IFPRI Discussion Paper 02149

December 2022

Comparing Delivery Channels to Promote Nutrition-Sensitive Agriculture

A Cluster-Randomized Controlled Trial in Bangladesh

Akhter Ahmed

Fiona Coleman

John Hoddinott

Purnima Menon

Aklima Parvin

Audrey Pereira

Agnes Quisumbing

Shalini Roy

Poverty, Health, and Nutrition Division

Cornell University

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI), a CGIAR Research Center established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. IFPRI's strategic research aims to foster a climate-resilient and sustainable food supply; promote healthy diets and nutrition for all; build inclusive and efficient markets, trade systems, and food industries; transform agricultural and rural economies; and strengthen institutions and governance. Gender is integrated in all the Institute's work. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components to translate IFPRI's research from action to impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support for country-led development. IFPRI collaborates with partners around the world.

AUTHORS

Akhter Ahmed (a.ahmed@cgiar.org), is a Senior Research Fellow in the Poverty, Health, and Nutrition Division, and the Country Representative of the International Food Policy Research Institute (IFPRI), in Dkaha, Bangladesh

Fiona Coleman (fmc47@cornell.edu), is a Ph.D candidate in International Nutrition at Cornell University

John Hoddinott (jfh246@cornell.edu), is the H.E. Babcock Professor of Food and Nutrition Economics and Policy, at Cornell University, Ithaca, NY

Purnima Menon (p.menon@cgiar.org**)** is a Senior Research Fellow in the Poverty, Health, and Nutrition Division of the International Food Policy Research Institute (IFPRI), and the Senior Director for Food and Nutrition Policy at the CGIAR

Aklima Parvin (a.parvin@cgiar.org**)** is a Senior Project Manager in the Poverty, Health, and Nutrition Division of the International Food Policy Research Institute (IFPRI)

Audrey Pereira (audreylpereira@gmail.com) was a Senior Research Analyst in the Poverty, Health, and Nutrition Division of the International Food Policy Research Institute (IFPRI) when she wrote this work. She is currently a Ph.D. candidate in Public Policy at the University of North Carolina, Chapel Hill, NC

Agnes Quisumbing (a.quisumbing@cgiar.org) is a Senior Research Fellow in the Poverty, Health, and Nutrition Division of the International Food Policy Research Institute (IFPRI), Washington, DC.

Shalini Roy (s.roy@cgiar.org) is a Senior Research Fellow in the Poverty, Health, and Nutrition Division of the International Food Policy Research Institute (IFPRI)

Notices

[1] IFPRI Discussion Papers contain preliminary material and research results and are circulated in order to stimulate discussion and critical comment. They have not been subject to a formal external review via IFPRI's Publications Review Committee. Any opinions stated herein are those of the author(s) and are not necessarily representative of or endorsed by IFPRI.

[2] The boundaries and names shown and the designations used on the map(s) herein do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI) or its partners and contributors.

Table of Contents

ABSTRACT

We use a randomized controlled trial in rural Bangladesh to compare two models of delivering nutrition content jointly to husbands and wives: deploying female nutrition workers versus mostly male agriculture extension workers. Both approaches increased nutrition knowledge of men and women, household and individual diet quality, and women's empowerment. Intervention effects on agriculture and nutrition knowledge, agricultural production diversity, dietary diversity, women's empowerment, and gender parity do not significantly differ between models where nutrition workers versus agriculture extension workers provide the training. The exception is in an attitudes score, where results indicate same-sex agents may affect scores differently than opposite-sex agents. Our results suggest opposite-sex agents may not necessarily be less effective in providing training. In South Asia, where agricultural extension systems and the pipeline to those systems are male-dominated, training men to deliver nutrition messages may offer a temporary solution to the shortage of female extension workers and offer opportunities to scale promote nutrition-sensitive agriculture.

Keywords: extension agents; community nutrition workers; nutrition knowledge; diet quality; women's empowerment; Bangladesh

ACKNOWLEDGMENTS

We thank Md. Zahidul Hassan and his colleagues at Data Analysis and Technical Assistance for excellent data collection and Wahid Quabili for exemplary research assistance. We also thank the survey respondents who spent many hours answering questions in the hope of contributing to a better understanding of the intervention. We thank colleagues at the Ministry of Agriculture (MOA) of the Government of Bangladesh and Helen Keller International. We also thank Federica Argento with help in formatting the manuscript. We honor the memory of Mr. Toufiqul Alam, former ANGeL Project Director from MOA and Agricultural Policy Support Unit Research Director, who played a key role in successfully implementing ANGeL. The usual disclaimers apply.

We acknowledge funding from the United States Agency for International Development (USAID) through the Policy Research and Strategy Support Program (PRSSP) in Bangladesh under USAID Grant Number EEM-G-00-04-00013-00; the Gender, Agriculture, and Assets Project – Phase 2 (GAAP2), supported by the Bill & Melinda Gates Foundation through INV-008977; the Transforming Agrifood Systems in South Asia Research Initiative of the CGIAR (TAFSSA), and the CGIAR Research Programs on Agriculture for Nutrition and Health (A4NH) and Policies, Institutions, and Markets (PIM).

ABOUT CGIAR
CGIAR is a global research partnership for a food secure future.

ABOUT TAFSSA
TAFSSA (Transforming Agrifood Systems in South Asia) is a CGIAR regional integrated initiative to support actions that improve equitable access to sustainable healthy diets, improve farmers' livelihoods and resilience, and conserve land, air, and water resources in South Asia. CGIAR Research Centers participating in TAFSSA are CIMMYT, IFPRI, ABC, CIP, WF, ILRI, IWMI, and IRRI.

1.Introduction

Making agriculture "nutrition-sensitive" is increasingly recognized as a strategy to improve diets and nutrition in developing countries at scale (Ruel et al. 2018). This approach implicitly assumes collaboration between the agriculture and nutrition sectors, yet little evidence-based guidance exists on how the sectors should collaborate. Because cross-sectoral programs are complex to design and coordinate, Ruel and Alderman (2013) ask whether different sectors should focus on "integration" (joint planning, implementation, monitoring, and assessment) or effective "co-location" (implementing programs managed by different sectors to reach and saturate the same communities, households, and individuals). In the context of nutrition-sensitive agriculture (NSA), co-location could imply enlisting a cadre of nutrition workers to provide nutrition counselling in the same communities and to the same households reached by agricultural extension agents work. Integration would typically involve more extensive coordination and management between the sectors. However, a light-touch option could be to embed nutrition ideas and engagement within the usual delivery of agricultural services – specifically, to train agriculture extension workers on delivering basic messages surrounding nutrition and good diets alongside their usual services.

There is limited evidence about the effectiveness of agricultural extension workers relative to designated nutrition workers in delivering nutrition-related content. An obvious concern is whether agricultural extension workers may have difficulty learning, communicating, and tailoring this unfamiliar material. An additional consideration relates to gender. Agricultural extension workers tend to be male in many settings, while nutrition messaging is often targeted to women. If gender-based homophily matters for learning or adoption of nutrition practices, male extension workers could be less effective in communicating nutrition messages to women. To the best of our knowledge, existing research does not test whether the gender of the person delivering nutrition messages matters for uptake of content on nutrition by men and women. However, a substantial literature documents the role of gender in uptake of extension services (see Appendix A).[1] Indeed, hiring more women agricultural extension workers has often been justified based on concerns around communications bottlenecks to female farmers, due to traditional and religious practices (such as *purdah*, or female seclusion) or women's lack of self-confidence in talking about their circumstances and problems with men (Lahai et al. 1999). Gender norms may also shape the type and content of extension messages that are trusted and perceived as appropriate (Poats et al. 1988, cited in Lahai et al. 1999). For instance, male knowledge providers may be less comfortable or credible to women regarding topics like breastfeeding, maternal nutrition, or food preparation, particularly in the South Asian context.

