertilizers – urea, triple super phosphate (TSP), di-ammonium phosphate (DAP), and muriate of potash (MoP) – on different rice varieties. Among the major types of rice, farmers use significantly more urea on boro HYV and hybrid rice varieties compared to t. aman local and HYV varieties.

Table 6.8 Fertilizer use by type of rice

Type of rice		Treatment arms[1]					Control	All
		T1	T2	T3	T4	T5		
		(kilograms/hectare)						
T. aman (local)	Urea	66.3	69.8	75.7	121.3	96.3	119.3	85.5
	TSP	18.1	16.2	30.1	86.6	45.9	66.3	36.4
	DAP	7.4	4.1	9.4	15.1	15.1	7.4	8.8
	MoP	4.0	7.9	18.6	33.2	24.9	29.1	16.2
T. aman (HYV)	Urea	144.3	139.6	165.4	146.0	185.4	175.7	161.3
	TSP	62.4	53.1	65.7	70.9	101.0	79.1	72.7
	DAP	28.8	39.8	37.8	20.7	22.2	36.0	31.4
	MoP	50.0	69.1	66.0	45.6	52.4	62.0	57.9
Boro (HYV and hybrid)	Urea	213.9	197.8	206.6	209.6	249.0	210.9	213.4
	TSP	96.9	84.7	94.4	86.3	129.0	97.3	97.5
	DAP	51.4	60.1	46.1	55.2	25.5	49.1	48.3
	MoP	83.5	96.6	81.8	85.5	88.2	86.9	86.6

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.4 Farmers' Access to Agricultural Extension Services and Credit

6.4.1 Agricultural Extension Services

Table 6.9 shows agricultural extension services, disaggregated by farm size groups and areas of agricultural extension support. Medium and large farmers consulted agriculture extension service the most during the 12 months preceding the survey (30 and 37 percent, respectively), whereas marginal farmers had significantly less contact with agricultural extension services during the same timeframe (only 13 percent). Farmers mostly consulted

agriculture extension for information on pesticides, insect and disease, and fertilizer (95 percent, 92 percent, and 90 percent, respectively).

Table 6.9 Agricultural extension services by farm size groups

Item	Farm size groups				All
	Marginal	Small	Medium	Large	
			(percent)		
Farmers who consulted an agricultural extension agent during 12 months preceding survey	12.5	21.0	30.0	36.5	20.7
Areas of support by agricultural extension:					
Fertilizer-related	88.7	91.4	87.7	86.3	89.6
Seed-related	89.5	89.1	85.2	87.4	88.3
Irrigation-related	73.4	76.0	67.2	75.8	74.0
Pesticide-related	92.7	96.9	93.4	93.7	95.1
Insects- and disease-related	87.9	92.6	92.6	94.7	92.0
Sowing-related	73.4	75.4	79.5	73.7	75.5
Soil type-related	46.0	53.1	46.7	44.2	49.5

Source: 2016 ANGeL Baseline Survey, IFPRI.

6.4.2 Credit

Table 6.10 shows the average size of loan (in taka) and the sources chosen by the households in the survey. Households on average had an outstanding loan of Tk 72,045 from various sources. NGOs provided nearly 43 percent of total number of loans, followed by close relatives, friends, or neighbors (21 percent). Table 6.11 summarizes the average annual interest rate paid by the households to different sources. Money lenders on average charged the highest interest rate – about 65 percent. NGOs charged nearly 14 percent, and relatives/friends/neighbors charged only about 3 percent annually.

Table 6.10 Loan size and source of loans

Loan size and source of loans	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
Average loan size (taka per household)	81,681	64,049	73,574	58,830	68,455	81,494	72,045
Source of loan	(percent of total number of loans)						
Relative/friend/neighbor	19.4	19.7	21.5	25.6	20.0	19.6	20.8
Bangladesh Krishi Bank (BKB)	5.6	6.2	5.4	5.9	6.4	6.2	6.0
Rajshahi Krishi Bank (RAKUB)	0.3	0.0	0.9	0.3	0.4	0.4	0.4
Other bank	4.2	3.5	2.9	3.6	5.0	3.8	3.8
Other financial institution	0.7	0.6	0.3	0.5	0.5	0.6	0.5
NGO	43.8	39.8	39.1	42.6	49.1	41.6	42.6
Employer	0.0	0.0	0.2	0.0	0.2	0.0	0.1
Shop/dealer/trader	0.4	0.4	0.8	0.6	1.2	0.7	0.7
Money lender	6.6	7.1	5.2	7.7	3.4	4.0	5.6
Shamity (other than NGO)	6.3	6.7	5.6	2.7	3.2	7.8	5.6
Mortgaged land to obtain loan	10.3	12.7	15.9	9.6	9.2	13.3	11.9
Others	2.3	3.2	2.0	1.0	1.6	2.2	2.1
Total	100	100	100	100	100	100	100

Source: 2016 ANGeL Baseline Survey.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 6.11 Interest rates by loan source

Loan source	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(percent/year)						
Relative/friend/neighbors	2.0	8.1	4.0	0.7	1.7	2.1	3.0
Bangladesh Krishi Bank	10.3	10.4	10.4	10.1	10.5	10.6	10.4
Other bank	11.7	12.4	11.5	15.7	12.9	12.7	12.8
Other financial institutions	16.7	10.0	14.0	18.8	11.7	14.0	14.2
NGO	14.4	14.4	14.5	14.1	14.4	14.1	14.3
Employer	0.0	0.0	8.0	0.0	5.0	0.0	6.5
Shop/dealer/trader	0.0	0.0	6.7	0.0	4.9	8.1	4.0
Money lender	68.1	66.5	76.5	60.0	83.8	42.0	65.0
Shamity (other than NGO)	17.6	27.2	19.8	17.9	14.6	18.6	19.9
Leased out land to other household	0.0	2.2	0.0	0.0	0.0	0.1	0.4
Others	14.8	6.6	11.5	3.8	5.1	6.4	8.3
Total	14.2	16.0	12.8	12.8	12.8	10.8	13.1

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.5 Yields of Agricultural Production

Table 6.12 reports average yields of different types of rice, wheat, and maize. Average rice yield is 2.92 tons per hectare, which is less than the 2015/16 national average, measured by the Bangladesh Bureau for Statistics (3.05 tons per hectare) (BBS 2016).

Table 6.12 Yields of rice, wheat, and maize

Crop	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(ton/hectare)						
Aus local	1.89	2.04	1.57	1.33	2.14	2.37	1.98
Aus (HYV+hybrid)	2.00	2.59	2.52	2.48	2.46	2.14	2.39
B. Aman local	0.94	1.28	0.90	1.20	0.89	0.94	0.97
T. Aman local	1.55	1.54	1.58	1.73	1.69	1.66	1.61
T. Aman (HYV+hybrid)	2.41	2.43	2.39	2.26	2.37	2.54	2.41
Boro (HYV)	3.73	3.54	3.66	3.46	3.67	3.68	3.63
Boro (hybrid)	4.55	4.23	4.40	3.93	4.37	4.23	4.31
Wheat	2.31	2.83	2.45	2.69	3.33	2.72	2.73
Maize	7.62	6.96	7.10	6.30	6.25	7.20	6.89

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 6.13 shows the results of the baseline balancing test across treatment arms and control on rice yields. About half of the differences in rice yields among various combinations of treatment arms and control are statistically significant at the 5 percent level, indicating that randomization may not be effective for this indicator. We will use appropriate controls in our ANCOVA regression models to estimate impact of ANGeL interventions on rice yields.

Table 6.13 Baseline balancing test across treatment arms and control for rice yields

Treatment arm[1]	F-statistic	p-value
T1=T2 example	1.98	0.16
T1=T3	0.26	0.61
T1=T4	12.75	0.00
T1=T5	4.48	0.03
T1=Control	0.06	0.81
T2=T3	3.69	0.05
T2=T4	4.74	0.03
T2=T5	0.52	0.47
T2=Control	1.67	0.19
T3=T4	16.69	0.00
T3=T5	6.92	0.01
T3=Control	0.63	0.43
T4=T5	2.1	0.15
T4=Control	13.25	0.00
T5=Control	4.26	0.04

Source: 2016 ANGeL Baseline Survey.
[1]See footnote of Table 5.1 for description of treatment arms.

6.6 Livestock Holding

Table 6.14 shows the average number of livestock owned by ANGeL sample households. While livestock holding of bullocks and milk cows is similar between the ANGeL sample and national rural Bangladesh, the ANGeL sample appears to have a slightly higher average number of chickens (6.6) and ducks (1.5) than national rural Bangladesh (chicken, 5.1 and duck, 1.2) (Ahmed et al. 2013). Baseline results also indicate that ANGeL households predominantly own chickens (77 percent), which is not surprising given that purchasing

chickens is a relatively low cost investment compared to more expensive livestock such as milk cows and bullocks.