There are also potential benefits to having agricultural extension agents deliver nutrition content. In addition to lower cost and less coordination required to ensure content on agriculture and on nutrition reach the same individuals, gender-based homophily could contribute to male farmers being more likely to trust or value male agricultural extension agents' information on nutrition. In settings where men play important roles deciding on food production and purchases, there may be benefits to engaging men to improve nutrition. Other differences between traditional nutrition workers and agricultural extension workers could also contribute to differing effectiveness in delivering nutrition information. For example, in many settings, agricultural extension agents tend to be more educated and better-compensated than nutrition workers.

In this study, we use a randomized controlled trial (RCT) to compare two models of delivering nutrition messages: deploying nutrition workers versus training agriculture extension workers to deliver basic nutrition messages. Our analysis is based on the Agriculture, Nutrition, and Gender Linkages (ANGeL) project in rural Bangladesh, implemented by the Ministry of Agriculture of the Government of Bangladesh. ANGeL was designed by the International Food Policy Research Institute (IFPRI) to inform scalable approaches for gender- and nutrition-sensitive agriculture in rural Bangladesh and compared

[1] Less investigation of differences in the effectiveness of men or women in delivering nutrition messages seems to be based on the premise that nutrition is a woman's domain. Most nutrition workers in many settings are women.

different packages of interventions provided jointly to husbands and wives. Intervention components included agricultural training, nutrition behavior change communication (BCC), and gender sensitization trainings.[2]

In this paper, we focus on comparing two treatment arms within ANGeL that were devoted to nutrition BCC, where the same nutrition content was provided either by (mostly male) sub-assistant agricultural officers (SAAOs) – also referred to as agricultural extension agents – who are permanent employees of the Department of Agricultural Extension (DAE) under the Ministry of Agriculture or by female nutrition workers. The female nutrition workers were hired from localities where ANGeL was implemented, specifically for the ANGeL project, and called "ANGeL *Pushti Kormi*" (APK; *Pushti Kormi* means "nutrition worker") to distinguish them from other community nutrition workers such as those employed at the larger *upazila*- (subdistrict) or district-level by BRAC or the Ministry of Health and Family Welfare. In both treatment arms, the trainer (either the SAAO or the APK) provided 19 nutrition training sessions over a 17-month period. Each training site invited about 25 pairs of husbands and wives in participant farm households. Training sessions were interactive, including lecture as well as discussions, practical demonstrations, and question-answer sessions. Although agriculture topics were not formally part of the curriculum in these treatment arms, due to the interactive nature of the training, any topic raised by participants was discussed, including practicalities of how to produce the nutritious foods being promoted (Ahmed et al. 2022). Similarly, gender sensitization was not part of the curriculum in these arms; however, it is plausible that changes in empowerment and attitudes could have occurred due to men and women being brought together in groups on domains traditionally associated with the opposite gender (Brody et al. 2015; Quisumbing et al. 2021).

[2] Behavior change communication (BCC), also called behavioral change communication, refers to the use of communication strategies to promote the sustained adoption of a desired health behavior or behaviors that may lead to positive health outcomes. Common means of BCC include interpersonal counseling, print and virtual educational materials, and mass media campaigns (Warren et al. (2020).

We thus compare effectiveness of nutrition training delivered by SAAOs versus APKs across several categories of outcomes for program participants: men's and women's knowledge of nutrition and agriculture, as well as adoption of improved agricultural practices; households' production diversification, including whether they grew nutrient-rich foods highlighted in the training; households' consumption of nutrient-rich foods highlighted in the training; households' measures of diet; individual men's and women's measures of diet; and men's and women's empowerment and attitudes. We find no statistically significant difference between the outcomes depending on whether APKs or SAAOs provided the training, except for attitudes, where same-sex agents showed different effects on scores from opposite-sex agents.

Our analysis provides insight into how outcomes related to nutrition, agriculture, and gender would change if agricultural extension workers provided nutrition information rather than traditional nutrition workers. The absence of a significant difference suggests that embedding nutrition content within agricultural extension workers' services could be a plausible alternative to co-locating specialized nutrition workers with agricultural extension workers. However, an important caveat is that we do not study a model where both nutrition *and* agricultural information are explicitly part of the curriculum.

Our study relates most closely to Olney et al. (2015), who also compare effectiveness of different types of providers for delivering nutrition information. They randomize the provision of nutrition BCC through either health committees composed of both men and women or older women leaders in a homestead food production program in Burkina Faso. They find that health committee members are better able to improve outcomes related to children's nutritional status and dietary diversity compared to the older women leaders. They attribute the differences in impacts to differences in knowledge, efficacy, or influence of the actors who delivered the BCC messages, and not their gender. Ragasa et al. (2019) examine the provision of both agricultural extension and nutrition messages in Malawi. They do not address the question of the gender of the extension worker but that of the recipient. They find that in households where a primary male and female adult are present, dietary diversity is higher if both the man and women received nutrition advice and if they both received market access advice, compared to if either of them received it alone. None of these studies address the policy-relevant question of whether (mostly male) agriculture extension agents can deliver nutrition BCC with the same effectiveness as women nutrition workers.

2.Interventions, study design, and data collection3

2.1 Study Design and Intervention Details

ANGeL aimed to deliver interventions that can leverage agricultural growth to increase farm household incomes, improve nutrition, and enhance women's empowerment in Bangladesh. A key feature of ANGeL was its use of SAAOs to deliver training in all but one of the treatment arms. Conventionally, in Bangladesh and elsewhere, nutrition training is provided by staff at health posts or by community nutrition workers employed either by governments or by non-governmental organizations. Like other countries in South Asia, agricultural extension agents are mostly male, whereas frontline nutrition workers are typically female, based on traditional perceptions that agriculture is a male domain, and nutrition female. Such staffing patterns also assume that female nutrition workers are better able to interact with mothers in delivering nutrition BCC.

To assess whether male extension agents deliver nutrition training as effectively as female nutrition workers, ANGeL included both a treatment arm with nutrition training delivered by SAAOs (T(SAAO)) and a treatment arm with nutrition training delivered by trained female nutrition workers who lived locally and were recruited specifically for the program (T(APK)).[4] For the T(SAAO) arm, ANGeL drew on SAAOs already working in the relevant blocks. For the T(APK) arm, *upazila*-level DAE officials solicited applications from women who completed at least secondary schooling in the 25 ANGeL blocks, interviewed the candidates, and hired the top individuals as APKs. The criteria and process for recruiting APKs followed

---

[3] This section draws on Quisumbing et al (2021).

[4] ANGeL included additional treatment arms that provided agricultural training on diversifying agriculture production, a treatment arm that combined agricultural training and nutrition BCC, and a treatment arm with agriculture, nutrition BCC, and gender sensitization. Analysis of the comparative effects of these treatments is found in Ahmed et al. (2022).

usual local practices for recruiting community nutrition workers. Compensation for the two roles also followed typical patterns: APKs were paid 3,000 taka per month (consolidated), whereas SAAOs' salaries ranged from 25,000-38,630 taka per month (based on salary scale) plus other allowances and pension after retirement. SAAOs were also paid 500 taka remuneration per ANGeL training session, while APKs did not get any remuneration for training beside salary.

For both the T(SAAO) and T(APK) arms, Helen Keller International (HKI) developed the curriculum and training materials for the nutrition BCC with the Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN) and IFPRI. Instructors from HKI trained APKs and SAAOs together on nutrition BCC at a Ministry of Agriculture facility near Dhaka; the form, content and duration of training was the same for both groups except on refresher training. Both SAAOs and APKs received three days intensive training on nutrition BCC, and both received printed training manuals: SAAOs received one day of refresher training; APKs received three days of refresher training.

Couples recruited for the study were invited to 19 nutrition BCC sessions over a 17-month period, delivered by either SAAOs or APKs depending on the treatment arm. The BCC sessions were conducted from July 2016 to December 2017, and each training session lasted approximately 1.5 hours. Training took place either in meeting rooms or open courtyards in the villages where study participants resided; approximately 90 percent of participants reported that training sites were within one kilometer of their homes. Trainings included lectures, interactive discussions, practical demonstrations, and question-answer sessions. Both husbands and wives were expected to attend each session, and active participation from both men and women was encouraged. Participants received a small allowance for each training session to cover incidental costs of attending: 125 taka for one participant or 250 taka per household if both the husband and wife participated. Appendix Table S1 summarizes the topics covered and the model of delivery.

2.2 Randomization, sampling, and survey administration

ANGeL's sample was designed so that, relative to the control group, there was a sufficient sample size to detect impacts of a 10% increase in households' per capita daily calorie availability and the Women's

Empowerment in Agriculture Index (WEAI) score (Alkire et al. 2013), setting 80% power and 0.05 level of significance. Power calculations used data from the 2011/2012 round of the Bangladesh Integrated Household Survey, which is nationally representative of rural Bangladesh. This sample size also provided 80% power at 0.05 level of significance to detect an increase of one new food produced in homestead gardens and 7.5% increase in a household-level Global Diet Quality Score – measures we use to assess impacts on production diversity and diets.

Because training would be conducted by SAAOs and APKs each assigned to a "block," cluster-randomization was conducted at the block level. Working with the Ministry of Agriculture, we identified all rural *upazilas* that were agro-ecologically suitable for agricultural diversification and had good market connectivity, thus considered appropriate for the ANGeL interventions. From a list of 484 such *upazilas*, 16 *upazilas* were purposively selected, such that each of the eight administrative divisions of Bangladesh was represented. From the list of all 525 blocks in 16 *upazilas*, we randomly selected 10 blocks from each *upazila*, yielding 160 blocks. Based on the power calculations, these were randomly assigned as follows: 25 blocks to each treatment arm – T(SAAO), T(APK), as well as the additional treatments described in footnote 3 – and 35 blocks to the control group, which did not receive any training, i.e. no visits by SAAOs or APKs.

One village from each block was randomly selected. Within each of these villages, 25 farm households with at least one child under 24 months were randomly selected to participate. This yielded 625 households in each treatment arm (1,250 households in total) and 875 households in the control group, for a total sample of 2,125 households.

Baseline data were collected between November 2015 and January 2016, prior to the start of the nutrition BCC sessions. Endline data were collected between January and March 2018, after BCC sessions had ended– ensuring minimal seasonal difference between baseline and endline surveys. In each household, both the primary female beneficiary and primary male beneficiary were interviewed separately. Some modules were answered by only the male (e.g., household demographics, assets and wealth, agricultural production), some were answered by only the female (e.g., food consumption and food security, diet data, women's status, and decision-making autonomy) and some were answered separately by each (e.g., data needed to construct measures of knowledge, empowerment).

2.3 Outcome variables

We assess impacts on a set of outcome variables based on ANGeL's theory of change; see Ahmed et al. (2022). ANGeL's nutrition training focused on the importance of diverse diets, including micronutrient-rich foods and animal source foods. If the training improved knowledge, this could change consumption of these foods in three, non-mutually exclusive ways. Households might choose to: (1) begin or increase production of specific micronutrient-rich or animal-source foods: non-rice crops (from the field or homestead), milk, eggs, fish; (2) consume a greater quantity of these nutrient rich foods already being produced; and/or (3) re-allocate spending so as to increase consumption of these foods. This change could entail consumption of food groups that the household otherwise might not have consumed, or more frequent consumption of certain food groups. It could also increase the actual quantities consumed of various food groups, rebalancing toward those that are micronutrient-rich (e.g., fruits and vegetables) and derived from an animal source (e.g., eggs, milk, fish). Lastly, as the nutrition training emphasizes the importance of improving dietary quality for young children and for women of reproductive age, we assess whether individual diets were affected by these treatment arms, as well as whether the engagement with couples increased men's and women's empowerment within the household. Our outcome variables trace out this trajectory.

Table 1 summarizes our outcome variables. To assess whether ANGeL increased male and female participants' nutrition knowledge, we administered questions related to the BCC curriculum – on optimal child feeding practices, the identification of foods rich in micronutrients, and correct food preparation practices. We also assessed participants' knowledge of production practices related to micronutrient-rich foods – specifically, improved crop production practices, improved livestock and poultry rearing practices, and improved cultured fishpond practices. Scores on both tests were converted to percent scores. We also asked whether men and women had adopted a series of improved agricultural practices.

Table 1: Description of outcomes

Domain	Variable	Description	Notes
Knowledge	Nutrition knowledge, percent correct	Respondents (mothers and fathers of children aged < two years) were administered 20 questions on optimal feeding practices for children < 2 years, identification of foods rich in micronutrients such as Vitamin A, iron, and zinc, and optimal food preparation practices (for example, cooking vegetables with oil to improve absorption of fat-soluble vitamins).	Ranges in value from 0 to 100 At endline, less than five percent of respondents scored below five percent or greater than 95 percent.
	Agriculture knowledge, percent correct	Respondents (women and male household members - usually husbands) were administered 32 questions covering cultivating fruit and vegetable crops, particularly in homestead gardens. Questions included: preparation of pits and beds for vegetable production, identifying quality seeds and fertilizers, seed storage, and organic methods of controlling pests. Similar questions were asked about the care and feeding of livestock and poultry and fish culture.	Ranges in value from 0 to 100 At endline, less than five percent of respondents scored below five percent or greater than 95 percent.
Adoption of new practices	Number, improved agricultural practices	Respondents (women and male household members - usually husbands) were administered 15 questions covering improvements to the management of their homestead gardens, livestock and poultry raising, and fishpond management.	Ranges in value from 0 to 15 At endline, less than two percent of respondents reported adopting 12 or more new practices
	Any adoption, improved agricultural practices	Respondents (women and male household members - usually husbands) were administered 15 questions covering improvements that could have made to the management of their homestead gardens, the raising of livestock and poultry or the management of fishponds.	=1 if any new practice was adopted, =0 otherwise
Production diversity on fields	Simpson Diversification Index (SDI)	The SDI accounts for both the number of different crops that the household grows and the acreage devoted to different crops. A value of zero means that the household devotes all its land to one crop. Higher values (values closer to 1) imply greater crop diversity.	Ranges in value from 0 to 1
	Number, non-rice field crops	Number of non-rice crops grown in farmer fields	
Production diversity on homestead	Number, homestead garden crops	Number of different fruit and vegetable crops grown in the homestead garden during the last 12 months	
	Any egg production	Whether poultry produced any eggs in the last 12 months	=1 if yes, =0 otherwise
	Any dairy production	Whether dairy cows produced any milk in the last 12 months	=1 if yes, =0 otherwise
	Any fish production	Whether household harvested any fish from fishponds in the last 12 months	=1 if yes, =0 otherwise
Production from homestead	Fruits and vegetables	Quantity (kg) of fruit and vegetables produced in homestead gardens in the last 12 months	Inverse Hyperbolic Sine (IHS) transformed
	Eggs	Quantity (number) of eggs produced in the last 12 months	IHS transformed
	Dairy	Quantity (litres) of milk produced in the last 12 months	IHS transformed