Table 6.14 Livestock holding

Item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(number)						
Bullock	0.4	0.5	0.5	0.5	0.4	0.5	0.5
Milk cow	0.8	0.7	0.7	0.7	0.7	0.8	0.7
Goat	0.4	0.7	0.5	0.4	0.5	0.6	0.5
Chicken	5.9	6.8	6.5	6.8	5.8	7.4	6.6
Duck	1.5	1.7	1.4	1.4	1.6	1.4	1.5
Others	0.5	0.6	0.7	0.6	0.9	1.0	0.7
	(percent of farmers)						
Own bullock	29.1	33.0	34.9	32.3	27.5	33.9	31.9
Own milk cow	39.5	36.3	37.3	38.2	37.8	40.8	38.5
Own goat	19.5	26.4	23.8	19.0	19.0	25.1	22.4
Own chicken	79.7	79.0	75.2	80.6	73.8	78.1	77.8
Own duck	34.2	33.0	32.8	32.2	32.2	33.4	33.0
Others	7.5	7.5	8.5	6.1	7.0	7.3	7.3

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

6.7 Fish Production

Table 6.15 shows the percent of all farmers producing different categories of fish. Out of the 4,000 sample households, 58 percent produce fish. Nearly 31 percent of all farmers produce a combination of small and big fish, and only 6 percent of farmers produce shrimp.

Table 6.15 Fish production

Item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(percent of farmers)						
Produce small fish only	0.5	0.3	0.2	0.5	0.0	0.0	0.2
Produce big fish only	19.7	19.7	24.0	17.0	20.3	23.7	20.9
Produce big and small fish	30.9	32.3	35.4	31.4	21.9	33.0	31.0
Produce shrimp only	10.2	8.3	5.3	1.9	8.6	1.7	5.8
Do not produce fish	38.7	39.5	35.4	49.3	49.1	41.6	42.2

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 6.16 shows the usage of fish production for the fish farming households. Nearly 87 percent of all fish farmers produced fish exclusively for consumption, and only 0.5 percent produced to sell only.

Table 6.16 Allocation of fish production

	Treatment arms[1]						
Item	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
	(percent of fish producers)						
For consumption only	85.3	89.2	88.6	82.9	87.7	88.2	87.1
For sale only	0.5	0.0	0.0	0.9	0.6	1.0	0.5
For consumption and sale	13.1	10.3	10.4	11.7	11.1	9.1	10.8

Source: 2016 ANGeL Baseline Survey, IFPRI.

[1]See footnote of Table 5.1 for description of treatment arms.

7. FOOD CONSUMPTION AND NUTRITION

7.1 Quantity of Food Consumed

Table 7.1 presents the quantity of food consumed by the treatment and control groups. The results indicate that rice is consumed the most across all groups. The average per capita rice consumption is 24 percent lower than the national rural average of 495.5 grams/person/day, as found in 2011/12 BIHS data (Ahmed et al. 2013), which may be explained by the fact that most of the ANGeL sample households are fairly young and small, with at least one child under age two, as per the selection criteria.

Other commodities consumed in relatively large amounts included potatoes, green leafy vegetables, eggplant, and a number of vegetables (labeled as "other vegetables" in the table), although consumption of different types of fruits are not as high. Sources of protein in the diet for the households in the sample are mainly different types of big fish with chicken, beef, and eggs consumed in relatively small quantities compared to big fish.

7.2 Calorie Share of Food Items and Cost of Calories

Tables 7.2 summarizes the per capita daily calorie intake by different food groups in the study sample, disaggregated by treatment and control arms. The table shows that daily per capita intake of food energy in the study sample varies from 1,933 kilocalories (kcal)/person/day in T5 to 1,988 kcal/person/day in T4, and is slightly lower than the 2011/12 BIHS national rural average of 2,243 kcal/person/day (Ahmed et al. 2013). This is again reflective of the fact that most of the households in our sample are fairly young and small households with at least one child under the age of two.

For treatment and control arms, rice accounts for the largest share of total calories consumed, ranging from 66.5 percent in T5 to 69.6 percent in T2, indicating very little diversity in diet. Oils and vegetables other than leafy vegetables contribute to the next highest shares of calories, 9 percent and 7 percent, respectively, which are still very low compared to the share from rice.

Table 7.1 Quantity of food consumed

Food item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(grams/person/day)						
Rice	376.7	391.8	371.2	368.3	364.1	378.7	375.3
Atta	14.8	14.2	14.9	23.7	25.6	20.8	19.1
Other cereal	6.5	8.9	12.1	9.0	9.2	8.3	8.9
Lentil	5.6	4.3	5.3	5.2	5.2	5.8	5.3
Chickpeas	0.4	0.6	0.8	0.7	0.3	0.6	0.6
Khesari	0.3	0.4	0.3	0.4	0.3	0.7	0.4
Other pulses	3.6	2.9	3.8	5.8	3.7	4.4	4.1
Soybean oil	15.4	15.0	14.8	18.1	17.3	15.9	16.1
Mustard oil	3.7	3.3	2.8	2.0	1.8	3.0	2.8
Ghee	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Other oils	0.4	0.2	0.8	0.9	0.1	0.4	0.5
Potatoes	55.0	57.5	71.0	58.5	62.2	63.3	61.4
Green leafy vegetables	40.4	38.5	34.6	37.3	32.8	39.7	37.4
Eggplants	35.8	35.8	31.3	40.3	27.7	38.2	35.0
Sweet gourd	2.4	2.4	0.5	0.4	1.0	0.4	1.1
Carrot	0.3	0.1	0.2	0.7	0.3	0.6	0.4
Other vegetables	155.7	144.6	145.9	174.7	167.8	148.1	155.6
Chicken	13.3	13.8	14.3	16.4	19.1	12.8	14.8
Beef	5.1	4.6	6.5	2.2	2.8	6.7	4.8
Goat meat	0.3	0.2	0.2	0.5	0.8	1.2	0.6
Other meats	3.2	0.5	0.7	2.0	1.2	2.0	1.6
Eggs	8.7	6.9	7.1	9.2	7.6	8.2	8.0
Milk	24.9	19.9	24.7	19.7	22.0	22.7	22.3
Milk products	1.6	3.8	4.6	3.1	2.8	2.7	3.1
Small fish	17.8	16.6	14.3	18.6	19.0	17.1	17.2
Big fish	50.4	41.5	53.1	49.2	44.2	48.8	47.9
Banana	3.0	2.6	2.5	2.6	1.8	2.7	2.5
Orange	1.9	2.2	1.9	3.2	1.2	1.8	2.0
Apple	1.9	2.3	2.5	1.7	1.5	1.8	2.0
Other fruits	3.7	5.0	3.9	3.5	3.0	4.4	4.0
Sugar	4.8	4.5	5.1	6.1	5.8	5.6	5.3
Gur	1.6	3.5	3.7	1.3	1.1	1.3	2.0
Salt	10.1	9.8	9.5	9.8	9.1	10.2	9.8
Spices	5.4	5.5	5.2	6.1	5.9	6.6	5.8
Prepared foods	13.5	12.0	15.5	17.0	17.3	14.8	15.0

Source: 2016 ANGeL Baseline Survey.

[1]See footnote of Table 5.1 for description of treatment arms.

Table 7.2 Calorie intake and share of food items consumed

Food item	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
Daily per capita calorie intake (kcal/person/day)[2]	1,933	1,963	1,943	1,988	1,933	1,986	1,960
Calorie share of food items				(percent)			
Rice	68.5	69.6	66.7	64.9	66.5	66.8	67.1
Atta	2.4	2.4	2.6	4.0	4.1	3.5	3.2
Other cereal	1.1	1.5	1.9	1.5	1.5	1.4	1.5
Pulses	1.7	1.4	1.7	1.8	1.6	1.9	1.7
Oils	8.8	8.2	8.4	9.2	8.5	8.6	8.6
Leafy vegetables	0.6	0.6	0.5	0.5	0.5	0.5	0.5
Other vegetables	6.9	6.6	7.5	7.4	7.3	7.0	7.1
Meats	1.0	0.8	0.9	0.9	0.9	1.0	0.9
Eggs	0.7	0.5	0.6	0.7	0.6	0.6	0.6
Milk and milk products	1.0	0.8	1.1	1.0	1.1	1.0	1.0
Small fish	2.0	1.7	2.2	2.0	1.8	2.0	2.0
Big fish	0.9	0.9	0.7	1.0	0.9	0.9	0.9
Fruits	0.5	0.5	0.4	0.3	0.3	0.4	0.4
Spices	0.7	0.7	0.7	0.8	0.7	0.8	0.7
Sugar and gur	1.0	1.2	1.2	1.2	1.2	1.1	1.1
Beverages	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Other prepared foods	2.3	2.4	2.8	2.7	2.5	2.6	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2016 ANGeL Baseline Survey.
[1]See footnote of Table 5.1 for description of treatment arms.
[2]Based on 24-hour individual food intake data.