Domain	Variable	Description	Notes
	Fish	Quantity (kg) of fish produced in the last 12 months	IHS transformed
Consumption from homestead	Fruits and vegetables	Quantity (kg) of fruit and vegetables consumed out of production from homestead gardens in the last 12 months	IHS transformed
	Eggs	Quantity (number) of eggs consumed out of own production in the last 12 months	IHS transformed
	Dairy	Quantity (litres) of milk consumed out of own production in the last 12 months	IHS transformed
	Fish	Quantity (kg) of fish consumed out of own production in the last 12 months	IHS transformed
Household diet	Household Diet Diversity Score (HDDS)	Uses data from seven-day recall of household food consumption. We determine whether (yes =1; no=0) households consumed foods from the following groups: Cereals; Roots and tubers; Vegetables; Fruit; Meat, poultry, offal; Eggs; Fish and seafood; Pulses, legumes and nuts; Milk and milk products; Oils/fats; Sugar/honey; Other foods. These values are summed to create the DDS.	Ranges in value from 0 to 12 At endline, less than five percent of respondents reported consuming more than 10 food groups
	Per capita caloric acquisition	Using data from seven-day recall of household food consumption, convert calories available for consumption to a daily value and divide by household size.	Log transformed
	household Global Diet Quality Score (hGDQS)	Uses data from seven-day recall of household food consumption. The GDQS consists of 25 food groups: 16 healthy food groups, 7 unhealthy food groups, and 2 food groups (red meat, high-fat dairy) that are unhealthy when consumed in excessive amounts. For 24 of the GDQS food groups, three ranges of quantity of consumption are defined (in grams/day): low, medium, and high. For one food group (high-fat dairy), four ranges of quantity of consumption are used: low, medium, high, and very high. Points associated with the healthy GDQS food groups increase for each higher quantity of consumption category. Points associated with the unhealthy GDQS food groups decrease for each higher quantity of consumption category. For the two food groups that are unhealthy in excessive consumption, points associated with the GDQS food group increase up to a threshold, then decrease. The overall hGDQS is the sum of the points across all 25 GDQS food groups.	GDQS has a range from 0 to 49. Log transformed
Individual intakes	Caloric intake	Food consumption, in calories, on the previous day, with data based on 24-hour diet recall survey module	Log transformed
	Calorie adequacy ratio (CAR)	Ratio of caloric intake to estimate average requirements (EAR) for calories, was used to determine the calorically adequacy of diets. A CAR value of 1 represents a calorically adequate diet. Estimated caloric requirements were calculated based on FAO guidelines and a	Log transformed

Domain	Variable	Description	Notes
		dataset of Bangladeshi-specific requirements developed by Waid et al. Requirements were specific to an individual's physical activity level as determined by primary occupation, pregnancy status, lactation status, and the ideal adult weight for each age and sex group given average physical stature of Bangladeshi adults (FAO, 2004; Picciano, 2003).	
	Global Diet Quality Score	Individual level GDQS based on 24-hour food intake data; see hGDQS for description of how this is calculated.	Log transformed
Empowerment	Empowerment score	The empowerment score is the weighted average of the 12 pro-WEAI indicators.	Ranges from 0 to 1
	Whether empowered	An individual is defined as empowered if s/he reaches the threshold of 75 percent or more of the weighted indicators.	=1 if yes, =0 otherwise
	Attitudes score (9-45)	Respondents were asked about their agreement (1 "strongly disagree" to 5 "strongly agree) on nine statements related to attitudes and perceptions about themselves and other household members. Examples include: I make important contributions to my family I sometimes refrain from voicing my opinion because I fear being ignored/ridiculed Women should stand up for themselves to get what they want Husbands should help wives with household chores like cooking and taking care of children We can change culture/tradition regarding what men/women do and how they relate to each other	Ranges from 9 to 45
	Gender parity	A household achieves gender parity if the woman respondent is empowered or her empowerment score is equal to or greater than that of the man respondent in the household.	=1 if yes, =0 otherwise

We assess whether the ANGeL treatment arms affected which crops participant households grew in fields and on homestead plots near homes. These measures include the Simpson Diversification Index (SDI), which has been used to assess production diversity in Bangladesh (Gautam et al. 2016; Rahman, 2009) and the number of non-rice field crops (Sibhatu and Qaim, 2018). We examine the impact of ANGeL on the number of non-rice field crops (grown on agricultural fields), and homestead crops.[5] We distinguish between field crops and production on homestead gardens, as the latter (homestead vegetable and fruit production to meet micronutrient needs) was encouraged during the nutrition trainings. We consider assessed levels of production of fruits and vegetables on homestead gardens, whether the household produced any of the animal source foods emphasized in training - eggs, milk, fish – and the amount of animal source foods produced.

We assess impacts of ANGeL on food consumption in several ways, reflecting the different pathways from production to consumption. The first measure examines the most direct pathway, consumption out of own production. We assess annual homestead vegetable consumption, homestead fruit consumption, and the quantities of egg, dairy, and fish consumed out of own production in kilograms. Next, we consider household-level measures of consumption quantity. Using data from a seven-day recall of household food consumption, we calculate a Household Diet Diversity Score (HDDS) and per capita caloric availability. We also adapt a recently developed indicator, the Global Diet Quality Score (GDQS; Bromage et al. 2021), to assess household-level diet quality. GDQS is defined at the individual-level, wherein each respondent receives points for each GDQS food group, according to the quantity of consumption consumed for that food group during the 24-hour reference period. We adapt the GDQS to a household-level GDQS (hGDQS), analyzing household consumption of the food groups found in the GDQS over the 7-day recall period, then converting these to a daily adult equivalent.[6]

---

[5] We exclude permanent tree crops such as mangoes and jackfruit, given the lag between planting these are their production of fruit.

[6] Because of our adaptation, our household-level calculations of hGDQS are not directly comparable to the GDQS calculated at the individual-level based on 24-hour diet intake recall. However, because we construct hGDQS in a consistent manner across the intervention arms in this study, this should not introduce bias for assessing impacts.

The ANGeL study also collected twenty-four-hour individual dietary recall data. In each household, the female in charge of food preparation (usually, the spouse of the household head) was interviewed about the foods consumed within and outside the home the previous day by all household members. Data on ingredients used to prepare meals, the caloric content of the foods prepared using food composition table specific to Bangladesh (Shaheen, 2014), and the portion size (grams) consumed by each household member were used to calculate caloric intakes for individuals aged 15 years and older. We also calculated Caloric Adequacy Ratios that assess caloric intakes relative to requirements and individual-level GDQS.

ANGeL also aimed to empower women, motivated by the documented links between empowerment status, agricultural production diversity, and nutritional outcomes in Bangladesh (Sraboni et al. 2014). Our measure of women's empowerment at endline is the pro-WEAI, an additive and decomposable index based on the Alkire-Foster methodology adapted from the WEAI (Alkire et al. 2013) for use in agricultural development projects (Malapit et al. 2019). We use the individual empowerment score and the individual's empowerment status. We are also interested in whether either treatment improved household gender parity and affected women's and men's attitudes about their own roles and gender norms, for which we constructed an attitudes score.

3.Methods and empirical methodology

3.1 Estimation strategy

We estimate intent-to-treat (ITT) impacts using an ANCOVA specification (McKenzie 2012):

$$Y_{ibt} = \alpha_t + \beta_Y Y_{ibt-1} + \beta_{T1} T(SAAO)_b + \beta_{T2} T(APK)_b + \beta_X X_{ibt-1} + \varepsilon_{ibt} \quad (1)$$

where Y_{ibt} is the outcome of interest for individual *i* residing in block *b* at time *t*; Y_{ibt-1} is the outcome in the prior period (baseline); $T(SAAO)_b$ and $T(APK)_b$ are dummy variables that take the value of 1 if block b was assigned to nutrition education and training through SAAOs and APKs respectively, and takes the value of 0 otherwise; X_{ibt-1} is a vector of baseline covariates; and ε_{ibt} is an error term. β_{T1} and β_{T2} represent the single-difference impact estimator for SAAO and APK respectively. For outcomes of interest collected only at endline (such as knowledge of correct agricultural practices), we use single difference estimates that do not include baseline values of the outcome variables.

We include the following baseline covariates, intended to capture demographic and socioeconomic characteristics, human capital, land and labor availability, as well as access to information prior to intervention: age of household head, sex of household head, mean education level of household males age 18 and older, mean education level of household females age 18 and older, number of adults in the household, dependency ratio, household wealth index, whether the household had access to electricity, amount of land owned by the household, whether any fishponds were owned by the household, the number of mobile phones owned by the household, whether the household owned a television, whether the household had recently received an extension visit for crop production, whether the household had recently received an extension visit for livestock or fish production, and dummies for location (*upazila*). We also include a dummy variable if the household reported being adversely affected by the widespread flooding that occurred in Bangladesh in the 12-month period before the endline survey.

We estimate ordinary-least-squares regressions for outcome variables that are continuous and linear probability models for dichotomous outcomes. Our outcome variables relating to levels of specific types of foods produced and consumed (homestead vegetables, homestead fruits, eggs, dairy, fish) contain both many zero values and many very large values. For these outcomes, we use the inverse hyperbolic sine (IHS) transformation and report marginal effects following Bellemare and Wichman (2020). Our household and individual measures of diet (except for the HDDS) are log transformed. In all cases, standard errors are clustered at the block level, the unit of randomization. We conduct Wald tests to assess whether the difference in impacts estimated from T(SAAO) and T(APK) are statistically significant.

We assess robustness in two ways. First, we estimate equation (1) excluding baseline control variables. Second, to assess whether our results are robust to considerations relating to multiple hypothesis testing, we calculate Romano-Wolf stepdown adjusted p-values using the Stata rwolf2 routine (Clarke, Romano, and Wolf, 2020).

3.2 Estimation sample, attrition, and baseline descriptives

We begin with the 2,125 households that comprised the sample at baseline of households in the two treatment groups and the control group. At endline, we successfully re-interviewed 2,069 households, representing 2.6 percent of the target baseline sample lost to follow up (Table 2). Appendix Table S2 reports how attrition is correlated with treatment arm and baseline covariates. Coefficients on the treatment arms are small in magnitude. There is no statistically significant impact on attrition of either treatment arm. An F test shows that we cannot reject the null hypothesis that, jointly, attrition does not differ across treatment arms; the p-value for this test is 0.23. With respect to our baseline covariates, attrition was slightly higher in households that owned a television and in wealthier households and was lower in households with an electricity connection. It is also lower in *upazilas* where flooding had occurred in the 12-month period prior to the survey. Attrition is not significantly associated with other selected baseline covariates.

Table 2: Sample characteristics, by treatment arm

	T(SAAO)		T(APK)		Control		All	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Baseline values								
Age of household head	40.15	14.00	38.85	12.92	41.17	13.87	40.19	13.66
Household head is female	0.04	0.19	0.03	0.18	0.03	0.18	0.03	0.18
Average schooling attainment, men 18y or older	4.87	3.65	4.50	3.71	4.72	3.89	4.70	3.77
Average schooling attainment, women 18y or older	5.16	2.73	5.09	2.86	5.16	2.90	5.14	2.84
Number of adults	3.27	1.61	3.00	1.40	3.17	1.43	3.15	1.48
Dependency ratio	0.96	0.63	0.98	0.61	1.00	0.62	0.98	0.62
Wealth index	-0.04	2.64	-0.50	2.58	0.23	2.51	-0.06	2.59
Household has fishpond	0.24	0.43	0.20	0.40	0.27	0.45	0.24	0.43
Land operated (ha)	1.18	1.29	1.08	1.28	1.07	1.08	1.10	1.21
Mobile phones owned, number	1.77	1.27	1.54	1.30	1.62	1.22	1.64	1.27
Household owns television	0.36	0.48	0.24	0.43	0.36	0.48	0.33	0.47
Received extension visit related to crops	0.21	0.41	0.19	0.39	0.19	0.40	0.20	0.40
Received extension visit related to livestock, poultry, fish	0.03	0.16	0.05	0.21	0.06	0.24	0.05	0.21
Household has electricity	0.70	0.46	0.60	0.49	0.76	0.43	0.69	0.46
Shocks between baseline and endline								
Experienced flooding	0.64	0.48	0.60	0.49	0.74	0.44	0.67	0.47
Number of observations, baseline (households)	625		625		875		2,125	
Number of observations, endline (households)	610		609		850		2,069	
Number of households lost to attrition	15		16		25		56	
Attrition rate (%)	2.40		2.56		2.86		2.64	

Table 2 also reports the mean values for the baseline covariates included in our regressions. Household heads in the control group are, on average, 41 years old and are overwhelmingly male (three percent of heads are female). Males aged 18 or older have on average, 4.7 years of schooling and females have 5.2 years of schooling. Just over a quarter of control households have a fishpond and they operate 1.07 acres of land. In the 12 months prior to the baseline survey, 19 percent of households had received a visit from an extension officer relating to crop cultivation and six percent had received a visit from an extension officer relating to livestock, poultry, or fish production. Magnitudes of baseline covariates are similar across treatment and control arms, although there are small differences; Appendix Table S3 shows formal tests of balance. We include baseline covariates in our regressions to help account for these small differences.

4.Results

4.1 Characteristics of SAAOs and APKs

Table 3 describes characteristics of SAAOs and APKs. Virtually all SAAOs were men (92 percent), and all APKs were women (100 percent). SAAOs were older than APKs on average: 43 years of age compared to 31 years for APKs. Most SAAOs (57.9 percent) had completed some form of secondary school compared to only 16 percent of APKs. As government staff, SAAOs were permanent employees of the Ministry of Agriculture, receiving much higher pay than the APKs who were temporary employees hired for the ANGeL project. Both SAAOs and APKs reported completing a similar number of training sessions with similar numbers of women and men. At endline, we administered a 24-item test to both SAAOs and APKs on the material that they were teaching; mean scores on this test were high for both groups with little difference between them (84.2 percent for SAAOs; 85.0 percent for APKs).

Table 3: Comparison of SAAO and APK characteristics

	SAAO	APK
Sex		
Male (%)	92.0	0.0
Female (%)	8.0	100.0
Mean age, years	43.3 (9.6)	30.6 (6.7)
Education, percent		
Lower secondary	15.8	32.0
Upper secondary	26.3	52.0
Bachelor's degree or higher	57.9	16.0
Religion, percent		
Muslim	83.3	80.0
Hindu or Christian	16.7	20.0
Ethnicity, percent		
Bangla	95.8	92.0
Hindi	4.2	8.0
Employment	Permanent government employee, Department of Agricultural Extension (DAE), Ministry of Agriculture	Locally recruited for ANGeL
Salary	25,000-38,630 taka per month (based on salary scale) plus other allowances and pension after retirement	3,000 taka per month (consolidated)
Remuneration for training sessions	500 taka per session per group	No additional remuneration
Prior occupation, percent		
Teacher	20.8	0.0
Other government job	4.2	0.0
NGO	8.3	16.0
Other occupation	16.7	32.0
Student	37.5	12.0
Not employed	12.5	40.0
Mean number of training sessions completed	20.4 (6.5)	17.7 (3.3)
Mean number of women that should attend training	23.6 (3.0)	23.4 (2.8)
Mean number of men that should attend training	23.4 (3.2)	23.3 (3.9)
Mean score on test of nutrition knowledge (percent)	84.2	85.0

Notes: Standard deviations in parentheses.

4.2 Implementation fidelity, design

Fidelity of implementation—whether the program was implemented as designed – was high in both treatment arms; see Table 4 and Appendix Tables S4-S6. Women attended 82 percent of the sessions provided by SAAOs and 86 percent of sessions run by APKs (the difference is significant at $p < 0.01$). Men attended 72 percent of SAAO sessions and 70 percent of APK sessions. In both treatment arms, more than 90 percent of men and women attended their training sessions together. However, if a husband refused to go, it was more likely that a woman could go by herself to a training session run by an APK (53.3 percent) than one led by a SAAO (46 percent).