Table 7.3 shows that the difference in per capita daily calorie intake between treatment and control groups is not statistically significant at the 5 percent level, indicating baseline balance in calorie intakes.

Table 7.3 Baseline balancing test across treatment arms and control for daily calorie intake per capita

Treatment arm[1]	F-statistic	p-value
T1=T2	0.78	0.38
T1=T3	0.08	0.77
T1=T4	2.62	0.11
T1=T5	0	0.99
T1=Control	2.87	0.09
T2=T3	0.36	0.55
T2=T4	0.54	0.46
T2=T5	0.8	0.37
T2=Control	0.54	0.46
T3=T4	1.77	0.18
T3=T5	0.09	0.77
T3=Control	1.91	0.17
T4=T5	2.65	0.10
T4=Control	0	0.96
T5=Control	2.89	0.09

Source: 2016 ANGeL Baseline Survey.
[1]See footnote of Table 5.1 for description of treatment arms.

7.3 Dietary Diversity

Household dietary diversity reflects an improvement in the household's diet. To better represent a quality diet, the number of different *food groups* consumed is calculated rather than the number of different *foods* consumed. Knowing that households consume, for example, an average of four different food groups implies that their diets offer some diversity in both macro- and micronutrients. This is a more meaningful indicator than knowing that households consume four different foods, which might all be cereals. The following set of 12 food groups is used to calculate the household dietary diversity score (Swindale and Bilinsky 2006).

1. Cereals
2. Roots and tubers
3. Vegetables
4. Fruits
5. Meat, poultry
6. Eggs
7. Fish and seafood
8. Pulses/legumes/nuts
9. Milk and milk products
10. Oils/fats
11. Sugar/honey
12. Miscellaneous

However, women's dietary diversity indicator aims to measure the micronutrient adequacy of the diet and reports the mean number of food groups consumed in the previous day by women of reproductive age (15-49 years). To calculate this indicator, nine food groups are used (Kennedy et al. 2010):

1. Starchy staples
2. Legumes, nuts, and seeds
3. Milk and milk products
4. Meat and fish
5. Organ meat
6. Eggs
7. Dark, green leafy vegetables
8. Other vitamin A-rich fruits and vegetables
9. Other fruits and vegetables

On the other hand, proportion of children 6–23 months of age who receive foods from four or more food groups of the seven food groups are said to be meeting minimum dietary diversity. The seven foods groups used for tabulation of this indicator are:

1. Grains, roots and tubers
2. Legumes and nuts
3. Dairy products (milk, yogurt)
4. Flesh foods (meat, fish, poultry, and liver/organ meats)
5. Eggs
6. Vitamin-A rich fruits and vegetables
7. Other fruits and vegetables

Consumption of any amount of food from each food group is sufficient to 'count' – that is, there is no minimum quantity unless an item was only used as a condiment (WHO 2010).

Information on household food consumption and individual food consumption should be collected using the previous 24-hours as a reference period (24-hour recall). When using the 24-hour recall method, the interviewer should first determine whether the previous 24 hour period was "usual" or "normal" for the household. If it was a special occasion, such as a funeral or feast, or if most household members were absent, another day should be selected for the interview (Swindale and Bilinsky 2006).

In the ANGeL baseline survey, food consumption of all individuals in the household was collected for one day using a combination of 24-hour food recall and food-weighing. Trained data collectors conducted interviewed the household member with primary responsibility for preparing and distributing meals in the home. The interviewer asked about recipes prepared, ingredients for the recipes, the sources of these ingredients (produced by the household, purchased in the market, collected, given by others), and amounts of foods and recipes eaten by various family members and guests.

The survey enumerator collected information from the respondent on what food items were prepared on the previous day for breakfast, lunch and dinner; and the ingredients used for each food item. Then the enumerator asked the respondent to show the raw food ingredients and the amount of each ingredient. The enumerator weighed the raw food using a weighing scale. The enumerator then asked the respondents to show the amount of food after cooking and the enumerator weighed the amount by measuring cups and standard bowls as appropriate.

The enumerator asked the respondent about how much of the cooked food was distributed to each of the household member and each guest, if any. Enumerators had with them standard pots, plates, cups and spoons to measure the cooked foods. Using these utensils, the respondent showed the enumerator the amount of each food item given to each individual. In case food is consumed outside the home by an individual household member, the enumerator asked that person to show or report the portion size of the food items. Using the information on the quantities of food items prepared at the household level and the quantities distributed to individuals, the proportion of each food item was estimated for each individual, and raw food ingredients were estimated for each household member and each guest, if any.

In addition, individual-level information was collected on leftovers/recipes eaten from the previous day, meals taken away from home, food given away, and food fed to animals. If meals were purposely missed or skipped by particular family members, respondents were asked to provide a reason (for example, felt ill). In some cases, family members were absent from home for one, two, or all three meals, and it was not known what was eaten. This information was also recorded. For the analyses, we excluded guests and people missing meals due to being absent from home whose food intakes were not known.

Table 7.4 shows that survey households consume an average of eight out of 12 food groups across all treatment groups. However, women of reproductive age (15-49 years) consume an average of five food groups out of nine groups. Approximately three out of seven food groups are consumed by children ages 6-23 months, which is lower than the recommended minimum dietary diversity level (four out of seven food groups).

Table 7.4 Dietary diversity

	Treatment arms[1]						
Indicator	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
	(number of food groups)						
Household's dietary diversity: out of 12 food groups	8.1	7.9	8.2	8.5	8.2	8.2	8.2
Woman's dietary diversity score (15-49 years): out of 9 food groups	5.1	4.9	5.1	5.4	5.3	5.0	5.1
Children's dietary diversity score (6-23 months): out of 7 food groups	3.1	3.0	3.2	3.1	3.1	3.2	3.1

Source: 2016 ANGeL Baseline Survey, IFPRI.
1 See footnote of Table 5.1 for description of treatment arms.

Table 7.5 shows baseline balancing across treatment arms for household dietary diversity. Approximately 66 percent of the combinations of treatment groups are significant at the 5 percent level, which indicates that the treatment arms are not well-balanced. We will use appropriate controls in our ANCOVA regression models to estimate impact on household dietary diversity.

Table 7.5 Household dietary diversity, baseline balancing test across treatment arms

Treatment arms[1]	F-statistic	p-value
T1=T2	4.23	0.04
T1=T3	4.40	0.04
T1=T4	24.47	0.00
T1=T5	3.21	0.07
T1=T6	3.40	0.07
T2=T3	17.24	0.00
T2=T4	49.04	0.00
T2=T5	14.80	0.00
T2=T6	16.52	0.00
T3=T4	8.12	0.00
T3=T5	0.09	0.76
T3=T6	0.18	0.67
T4=T5	9.96	0.00
T4=T6	12.24	0.00
T5=T6	0.01	0.93

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 7.6 demonstrates baseline balancing across treatment arms on women's dietary diversity. Approximately 80 percent of various combinations of treatment groups are

significant at the 5 percent level, which indicates that randomization was not effective at balancing baseline characteristics related to women's dietary diversity. We will use appropriate controls in our ANCOVA regression models to estimate impact.

Table 7.6 Women's dietary diversity, baseline balancing test across treatment arms

Treatment arms[1]	F-statistic	p-value
T1=T2	9.52	0.00
T1=T3	0.00	0.98
T1=T4	38.47	0.00
T1=T5	15.64	0.00
T1=T6	0.01	0.91
T2=T3	9.28	0.00
T2=T4	84.76	0.00
T2=T5	48.67	0.00
T2=T6	10.13	0.00
T3=T4	38.23	0.00
T3=T5	15.60	0.00
T3=T6	0.01	0.93
T4=T5	4.94	0.03
T4=T6	45.42	0.00
T5=T6	18.79	0.00

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

7.3.1 Minimum Acceptable Diet

This indicator measures the proportion of children ages 6-23 months who receive a minimum acceptable diet (MAD), apart from breastmilk. The "minimum acceptable diet" indicator measures both the minimum feeding frequency and minimum dietary diversity, as appropriate for various age groups. If a child meets the minimum feeding frequency and minimum dietary diversity for their age group and breastfeeding status, then they are considered to receive a minimum acceptable diet. Minimum meal frequency for breastfed children is defined as two or more feedings of solid, semi-solid, or soft food for children ages 6-8 months and three or more feedings of solid, semi-solid or soft food for children 9-23 months (Feed the Future Indicator Handbook, 2013). Table 7.7 shows that slightly more than 35 percent of children ages 6-23 months consume a minimum acceptable diet among ANGeL sample households, which is higher than the 2014 national average, 23 percent (NIPORT 2015).

Table 7.7 Prevalence of minimum acceptable diet among children ages 6-23 months

	Treatment arms[1]						
Indicator	T1	T2	T3	T4	T5	Control	All
Minimum acceptable diet	35.4	31.0	37.9	36.4	35.6	36.2	35.5

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

For children consuming a minimum acceptable diet (ages 6-23 months), Table 7.8 shows that nearly all treatment arms have p-values that are statistically non-significant at the 5 percent level or lower, indicating baseline balance.

Table 7.8 Minimum acceptable diet (children ages 6-23 months), baseline balancing test across treatment arms

Treatment arm[1]	F-statistic	p-value
T1=T2	2.01	0.16
T1=T3	0.63	0.43
T1=T4	0.11	0.74
T1=T5	0.00	0.95
T1=T6	0.08	0.78
T2=T3	4.97	0.03
T2=T4	3.12	0.08
T2=T5	2.24	0.13
T2=T6	3.37	0.07
T3=T4	0.23	0.63
T3=T5	0.55	0.46
T3=T6	0.34	0.56
T4=T5	0.07	0.79
T4=T6	0.00	0.94
T5=T6	0.05	0.83

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

7.4 Infant and Young Child Feeding Practices

7.4.1 Knowledge and Incidence of Breastfeeding

Table 7.9 summarizes the mothers' knowledge on breastfeeding practices. The starting time of breastfeeding and use of colostrum were already well understood by virtually all mothers at baseline. However, only 15 percent of mothers correctly stated the ideal frequency of breastfeeding. Mothers also lacked knowledge about the age at which children should be first fed semi-solids and liquids other than breast milk. On average, mothers answered only about three questions correctly out of the seven.

Table 7.9 Maternal knowledge regarding breastfeeding

Survey question	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(percent)						
Mothers correctly state how frequently they should breastfeed	21.0	10.4	15.4	14.2	16.2	14.2	15.2
Mothers correctly state when to initiate breastfeeding	96.8	95.0	94.1	96.5	94.2	97.0	95.7
Mothers correctly state age at which baby can be given liquids	10.7	12.0	8.6	9.6	11.0	10.5	10.4
Mothers correctly state age at which baby can be given semi-solid foods	11.8	15.4	9.9	11.2	13.9	8.6	11.6
Mothers correctly state what to do with colostrum	95.7	96.6	97.3	96.0	97.1	96.3	96.5
Mothers correctly state what to do if baby is not consuming enough breastmilk	61.6	52.5	50.1	54.6	57.0	53.4	54.8
Mothers know not to give baby <6m water when it is hot	40.5	34.2	41.9	35.0	43.2	39.8	39.2
Mean number of correct answers	3.38	3.16	3.17	3.17	3.33	3.20	3.23

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 7.10 shows the percent of children ages 0-5 months who were exclusively breastfed the day preceding the survey. Exclusive breastfeeding means that the infant received breast milk and may have received oral rehydration solution (ORS), vitamins, minerals and/or medicines, but did not receive any other food or liquid, including water. The denominator is the total number of children 0-5 months in the sample with exclusive breastfeeding data. Results show 66.2 percent of children under six months of age are exclusively breastfed, which is slightly more than the 2014 national average of 55 percent (NIPORT 2015).

Table 7.10 Children ages 0-5 months exclusively breastfed

Indicator	Treatment arms[1]					Control	All
	T1	T2	T3	T4	T5		
	(percent)						
Exclusively breastfed children	68.2	65.8	68.1	58.8	77.6	60.6	66.2

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

7.4.2 Knowledge of Micronutrient Supplements

Mothers were asked if they had ever heard of the micronutrient powder Sprinkles, given Sprinkles to their children (under 60 months), and whether they had used Sprinkles in the previous month. Enumerators carried sample packets so that mothers would know exactly what the questions were referring to. Table 7.11 shows that nearly 49 percent of the mothers had heard of Sprinkles, and only 14.6 percent had ever given their children this micronutrient powder.

Table 7.11 Awareness and use of micronutrient powders

	Treatment arms[1]						
Survey question	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
	(percent of respondents responding yes)						
Have you ever heard of a powder called Sprinkles for putting in the food of young children?	54.2	47.0	54.1	41.1	44.6	53.6	49.4
Have you ever given these to your preschool children?	15.4	14.4	14.4	12.5	11.8	17.6	14.6
Have you used these in the last month?	5.4	6.6	5.1	3.4	3.4	7.1	5.3

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

7.5 Anthropometry

The ANGeL baseline survey collected anthropometric data (age, weight, and height) for all household members in the ANGeL sample households. In this section, we use these anthropometric data to assess the nutritional status for children ages 0-59 months.

Stunting is an indicator of chronic malnutrition, measured by height-for-age Z-score (HAZ). Children who are below -2 standard deviations of the median are considered stunted by World Health Organization (WHO) Child Growth Standards. Table 7.12 shows that 33.4 percent of all children 0-59 months sampled are stunted compared to 36 percent from the 2014 national average (NIPORT 2015). The ANGeL data suggest that boys have higher levels of stunting compared to girls across all treatment and control groups. This counters conventional knowledge, which may assume that girls would be discriminated against and be more at risk of stunting.

Wasting is an indicator of acute undernutrition, measured by weight-for-height Z-score (WHZ). Children who are below -2 standard deviations of the median are considered wasted by WHO Child Growth Standards. Table 7.12 shows that 8.8 percent of all children 0-59 months are wasted in the ANGeL sample, which is less than the 2014 national average, 14 percent (NIPORT 2015).

The proportion of underweight, measured by weight-for-age Z-score (WAZ), measures progress toward reducing hunger. Children who are below -2 standard deviations of the

median are considered underweight by WHO Child Growth Standards. Table 7.12 shows that boys have higher levels of underweight than girls across all groups except T1. The percent of underweight children in the sample ranges from 18.0 percent in T5 to 24.2 percent in T1, which is lower than the 2014 national average – 33 percent (NIPORT 2015).

Table 7.12 Nutritional status of children (0-59 months)

	Treatment arms[1]											
	T1		T2		T3		T4		T5		Control		All	
	Percentage below -2 SD	Mean Z-score (SD)	Percentage below -2 SD	Mean Z-score (SD)	Percentage below -2 SD	Mean Z-score (SD)	Percentage below -2 SD	Mean Z-score (SD)	Percentage below -2 SD	Mean Z-score (SD)	Percentage below -2 SD	Mean Z-score (SD)	Percentage below -2 SD	Mean Z-score (SD)
Height-for-age														
Male	37.0	-1.5	38.1	-1.7	36.6	-1.6	32.4	-1.4	30.0	-1.5	36.9	-1.5	35.2	-1.5
Female	34.2	-1.5	30.6	-1.4	28.0	-1.3	28.9	-1.4	30.5	-1.4	35.7	-1.4	31.6	-1.4
All	35.5	-1.5	34.2	-1.5	32.3	-1.5	30.7	-1.4	30.3	-1.4	36.3	-1.5	33.4	-1.5
Weight-for-height														
Male	7.8	-0.5	8.0	-0.5	8.1	-0.4	12.1	-0.6	7.1	-0.4	9.2	-0.5	8.7	-0.5
Female	11.9	-0.6	9.6	-0.6	6.8	-0.5	10.3	-0.6	6.4	-0.5	8.5	-0.5	8.9	-0.5
All	10.0	-0.6	8.8	-0.5	7.5	-0.4	11.2	-0.6	6.8	-0.4	8.8	-0.5	8.8	-0.5
Weight-for-age														
Male	20.4	-1.2	25.1	-1.3	22.4	-1.2	24.5	-1.2	18.3	-1.1	23.2	-1.2	22.3	-1.2
Sex	27.7	-1.3	24.2	-1.2	18.3	-1.1	22.6	-1.3	17.8	-1.1	22.1	-1.2	22.2	-1.2
All	24.2	-1.3	24.7	-1.2	20.4	-1.2	23.6	-1.2	18.0	-1.1	22.6	-1.2	22.3	-1.2

Source: 2016 ANGeL Baseline Survey, IFPRI.