Table 4: Attendance at training sessions, by treatment arm

	T(SAAO) (n=1274)	T(APK) (n=1254)	T(SAAO) = T(APK)
Number of training sessions attended			
Mean (SD)	14.68 (5.89)	14.92 (4.84)	0.29
Median (Q1, Q3)	17.0 (12.0, 19.0)	16.0 (14.0, 18.0)	
Females: Percentage of trainings attended			
Mean (SD)	82.07 (28.67)	86.25 (18.86)	<0.01
Median (Q1, Q3)	89.5 (73.7, 100.0)	89.5 (84.2, 100.0)	
Males: Percentage of trainings attended			
Mean (SD)	72.14 (32.53)	70.28 (28.86)	0.32
Median (Q1, Q3)	84.2 (52.6, 100.0)	78.9 (52.6, 89.5)	
Percent attending training together with spouse	91.2	93.1	0.08
Reason for not attending all training sessions (%)			
Attended all sessions	38.5	41.6	
Agricultural work	6.6	8.2	
Work, other	38.0	33.2	
Illness	10.8	11.6	
Social obligation	3.5	3.6	
Bad weather	0.9	0.5	
Did not think the training would be useful	1.7	1.3	0.19
Whether SAAO/APK came to respondent if missed a session (% reporting yes)	60.1	60.4	0.89
Whether another household member attended in place if respondent missed a session (% reporting yes)	7.8	17.0	<0.01
Whether husband/inlaws were dissatisfied because respondent attended session (% reporting yes)	9.4	6.8	0.10
Whether could attend session alone if husband refused to go (% reporting yes)	46.0	53.3	0.01
Yes			

Training sessions were held in a location approximately 0.5km from participants' homes, about a 10-minute walk. Participants reported valuing the trainings (Appendix Table S4). Nearly all respondents felt that the contents of the training sessions were moderately or very informative; around 80 percent described the trainers as very communicative, understandable, and well prepared (83 percent). More than 80 percent of participants reported that they mostly or always understood what was taught, and over 90 percent reported that if they did not understand what was taught, they asked the trainer to repeat, and the trainer did so happily. There are no meaningful differences in this assessment of trainings provided by SAAOs or APKs.

Both women (Appendix Table S5) and men (Appendix Table S6) reported that the training was helpful, whether provided by SAAOs or APKs. Trainings were perceived to be valuable in terms of both information learned and improved confidence, relationships, and social ties. Women in both arms reported that sessions improved their understanding of care and nutrition of women and children. Following the training, more than 70 percent of women in both arms reported that they gained more respect or status within their homes and communities and that they felt more confident in making decisions about spending money. Nearly all women reported forming close ties with other participants and meeting with new friends after the training. Similarly, men reported that trainings improved their understanding of care and nutrition of women and children and learned new agriculture practices. 70-75 percent of men reported gaining more respect or status within their homes and communities and feeling more confident in making decisions about spending money. More than 80 percent of men formed close ties with other participants, and more than 78 percent met with new friends after the training. Nevertheless, between 24-31 percent of women reported that participation in the program interfered with domestic responsibilities, as did 48—61 percent of men.

4.3 Impacts on knowledge

Table 5 reports the impact of the SAAO and APK treatment arms on knowledge of optimal nutrition practices and on improved agricultural practices relating to crops, livestock, and fish, and whether adoption of these improved practices differed by sex.

Table 5: Impacts on nutrition knowledge, agriculture knowledge and adoption of improved agricultural production practices, by sex

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	Nutrition knowledge, percent correct	Agriculture knowledge, percent correct	Any adoption, improved agricultural practices	Number, improved agricultural practices		Nutrition knowledge, percent correct	Agriculture knowledge, percent correct	Any adoption, improved agricultural practices	Number, improved agricultural practices
	Women					Men			
Treatments									
T(SAAO)	3.257***	4.608***	0.094***	0.502***		4.894***	7.351***	0.244***	0.868***
	(0.663)	(1.201)	(0.031)	(0.159)		(0.698)	(1.078)	(0.037)	(0.157)
T(APK)	4.162***	3.434***	0.075***	0.274**		4.240***	6.312***	0.182***	0.711***
	(0.671)	(1.007)	(0.026)	(0.112)		(0.781)	(0.973)	(0.037)	(0.158)
P values on equality of treatments									
T(SAAO) = T(APK)	0.21	0.33	0.56	0.19		0.38	0.29	0.13	0.34
Mean, Control group	80.1	51.2	0.27	0.85		71.5	53.7	0.20	0.71
Observations	2,060	2,069	2,061	2,061		1,638	1,929	1,929	1,929
R-squared	0.167	0.266	0.223	0.233		0.198	0.255	0.199	0.189

Notes: Estimates are intent-to-treat from OLS models. Standard errors adjusted for clustering at block level are in parentheses. *p<.10; **p<.05; ***p<.01. All

Both treatment arms improved women's nutrition knowledge. The magnitude of the impacts, however, was relatively small, possibly because knowledge was already relatively high, with women in the control group scoring 80 percent on the baseline test. The magnitude of the impacts on men's knowledge was slightly higher, possibly because their baseline levels of knowledge were lower. There is no statistically significant difference in impact by treatment arm, nor are the impacts appreciably different between women and men.

Although the nutrition BCC curriculum did not explicitly emphasize training on agricultural topics, as noted above, any topic raised by participants was discussed due to its interactive nature, including practicalities of how to produce the nutritious foods being promoted. Both women and men indicated that the trainings led to increases in post-intervention agricultural incomes and that they learned new agricultural practices (see Table 5 and Appendix Table S7), with men in the SAAO treatment arm most likely to say this. Consistent with these statements, both treatment arms increased knowledge of improved agricultural practices. This was slightly more pronounced for men and for participants in the SAAO treatment arm. That said, the magnitudes of these differences are small. Table 5 also
shows that both treatments increased both the likelihood and number of improved agricultural practices adopted by both women and men, with the effect sizes larger for men. However, there are no statistically significant differences in these impacts by treatment arm for either women or men.

4.4 Impacts on production diversity and levels

Neither treatment increased diversification of household food production as measured by the SDI, the number of non-rice field crops, the number of crops produced on homestead gardens, or the likelihood of fish production (Table 6). There are increases at the extensive margin for egg and dairy production; for the APK treatment arm, these effect sizes are 6.8 and 6.2 percentage points respectively. While statistically significant, we cannot reject the null that these impacts are equal to those found for the SAAO treatment.

Table 6: Impacts on diversification of agricultural products grown in fields and on homesteads

	(1)	(2)		(3)	(4)	(5)	(6)
	Diversification of crops grown in fields			Diversification of products produced at the homestead			
	Simpson Diversification Index	Number, non-rice field crops		Number, homestead garden crops	Any egg production	Any dairy production	Any fish production
Treatments							
T(SAAO)	0.006	0.035		0.005	0.034	0.023	0.004
	(0.019)	(0.082)		(0.125)	(0.026)	(0.020)	(0.030)
T(APK)	0.007	0.041		0.151	0.068***	0.062**	-0.001
	(0.020)	(0.091)		(0.103)	(0.026)	(0.024)	(0.024)
P values on equality of treatments							
T(SAAO) = T(APK)	0.97	0.96		0.39	0.22	0.11	0.89
Mean, Control group	0.20	0.68		1.8	0.76	0.32	0.58
Observations	1,825	2,069		2,069	2,069	2,069	2,069
R-squared	0.397	0.272		0.294	0.118	0.197	0.207

Notes: See Table 5.

We also considered the intensive margin of production diversification. Table 7 shows that the APK treatment arm increased the production of eggs and dairy products produced on homesteads. Expressed as a percentage, the impacts are large (51 and 38.0 percent, respectively); but given low baseline values, the magnitudes are relatively small. For example, for eggs, the percentage change is equivalent to (relative to the control group), an increase in annual household egg production of 35 eggs. We do not reject the null that the impacts on egg and dairy production are equal across treatment arms. These modest effects could be because households were selling, not consuming, these products, but there is no statistically significant impact of either treatment arm on gross sales revenues from eggs, dairy, or fish products (result available on request).