[1]See footnote of Table 5.1 for description of treatment arms.

8. WOMEN'S EMPOWERMENT

8.1 Women's Empowerment in Agriculture Index (WEAI)

The Women's Empowerment in Agriculture Index (WEAI) measures the empowerment, agency, and inclusion of women in the agriculture sector in an effort to identify and address the constraints that hinder women's full engagement in the agriculture sector.
The WEAI is composed of two sub-indexes: (1) the five domains of empowerment sub-index (5DE) measures the empowerment of women in five areas; and the gender parity sub-Index (GPI) measures the average level of equality in empowerment of men and women within the household. The WEAI is an aggregate index based on individual-level data on men and women within the same households and data on women living in households with no adult male.

The 5DE sub-index assesses whether women are empowered across the five domains examined in the WEAI. Each domain is weighted equally, as are each of the indicators within a domain. The five domains, their definitions under the WEAI, the corresponding indicators, and their weights for the 5DE are presented in Table 8.1 (Alkire et al. 2012).

The 5DE is a measure of empowerment rather than disempowerment. A woman is defined as empowered in the 5DE if she reaches the threshold of empowerment in 80 percent or more of the weighted indicators. For disempowered women, the 5DE also shows the percentage of indicators in which those women meet the threshold of empowerment. The 5DE contributes 90 percent of the weight to the WEAI.

The GPI reflects the percentage of women who are as empowered as the men in their households. It is a relative equality measure that demonstrates the equality in 5DE profiles between the primary adult male and female in each household. In most cases, these are husband and wife, but they can be the primary male and female decision-maker regardless of their relationship to each other. For households that have not achieved gender parity, the GPI shows the gap that needs to be closed for women to reach the same level of empowerment as men. By definition, households without a primary adult male are excluded from this measure, and thus the aggregate WEAI uses the mean GPI value of dual-adult households. The GPI contributes 10 percent of the weight to the WEAI.

The 5DE score ranges from zero to one, where higher values indicate greater empowerment. It is constructed using a robust multidimensional methodology known as the Alkire Foster Method (see http://www.ophi.org.uk/research/multidimensional-poverty/alkirefoster-method/ for information on the method). The score has two components. First, it reflects the percentage of women who are empowered (He). Second, it

reflects the percentage of domains in which those women who are not yet empowered (Hn) still have adequate achievements (Aa).The 5DE formula is: 5DE = {He + (Hn x Aa)), where He + Hn= 100% and 0 <Aa< 80%.

Table 8.1 The five domains of empowerment in the WEAI

Domain (each weighted 1/5 of 5DE sub-index)	Definition of domain	Indicators	Weight of indicator in 5DE sub-index
Production	Sole or joint decision-making over food and cash crop farming, livestock, fisheries as well as autonomy in agricultural production.	Input in decisions	1/10
		Autonomy in production	1/10
Resources	Ownership, access to, and decision-making power over productive resources such as land, livestock, agricultural equipment, consumer durables, and credit	Ownership of assets	1/15
		Purchase, sale, or transfer of assets.	1/15
		Access to and decisions on credit.	1/15
Income	Sole or joint control over income and expenditures.	Control over use of income.	1/5
Leadership	Membership in economic or social groups and comfort speaking in public.	Group member.	1/10
		Speaking in public.	1/10
Time	Allocation of time to productive and domestic tasks and satisfaction with the available time for leisure activities	Workload	1/10
		Leisure	1/10

Source: Alkire et al. 2012.

The GPI ranges from zero to one, with higher values indicating greater gender parity, and is constructed with two factors. First, it shows the percentage of women whose empowerment scores are lower than the men's in the household (HGPI). Second, the GPI shows the percentage shortfall in empowerment scores (IGPI) for those women who do not have gender parity. The overall formula is the product of these two numbers, following the Foster Greer Thorbecke "poverty gap" measure: GPI = {1 − (HGPI x IGPI)}.

8.1.1 Abbreviated WEAI (A-WEAI)

IFPRI's BIHS 2011/12 used the original WEAI. In November 2013, IFPRI and USAID implementing partners shared their experiences using WEAI. Partners reported that WEAI was resource-intensive (for example, time to administer modules and field costs), and certain modules – particularly time use, autonomy in production, and speaking up in public – were time-consuming, sensitive, and difficult to understand. IFPRI, in consultation with USAID and Oxford Poverty and Human Development Initiative (OPHI), incorporated this feedback to revise the WEAI, which resulted in two tools: (1) an updated version of the original WEAI; and (2) a shorter, streamlined version known as the Abbreviated WEAI (A-WEAI) (Table 8.2).

The updated WEAI contains primarily the same indicators and questions as the original WEAI, except for the autonomy module revised to include vignettes (short hypothetical stories). The updated WEAI also includes minor changes such as streamlined response codes, improved formatting, and additional instructions. On the other hand, the A-WEAI retains the five domains of empowerment, but the 10 indicators are reduced to six, and therefore takes about 30 percent less time to administer compared to the original WEAI. It also includes a simplified 24- hour recall time module that collects only primary activities and streamlined sections on production decisions and resources. Table 8.2 compares the domains and indicators between the original WEAI and A-WEAI. The original WEAI is also referred to as WEAI 1.0.

ANGeL uses the A-WEAI to track empowerment within the sample over the course of the project. Similar to the original WEAI, A-WEAI captures (1) production, (2) resources, (3) income, (4) leadership, and (5) time; however, select sub-domains are omitted. Since A-WEAI typically removes the calculation the sub-domain "autonomy in production," IFPRI researchers decided to capture A-WEAI with and without autonomy in production, given that this is a central area of research of which we would like to draw conclusions.

Table 8.2 Comparison of original WEAI and A-WEAI

Original WEAI		A-WEAI	
Domains	**Indicators**	**Domains**	**Indicators**
Production	Input in productive decisions Autonomy in production	Production	Input in productive decisions
Resources	Ownership of assets Purchase, sale, or transfer of assets Access to and decisions on credit	Resources	Ownership of assets Access to and decisions on credit
Income	Control over use of income	Income	Control over use of income
Leadership	Group membership Speaking in public	Leadership	Group membership
Time	Workload Leisure	Time	Workload

Source: Constructed by authors.

Table 8.3 shows that 69.05 percent of women are disempowered in the five domains (that is, production, resources, income, leadership, and time); thus, only 30.95 percent of all women are empowered. This percentage is quite low, but logical as the female respondents are relatively young (mothers of children under 24 months, as per the selection criteria) and age is seen to be significantly associated with women's empowerment (Sraboni, Quisumbing, and Ahmed 2014a). Among the sample households, the women who are not yet empowered still have, on average, adequate achievements in 58.87 percent of the domains. Thus, the overall five dimensions of empowerment (5DE) for women is 30.95 percent + (69.05 percent x 58.87 percent) =0.72. The WEAI for the sample households is 0.73. It is a weighted average of the 5DE sub-index value of 0.72 and the GPI sub-index value of 0.89.

Meanwhile, 58.07 percent of women have gender parity with the primary male in their household. Of the 41.93 percent of women who do not have gender parity, the empowerment gap between the female and male household heads is 26.9 percent. Thus, the overall GPI is {1-(41.93 percent x 26.91 percent)}, or 0.89. Figure 8.1 illustrates women's empowerment status among the sample households.

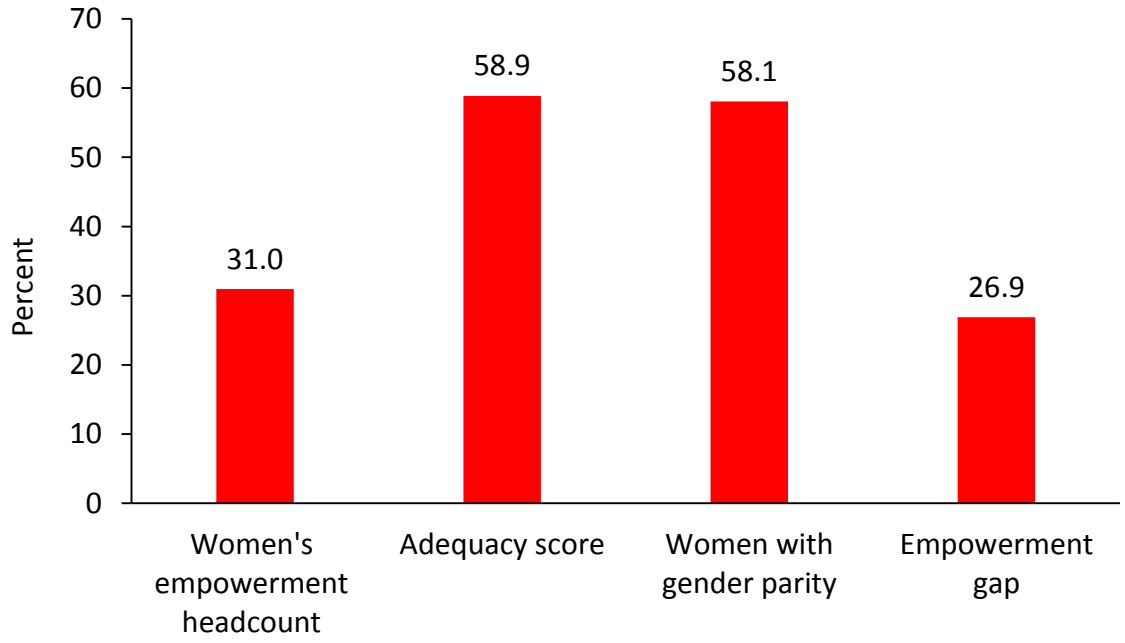
Table 8.3 A-WEAI results

	Treatment arms[1]						
Indicator	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
Women							
Disempowered headcount (%)	68.3	69.1	72.9	68.4	63.2	69.3	69.1
Empowered headcount (%)	31.8	30.9	27.1	31.6	36.8	30.7	31.0
Average inadequacy score	39.77	43.93	41.37	40.41	39.93	41.85	41.13
Average adequacy score	60.23	56.07	58.63	59.59	60.07	58.15	58.87
5DE Index	0.73	0.70	0.70	0.72	0.75	0.71	0.72
% of women with no gender parity (HGPI)	35.10	46.22	43.16	42.03	36.67	46.48	41.93
% of women with gender parity (HWGP)	64.90	53.78	56.84	57.97	63.33	53.52	58.07
Average Empowerment Gap (IGPI)	25.51	29.40	25.65	25.48	27.00	27.57	26.91
GPI[1-(HGPI*IGPI)]	0.91	0.86	0.89	0.89	0.90	0.87	0.89
WEAI=(.9*5DE+0.1*GPI)	0.75	0.71	0.72	0.74	0.76	0.73	0.73
Men							
Disempowered headcount (%)	64.5	56.8	60.3	60.6	55.9	54.4	58.5
Empowered headcount (%)	35.6	43.2	39.7	39.4	44.1	45.6	41.5
Average inadequacy score	39.70	39.20	39.02	38.00	38.84	38.89	38.94
Average adequacy score	60.30	60.80	60.98	62.00	61.16	61.11	61.06
5DE Index	0.74	0.78	0.76	0.77	0.78	0.79	0.79

Source: 2016 ANGeL Baseline Survey, IFPRI.

[1]See footnote of Table 5.1 for description of treatment arms.

Figure 8.1 Women's empowerment status among the ANGeL sample household



Source: 2016 ANGeL Baseline Survey, IFPRI.

To observe how A-WEAI is affected when autonomy is added, we also calculated A-WEAI with autonomy. Table 8.4 shows that adding autonomy slightly reduces the percentage of empowered women (30.95 vs. 29.61 percent) and men (41.52 vs. 39.54 percent); however, GPI remains the same.

Table 8.4 A-WEAI + autonomy

	Treatment arms[1]						
Indicator	**T1**	**T2**	**T3**	**T4**	**T5**	**Control**	**All**
Women							
Disempowered headcount (%)	69.5	70.8	75.0	70.3	63.2	71.0	70.4
Empowered headcount (%)	30.5	29.2	25.0	29.7	36.8	29.03	29.6
Average inadequacy score	38.98	43.17	41.44	40.33	39.04	42.05	40.84
Average adequacy score	61.02	56.83	58.56	59.67	60.96	57.95	59.16
5DE Index	0.73	0.69	0.69	0.72	0.75	0.70	0.71
% of women with no gender parity(HGPI)	35.47	48.86	46.00	45.08	36.67	48.82	43.84
% of women with gender parity(HWGP)	64.53	51.14	54.00	54.92	63.33	51.18	56.16
Average Empowerment Gap (IGPI)	23.70	13.24	24.85	23.83	24.82	26.73	25.4
GPI[1-(HGPI*IGPI)]	0.92	0.87	0.89	0.89	0.91	0.87	0.89
WEAI=(.9*5DE+0.1*GPI)	0.75	0.71	0.71	0.73	0.77	0.72	0.73
Men							
Disempowered headcount (%)	66.8	58.9	62.8	62.4	57.3	56.2	60.5
Empowered headcount (%)	33.2	41.1	37.2	37.6	42.7	43.8	39.5
Average inadequacy score	38.99	38.55	38.64	37.76	38.56	38.41	38.49
Average adequacy score	61.01	61.45	61.36	62.24	61.44	61.59	61.51
5DE Index	0.74	0.77	0.76	0.76	0.78	0.78	0.77

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 8.5 indicates that nearly one-half of combinations of treatment and control groups are statistically significant at the 5 percent level (47 percent). We will use appropriate controls in our ANCOVA regression models to estimate impact.

Table 8.5 Individual level 5DE (A-WEAI) for women, baseline balancing test across treatment arms and control

Treatment arms[1]	F-statistic	p-value
T1=T2	7.86	0.01
T1=T3	9.49	0.00
T1=T4	1.41	0.24
T1=T5	8.09	0.00
T1= Control	6.54	0.01
T2=T3	0.08	0.78
T2=T4	2.60	0.11
T2=T5	31.99	0.00
T2= Control	0.22	0.64
T3=T4	3.59	0.06
T3=T5	35.10	0.00
T3= Control	0.59	0.44
T4=T5	16.24	0.00
T4= Control	1.63	0.20
T5= Control	31.72	0.00

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

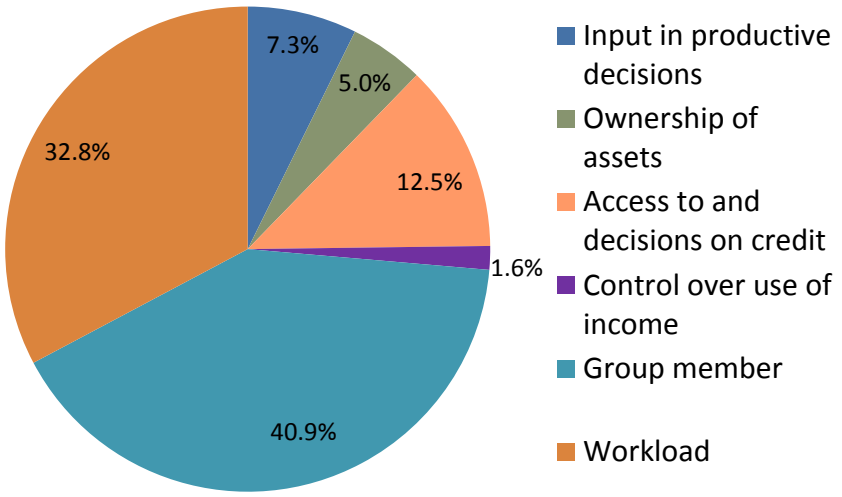
Tables 8.6 and 8.7 show the contribution of six indicators towards disempowerment of women and men, respectively, disaggregated by treatment and control groups. Across all treatment and control groups, major areas of disempowerment for women and men include lack of access to and decisions on credit, lack of group membership, and lack of satisfaction with the available time for leisure activities. Figure 8.2 illustrates the contribution of the indicators to disempowerment of women.

Table 8.6 Contribution of each of the six domain indicators to disempowerment of women

Domain	Indicators	Weight of indicator in 5DE Sub-Index	Treatment arms[1]						
			T1	T2	T3	T4	T5	Control	All
			(percent)						
Production	Input in productive decisions	1/5	9.0	7.6	5.3	6.9	9.3	6.4	7.3
Resources	Ownership of assets	2/15	3.8	5.8	5.0	2.8	5.1	6.5	5.0
	Access to and decisions on credit	1/15	13.2	11.0	12.8	12.5	13.7	12.3	12.5
Income	Control over use of income	1/5	0.8	2.7	1.1	2.0	1.9	1.1	1.6
Leadership	Group member	1/5	39.8	37.6	44.1	42.3	40.5	40.9	40.9
Time	Workload	1/5	33.3	35.4	31.6	33.5	29.5	32.8	32.8

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Figure 8.2 A-WEAI: Contribution of each indicator to women's disempowerment



Source: 2016 ANGeL Baseline Survey, IFPRI.