4.5 Impacts on food consumption

Given that both treatment arms led to increased quantities of certain foods produced on the homestead, we assess the extent to which study participants consumed this increased production. Columns 5-8 of Table 7 indicate that the APK treatment resulted in a statistically significant increase in consumption of eggs and dairy, but not fruits, vegetables, or fish. The magnitudes of these effect sizes are large when expressed as percent increases – 47 percent for eggs and 36 percent for dairy – but again given the low baseline mean levels of consumption of these foods, the absolute level of the change is modest. The coefficients of the SAAO treatment arm on the consumption of eggs and dairy are positive, but not statistically significant and we cannot reject the null that they are equal to the coefficients for the APK treatment arm.

Table 7: Impacts on production and consumption of foods produced on homesteads

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	Production					Consumption			
	Fruit and vegetables	Eggs	Dairy	Fish		Fruit and vegetables	Eggs	Dairy	Fish
Treatments									
T(SAAO)	-0.058	0.169	0.139	0.080		-0.033	0.187	0.146	0.050
	(0.102)	(0.139)	(0.109)	(0.125)		(0.091)	(0.123)	(0.100)	(0.118)
T(APK)	0.110	0.409***	0.320**	0.136		0.106	0.385***	0.311**	0.105
	(0.100)	(0.132)	(0.130)	(0.105)		(0.097)	(0.114)	(0.123)	(0.095)
		[0.51]	[0.38]				[0.47]	[0.36]	
P values on equality of treatments									
T(SAAO) = T(APK)	0.20	0.13	0.17	0.67		0.25	0.13	0.19	0.65
Mean, Control group (Levels)	209.9	69.7	78.5	179.8		125.2	44.9	37.8	94.9
Observations	2,069	2,069	2,069	2,069		2,069	2,069	2,069	2,069
R-squared	0.277	0.147	0.211	0.311		0.273	0.148	0.203	0.274

Notes: See Table 5. Values in square brackets are marginal effects.

We now turn to three household-level measures of diet, the HDDS, caloric availability, and the hGDQS (Table 8). Both treatment arms increase household diet diversity, but the magnitudes are small relative to the baseline control group mean of 7.7 food groups: 0.16 for T(SAAO) and 0.33 for T(APK) Impacts on household calories are small and imprecisely measured. By contrast, when we use log hGDQS, both treatments have a significant effect, increasing this measure of dietary quality by 6.3 (SAAO) and 5.1 percent (APK); the difference in these impacts is not statistically significant.

Table 8: Impacts on measures of household diet

	(1)	(2)	(3)
	Dietary Diversity Score	Log per capita caloric acquisition	Log household Global Diet Quality Score
Treatments			
T(SAAO)	0.163**	0.028*	0.061***
	(0.080)	(0.016)	(0.010)
		[0.028]	[0.063]
T(APK)	0.332***	0.020	0.050***
	(0.095)	(0.015)	(0.012)
			[0.051]
P values on equality of treatments			
T(SAAO) = T(APK)	0.08	0.66	0.43
Mean, Control group (Levels)	7.7	1982	22.2
Observations	2,069	2,069	2,069
R-squared	0.271	0.109	0.285

Notes: See Table 5. Values in square brackets are marginal effects.

In Table 9, we assess whether these changes in household diet benefit both men and women. There is no impact on caloric intake for either men or women, even after adjusting for caloric requirements. However, both treatment arms improve both women's and men's diet quality, by 5.5 percent for the T(SAAO) arm and 8.8 to 9.0 percent for the T(APK) arm with the effects nearly identical for women and men.

Table 9. Individual dietary intakes (calories, GDQS)

	(1)	(2)	(3)		(4)	(5)	(6)		(7)	(8)	(9)
	All				Males				Females		
	Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score		Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score		Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score
Treatments											
T(SAAO)	0.003	-0.003	0.054**		0.008	0.009	0.055**		-0.003	-0.011	0.055**
	(0.015)	(0.006)	(0.021)		(0.021)	(0.007)	(0.021)		(0.014)	(0.008)	(0.023)
			[0.055]				[0.056]				[0.056]
T(APK)	0.002	-0.001	0.089***		-0.004	0.004	0.090***		0.005	-0.004	0.088***
	(0.013)	(0.006)	(0.020)		(0.016)	(0.005)	(0.022)		(0.013)	(0.009)	(0.021)
			[0.093]				[0.094]				[0.091]
P values on equality of treatments											
T(SAAO) = T(APK)	0.96	0.74	0.18		0.60	0.42	0.23		0.58	0.48	0.21
Mean, Control group (Levels)	2354	0.90	8.18		2488	0.86	8.36		2232	0 .94	8.01
Observations	5,490	5,490	5,490		2,501	2,501	2,501		2,989	2,989	2,989
R-squared	0.19	0.77	0.21		0.16	0.78	0.21		0.15	0.75	0.21

Notes: See Table 5. Values in square brackets are marginal effects.

4.6 Impacts on empowerment and attitudes

Table 10 presents single-difference ITT impacts of the SAAO and APK treatments on pro-WEAI outcomes: women's and men's empowerment scores, whether women and men are empowered, and whether the household achieves gender parity. In the control group at endline, the mean empowerment score for women is 0.59; only 25 percent of women are empowered, compared to 39 percent of men, and 47 percent of control households achieve gender parity. For women's empowerment outcomes, there are significant positive impacts from both treatment arms relative to the control group. The women's empowerment score increases by 0.03 and the prevalence of empowered women increases by 5-6 percentage points. For both outcomes, Wald tests show that there is no statistically significant difference in impacts by treatment arm. The impacts on men's empowerment are comparable in magnitude, with no statistically significant differences by treatment arm.

Table 10. Single-difference impacts on Pro-WEAI and on attitudes score

	(1)	(2)	(3)		(4)	(5)	(6)		(7)
	Women				Men				
	Empowerment score	Whether empowered	Total attitudes score		Empowerment score	Whether empowered	Total attitudes score		Gender parity
Treatments									
T(SAAO)	0.035***	0.053**	0.433		0.031***	0.089***	0.609**		0.020
	(0.011)	(0.026)	(0.265)		(0.010)	(0.032)	(0.248)		(0.029)
T(APK)	0.034***	0.066**	0.721**		0.027***	0.084***	-0.010		0.018
	(0.011)	(0.029)	(0.298)		(0.009)	(0.031)	(0.195)		(0.032)
P values on equality of treatments									
T(SAAO) = T(APK)	0.94	0.67	0.34		0.67	0.88	0.03		0.97
Mean, Control group (Levels)	0.59	0.25	34.4		0.67	0.39	34.5		0.47
Observations	1,743	1,743	1,743		1,743	1,743	1,743		1,743
R-squared	0.123	0.068	0.151		0.131	0.089	0.082		0.082

Notes: See Table 5. Estimates are single difference. Sample is restricted to households where both women and men complete the survey modules needed to construct the Pro-WEAI.

When we focus on the attitudes score, a slightly different pattern emerges. The SAAO treatment increases the attitudes score more for men whereas the APK treatment increases this more for women; the difference in impacts between the SAAO and APK treatments for men is statistically significant. That said, the magnitude of the impact of the SAAO treatment on men's attitudes is small, 0.60, relative to the control group mean of 34.5.

4.7 Robustness checks

We subjected all results to two robustness checks. In Appendix Table S8, we show results when we exclude all control variables and baseline values, leaving only the dummy variables for treatment status as controls. We obtain parameter estimates nearly identical to those shown in Tables 5-10 but, predictably, these are estimated with less precision. In Appendix Table S9, we assess whether our results are robust to adjusting for multiple hypothesis testing across the outcome domains we consider in the paper; again, our results are robust to this concern.