Table 8.7 Contribution of each of the six sub-domain indicators to disempowerment of men

Domain	Indicators	Weight of indicator in 5DE Sub-Index	Treatment arms[1]					Control	All
			T1	T2	T3	T4	T5		
						(percent)			
Production	Input in productive decisions	1/5	3.2	4.9	3.3	4.9	5.6	3.4	4.1
	Ownership of assets	2/15	-	0.3	-	0.3	0.2	-	0.1
Resources	Access to and decisions on credit	1/15	8.4	8.0	9.2	9.6	7.9	9.8	8.9
Income	Control over use of income	1/5	-	-	0.1	-	-	-	0.0
Leadership	Group member	1/5	48.3	49.4	49.6	49.9	48.5	49.5	49.2
Time	Workload	1/5	40.1	37.4	37.8	35.3	37.8	37.3	37.6

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Tables 8.8 and 8.9 show disempowerment headcounts of women and men, respectively, disaggregated by treatment and control groups. For women and men, disempowerment rates were highest in the leadership domain (59.7 and 52.4 percent, respectively). The second leading domain for women's disempowerment was access to and decisions on credit (53.6 percent), whereas men's second leading domain for disempowerment was leisure, as denoted by the time domain (39.5 percent).

Table 8.8 WEAI: Disempowerment headcount of women by six sub-domains

Domain	Indicators	Weight of indicator in 5DE Sub-Index	Treatment arms[1]					Control	All
			T1	T2	T3	T4	T5		
						(percent)			
Production	Input in productive decisions	1/5	10.4	12.3	11.5	8.0	9.6	11.8	9.3
Resources	Ownership of assets	2/15	10.6	7.7	13.2	11.4	5.8	9.6	14.3
	Access to and decisions on credit	1/15	53.3	53.9	50.4	58.1	51.9	52.0	53.6
Income	Control over use of income	1/5	2.2	1.1	4.1	1.7	2.7	2.4	1.6
Leadership	Group member	1/5	58.0	54.0	57.4	66.6	58.8	51.2	59.7
Time	Workload	1/5	46.5	45.3	54.0	47.7	46.6	37.3	47.9

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

Table 8.9 WEAI disempowerment headcount of men by six sub-domains

Domain	Indicators	Weight of indicator in 5DE Sub-Index	Treatment arms[1]					Control	All
			T1	T2	T3	T4	T5		
						(percent)			
Production	Input in productive decisions	1/5	4.7	3.2	5.5	3.8	5.7	6.1	3.6
	Ownership of assets	2/15	0.2	-	0.5	-	0.5	0.3	-
Resources	Access to and decisions on credit	1/15	30.4	8.4	26.8	32.7	33.3	25.8	31.2
Income	Control over use of income	1/5	0.0	-	-	0.2	-	-	-
Leadership	Group member	1/5	56.0	48.3	55.0	58.3	57.4	52.7	52.4
Time	Workload	1/5	42.9	40.1	41.6	44.5	40.6	41.0	39.5

Source: 2016 ANGeL Baseline Survey, IFPRI.
[1]See footnote of Table 5.1 for description of treatment arms.

9. SUMMARY AND CONCLUSIONS

The Agriculture, Nutrition, and Gender Linkages (ANGeL) Project is a randomized controlled trial experiment that aims to identify actions and investments in agriculture that will help to improve nutrition and empower women. IFPRI researchers designed this project, which the Bangladesh Ministry of Agriculture and other partners are implementing. IFPRI will evaluate the impact of three types of interventions under ANGeL for promoting nutrition- and gender-sensitive agriculture: (1) agricultural production, (2) nutrition knowledge, and (3) gender sensitization. The Ministry of Agriculture plans to use ANGeL data to (1) identify which interventions most effectively increase agricultural diversity, improve nutrition, and promote women's empowerment; and (2) scale up the most effective interventions at the national level.

The ANGeL baseline survey was conducted under the Bangladesh Policy Research and Strategy Support Program (PRSSP) implemented by IFPRI, with financial support from USAID. The ANGeL baseline survey sampled 3,125 treatment households and 875 control households across 16 districts in rural Bangladesh from November 2015 to January 2016.

The report examines a wide variety of areas – surveyed household characteristics, agricultural production and practices, food consumption and nutrition, and women's empowerment – which, altogether, seek to provide a comprehensive profile of the ANGeL sample prior to the project's two-year implementation. This report provides key findings from the baseline study, which will be compared with the final evaluation survey to assess the impacts of a combination of interventions on agricultural production, nutrition knowledge, and gender sensitization of participant households. These findings will later guide the design of a national program to be implemented by the Ministry of Agriculture following the ANGeL project's conclusion.

Agriculture

Land is the most important factor of agriculture production. Most sample households are reliant on farming for their main source of income. However, 37 percent of the ANGeL sample farmers are pure tenants – that is, they do not own the land they work. Therefore, they have insecure, prohibitive, and unstable access to land through sharecropping or cash-leasing arrangements, which act as a deterrent for technology adoption. These farmers must pay rent (in cash or crop) for the land they cultivate, which makes farming a low-profit enterprise for them. The final ANGeL study will take into account the implications of this important constraint arising from the prevailing agrarian structure in the country.

The dominant tenurial arrangement among ANGeL households is sharecropping (50 percent), in which the produce is shared between the cultivator and the landowner in different proportions that have been agreed upon prior to cultivation. This rate is

significantly higher than the BIHS 2011/12 national average of sharecropping, which is around 40 percent (Ahmed et al. 2013).

Marginal and small farmers are the largest share of farmers in this sample (80 percent); however, agricultural extension outreach to these two groups is low in absolute terms (34 percent), and considerably less than medium- and large-size farmers, who receive three-quarters of agricultural extension service, but make up only one-fifth of all sample farmers. The use of agricultural extension officials to disseminate agriculture production messages during ANGeL trainings may help overcome this disconnect, which will be evaluated in the final study.

Using data from 2011/12 BIHS, IFPRI research shows a strong and significant positive association between crop diversity and dietary diversity – the more food crops the households produce, the higher their dietary diversity (Sraboni et al. 2014b). Given that most food produced is consumed locally and nationally, crop choices also have implications for nutrition. Using the Simpson diversification index, we observe low levels of agricultural diversity among the ANGeL sample (15–21 percent), which falls below the national average of 24 percent (calculated by authors using data from 2015 BIHS).

Despite the fact that crops such as rice that give relatively low value output per unit of land offer less scope for sustained income growth than high-value agricultural commodities, rice remains overwhelmingly dominant in the cropping patterns, as well as in the diet of the people in Bangladesh. Baseline results indicate that the share of rice on total cropped land is higher than the 2011/12 BIHS national rural average (82 percent vs. 77 percent) (Ahmed et al. 2013).

There are various constraints for agricultural diversification. Year-to-year price fluctuations are much larger for non-rice crops than for rice, indicating relatively high levels of market-induced risks for production of non-rice crops. High-value crops, especially fruits and vegetables, have thin domestic markets owing to relatively low levels of demand for them. Horticultural crops also face special problems related to perishability, which increases the risks of marketing. The interplay of these factors contributes to the risks in producing horticultural crops. However, these factors also imply that addressing the market efficiency issues is likely to be an effective means of reducing the risks associated with adoption of high-value agricultural production. The ANGeL Project aims to reveal the constraints to agricultural diversity and to formulate appropriate policies to remove them.

The baseline results highlight the need for further investment in the agriculture sector and, in particular, support for smallholder farmers to promote diversification beyond cereal crops. In this regard, it will be interesting to see the impact of trainings for farm households by agriculture extension workers on agricultural diversity at endline.

Food Consumption and Nutrition

Improving dietary diversity is one of the primary objectives of the ANGeL Project because it is closely associated with maternal and child nutrition outcomes. ANGeL households consume an average of eight out of twelve food groups across all treatment groups. Moreover, women of reproductive age (15-49 years) only consume an average of five food groups out of nine groups, and children ages 6-23 months consume only three out of seven food groups, which is lower than the recommended minimum dietary diversity level (four out of seven food groups). These findings corresponds with results that show that three-fourths of calories in the diet of sample households come from rice, indicating highly rice-centric diets.

Most households have sufficient knowledge on infant and young child feeding (IYCF) practices, particularly breastfeeding. Three-fourths of children under six months are exclusively breastfed, which is slightly more than the 2014 national average (55 percent) (NIPORT 2015). Nonetheless, greater coverage of high quality interventions to promote exclusive breastfeeding for the first six months of life, continued breastfeeding after the introduction of complementary foods, and ensured adequate dietary diversity and meal frequency are urgently needed if better nutritional outcomes for Bangladesh's most vulnerable subgroups of infants and children is to be secured. ANGeL's nutrition BCC intervention aims to increase this knowledge base for this target population.

Children's Nutritional Status

Anthropometric indicators for children under five years of age (0-59 months) provide outcome measures of nutritional status. Overall, sampled households have slightly better anthropometric outcomes compared to the 2014 national results. For example, one-third of sampled children are stunted, which is slightly lower than the 2014 DHS national results (36 percent). Around 9 percent of children under-five among ANGeL sample households are wasted versus the 2014 national average – 14 percent. Nearly 23 percent of under-five children are underweight in the ANGeL sample, which similarly falls below the 2014 national average of 33 percent (NIPORT 2015). Further, ANGeL baseline results suggest that boys under-five have higher levels of underweight and stunting compared to girls of the same age cohort.

These findings are important because both underweight and stunting are longitudinal measures of child nutrition. They demonstrate chronic nutritional status, and can thereby implicate long-term food security issues. Wasting, on the other hand, reflects the short-term nutritional context (for example, acute illness like diarrhea or calorie deficiency based on an idiosyncratic event caused by shocks). Thus, high rates of stunting and underweight in children under-five demonstrates Bangladesh's intertwined food security and nutritional challenges, which ANGeL's interventions aim to address.

Women's Empowerment

The ANGeL baseline survey is the first survey in Bangladesh to use the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI), which is a shorter, more streamlined version of the WEAI.

In four treatment arms of ANGeL, agricultural extension workers deliver extension messages and training to both women and men, with special efforts to ensure that this training reaches women. At endline the study will examine whether women's access to agricultural extension services empowers them in terms of sole or joint decisionmaking over farming and autonomy in agricultural production and marketing (for example, what inputs to buy, what crops to grow, what livestock to raise, what and how much produce to sell, etc.). Further, ANGeL's gender sensitization activities, using a tool called Nurturing Connections developed by HKI, foster communication, negotiation skills, and mutual respect and appreciation within families, which, in turn, may promote women's empowerment.

REFERENCES

Ahmed, A.U., K. Ahmad, V. Chou, R. Hernandez, P. Menon, F. Naeem, W. Quabili, E. Sraboni, and B. Yu. 2013. *The Status of Food Security in the Feed the Future Zone and Other Regions of Bangladesh: Results from the 2011-2012 Bangladesh Integrated household Survey.* Project Report prepared for the U.S. Agency for International Development (USAID). Dhaka: International Food Policy Research Institute. http://thedata.harvard.edu/dvn/dv/IFPRI/faces/study/StudyPage.xhtml?globalId=hdl:1902.1/21266

Ahmed, A. U., J. Hoddinott, S. Roy, E. Sraboni, W. Quabili, and A. Margolies. 2016. *Which Kinds of Social Safety Net Transfers Work Best for the Ultra Poor in Bangladesh? Operation and Impacts of the Transfer Modality Research Initiative*. Project report. Dhaka: International Food Policy Research Institute.

Alkire, S., R. Meinzen-Dick, A. Peterman, A. R. Quisumbing, G. Seymour, and A. Vaz. 2012. The Women's Empowerment in Agriculture Index. IFPRI Discussion Paper 1240. Washington, DC: International Food Policy Research Institute. Downloadable at: http://www.ifpri.org/publication/women-s-empowerment-agriculture-index.

Asaduzzaman, M. 2010. *The Next Agricultural Transition in Bangladesh: Which Transition, Why, and How.* Paper presented at the Conference on Understanding the Next Generation in Asia. Bangkok, Thailand.

BBS (Bangladesh Bureau of Statistics). 2012. *Statistical Year Book Bangladesh 2011*. Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

BBS (Bangladesh Bureau of Statistics). 2016. *Statistical Year Book Bangladesh 2015*. Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

Friedman, M. 1957. *A Theory of the Consumption Function*. Princeton, N.J.: Princeton University Press.

Heady, D. and J. Hoddinott. 2016. Agriculture, Nutrition and the Green Revolution in Bangladesh. *Agricultural Systems* 149: 122-131.

Herforth, A., and J. Harris. 2014. *Understanding and Applying Primary Pathways and Principles*. Brief #1. Improving Nutrition through Agriculture Technical Brief Series. Arlington, VA: USAID/Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) Project.

Hidrobo, H., J. Hoddinott, A. Peterman, A. Margolies, and V. Moreira. 2014. Cash, Food, or Vouchers? Evidence From a Randomized Experiment in Northern Ecuador. *Journal of Development Economics* 107: 144–156.

ICDDR,B (International Center for Diarrheal Disease Research, Bangladesh), UNICEF (UN Children's Fund), GAIN (Global Alliance for Improved Nutrition), IPHN (Institute of Public Health and Nutrition). 2013. *National Micronutrients Survey 2011-12*. Dhaka: Centre for Nutrition and Food Security, ICDDR,B.

Kennedy, G., T. Ballard, and M.C. Dop. 2010. *Guidelines for Measuring Household and Individual Dietary Diversity*. Nutrition and Consumer Protection Division, Food and Agriculture Organization of the United Nations. [Available in: http://www.fao.org/3/a-i1983e.pdf]

Malapit, H. J. L., E. Sraboni, A. R. Quisumbing, and A. Ahmed. 2015. *Gender Empowerment Gaps in Agriculture and Children's Well-Being in Bangladesh*. IFPRI Discussion Paper 1470. Washington, DC: International Food Policy Research Institute.

McKenzie, D. 2010. *Beyond Baseline and Follow-Up: The Case for More T in Experiments.* Policy Research Working Paper 5639. Washington, DC: The World Bank.

Menon, P., P. H. Nguyen, K. K. Saha, A. Khaled, T. Sanghvi, J. Baker, K. Afsana, R. Haque, E. A. Frongillo, M. T. Ruel, and R. Rawat. 2016. Combining Intensive Counseling by Frontline Workers with a Nationwide Mass Media Campaign Has Large Differential Impacts on Complementary Feeding Practices but Not on Child Growth: Results of a Cluster-Randomized Program Evaluation in Bangladesh. *The Journal of Nutrition*. doi: 10.3945/jn.116.232314

NIPORT (National Institute of Population Research and Training). 2015. *Bangladesh Demographic and Health Survey 2014.* Dhaka, Bangladesh and Calverton, MD: NIPORT, Mitra and Associates, and ICF International.

Smith, L.C., U. Ramakrishnan, A. Ndiaye, L. Haddad, and R. Martorell. 2003. *The Importance of Women's Status for Child Nutrition in Developing Countries,* Research Report 131, International Food Policy Research Institute, Washington DC, Department of International Health, Emory University.

Sraboni, E., A. R. Quisumbing, and A. U. Ahmed. 2014a. How Empowered are Bangladeshi Women in the Agricultural Setting? Empirical Evidence Using a New Index. *Bangladesh Development Studies* 37(3): 1-25.

Sraboni, E., H. J. Malapit, A. R. Quisumbing, and A. U. Ahmed. 2014b. Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh? *World Development* 61: 11-52.

Swindale, A. and P. Bilinsky. 2006. *Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (v.2)*. Washington, DC: FHI 360/FANTA.

von Grebmer, K., B. Nestorova, A. R. Quisumbing, R. Fertziger, H. Fritschel, R. Pandya-Lorch, and Y. Yohannes. 2009. *2009 Global Hunger Index: The Challenge of Hunger: Focus on Financial Crisis and Gender Inequality.* Bonn, Washington DC, and Dublin: Deutsche Welthungerhilfe, International Food Policy Research Institute, and Concern Worldwide.

WHO (World Health Organization). 2010. Indicators for Assessing Infant and Young Child Feeding Practices. Part 2 Measurement. Geneva; WHO. Available at: http://www.who.int/nutrition/publications/infantfeeding/9789241596664/en/index.html

Photo credits
Cover page (left to right): Farha Khan, Stephen Bugno, Farha Khan

Cover design
Samita Kaiser, IFPRI-Dhaka

IFPRI Bangladesh
House 10A, Road 35, Gulshan 2, Dhaka 1212, Bangladesh
Tel: +88.02.989.8686, 989.3434 I Fax: +88.02.989.6760 | IFPRI-Bangladesh@cgiar.org

IFPRI Headquarters
2033 K Street, NW, Washington, DC 20006-1002, USA
Tel: +1.202.862.5600 | Fax: +1.202.467.4439 | ifpri@cgiar.org | www.ifpri.org
A member of the CGIAR Consortium