5.Discussion and policy implications

Despite their different backgrounds and compensation, SAAOs and APKs seem to generate similar improvements in nutrition knowledge and good agricultural practices (even though agriculture training was not a part of the nutrition BCC), similar non-impacts on most measures of agriculture production diversity (eggs and dairy being the exceptions) and similar and relatively large improvements in hGDQS. Across many of these impacts, there is a slightly larger impact when the training is delivered by APKs but we generally cannot reject the null of equal effects. The only area where having the same gender as the trainer appears to have a greater impact is on attitudes: men's attitude scores increase more when trained by male SAAOs, and women by female APKs.

Our findings indicate that in most cases, the effectiveness of mostly male agricultural extension workers in improving nutrition knowledge, agricultural knowledge, and women's empowerment does not significantly differ from the effectiveness of the program's female nutrition workers. This finding differs from conventional wisdom that same-sex agents are more effective in reaching women, as suggested by studies of agricultural extension in Africa (e.g. Kondylis et al. 2016, Buehren et al. 2019).

Several caveats apply to these findings. First, we do note a pattern of larger point estimates from APK training than SAAO training for increases in homestead production of eggs and dairy, household consumption of eggs and dairy, and men's and women's GDQS. However, differences between APK impacts and SAAO impacts on these outcomes are not statistically significant, thus not conclusive. Second, while we highlight the difference in gender composition of the SAAOs versus APKs, there are differences besides gender in these two groups that could play a role in their relative effectiveness. For example, SAAOs tend to hold higher education levels and were substantially better compensated; SAAOs participating in ANGeL were also experienced, while APKs were newly hired for this project. Thus, we do not compare two delivery modalities that differ only by gender. That said, the T(SAAO) and T(APK) arms are fairly representative of the types of staff who could be realistic options for delivering nutrition content in Bangladesh, thus the comparison is policy-relevant.

Bearing in mind these caveats, our results suggest opposite-sex agents may not necessarily be a barrier to effective training. Can training men and women jointly overcome the usual barriers faced in training those of a different gender? For example, because husbands were present, it is possible that male extension workers were more comfortable discussing nutrition topics in front of women. Although we cannot answer this question definitively, since we did not have a treatment arm where men or women were trained alone, this finding is consistent with several studies conducted in Africa. For example, Ragasa et al. (2019) find that, in Malawi, targeting agriculture and nutrition messages to husbands and wives together was more effective than targeting to individual spouses. Lambrecht et al. (2016) find that joint participation in an extension program on integrated soil fertility management in the Democratic Republic of Congo leads to the highest adoption rates compared to female or male participation alone. Similarly, in Uganda, Lecoutere et al. (2019) show that providing information to female and male co-heads together can contribute to greater involvement of women in joint decision-making and joint action even if they may not translate into better agricultural outcomes on jointly managed plots or increased joint sales.

Indeed, qualitative work on ANGeL reveals that men and women beneficiaries in the T(SAAO) and T(APK) arms valued the joint training of husbands and wives (Quisumbing et al. 2021). For example, a woman beneficiary in the APK treatment arm said (Younus 2018):

"If I attend the training sessions alone, I (have) to explain in detail to my husband. It can be tough for me to convince him. Now, since we go together, he knows all the things. We discuss and take decision easily." — (Woman beneficiary, APK arm)

"*It is very much helpful for the family if trainings are combined…Nutrition is from vegetables. Now, my wife grows vegetables at home to help meet our nutritional demands." — (Man beneficiary, SAAO arm)*

There are several features of the intervention that likely contributed to positive impacts. In both arms, the implementing frontline workers – the SAAOs and the APKs – are compensated for their work; the development of training materials and pedagogical approaches drew on expertise and experience around agriculture, nutrition, and gender; and both SAAOs and APKs were well-trained using the same training methods and trainers. On the demand side, the participating households received small incentives and the intervention deliberately targeted married couples. In addition, the delivery of the intervention content in groups, rather than via 1-1 interactions, is an important feature to consider – joint learning, sharing, support and peer pressure could all have contributed to the kinds of impacts found here. Thus, the ANGeL intervention itself, in all its fullness, was a well-designed and well-implemented intervention, and in this context, opposite-sex trainers did not prevent improvements in knowledge, practices, and nutrition-related outcomes.

6.Conclusion

Our study, based on a cluster-randomized controlled trial in rural Bangladesh, provides evidence on the effectiveness of alternative delivery workers in providing nutrition BCC to women and men, who were trained jointly. Both approaches increased nutrition knowledge of men and women, household and individual diet quality and women's empowerment. We find no significant difference in men's and women's agricultural knowledge, nutrition knowledge, dietary diversity, women's empowerment, and gender parity, whether the training was delivered by mostly male agriculture extension agents or female nutrition workers hired by the project. The only evidence of same-sex homophily comes from an attitudes score, which increases more for men if they were trained by SAAOs, and more for women if trained by APKs.

Our findings also appear to run counter to the conventional wisdom that farmers learn more from trainers of the same sex. However, those studies were conducted in Africa, where there is possibly a clearer delineation between men's and women's responsibilities in agriculture. Although it would be ideal to train more female extension workers, the realities of agricultural extension systems in South Asia are that the pipeline into government agricultural extension departments remain male-dominated. In the short run, to scale up nutrition-sensitive agriculture in South Asia, it is still important to train male agriculture extension workers to deliver nutrition-sensitive agriculture content effectively. ANGeL participants perceive that the provision of training to husbands and wives together was an important factor behind the effectiveness of this intervention; this is consistent with the growing popularity of "household methodologies" such as the Gender Action Learning System (GALS) where husbands and wives are trained together to visualize a future for their family and to plan towards that goal (IFAD, 2022).

References

Ahmed, A., Coleman F., Ghostlaw J., Hoddinott J., Menon P., Parvin A., Pereira A., Quisumbing A., Roy S., and Younus M. 2022. Increasing Production Diversity and Diet Quality: Evidence from Bangladesh. Unpublished manuscript.

Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G. and Vaz, A., 2013. The women's empowerment in agriculture index. *World Development*, 52, 71-91.

Bellemare, M. F. and Wichman C.J. 2020. Elasticities and the Inverse Hyperbolic Sine Transformation, *Oxford Bulletin of Economics and Statistics* 82(1): 50-61.

Buehren, N., Goldstein, M., Molina, E., & Vaillant, J. 2019. The impact of strengthening agricultural extension services on women farmers: Evidence from Ethiopia. *Agricultural Economics*, 50, 407–419.

Brody, C., De Hoop, T., Vojtkova, M., Warnock, R., Dunbar, M., et al. 2015. Economic Self-Help group programs for improving women's Empowerment: a systematic review. *Campbell Systematic Reviews*, 11(1), 1-182.

Bromage, S., Batis, C., Bhupathiraju, S.N., Fawzi, W.W., Fung, T.T., Li, Y., Deitchler, M., et al. 2021. Development and Validation of a Novel Food-Based Global Diet Quality Score (GDQS). *Journal of Nutrition* 151, 75S-92S.

Clarke, D., Romano J.P. and Wolf M., 2020. The Romano-Wolf Multiple Hypothesis Correction in Stata, *Stata Journal* 20(4).

FAO. 2004. Human energy requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. FAO Food and Nutrition Technical Report series 1. Rome.

Gautam, M. and R. Faruqee. 2016. Dynamics of Rural Growth in Bangladesh: Sustaining Poverty Reduction. Directions in Development. Washington, DC: World Bank.

IFAD. 2022. *How to integrate the Gender Action Learning System (GALS) in IFAD operations.* IFAD, Rome.

Kondylis, F., Mueller, V., Sheriff, G., & Zhu, S. 2016. Do female instructors reduce gender bias in diffusion of sustainable land management techniques? Experimental evidence from Mozambique. *World Development*, 78, 436–449.

Lahai, B.A.N., Goldey P. and Jones G.E. 1999. The gender of the extension agent and farmers' access to and participation in agricultural extension in Nigeria. *Journal of Agricultural Education and Extension*, 6:4, 223-233.

Lambrecht, I., Vanlauwe, B. and Maertens, M., 2016. Agricultural extension in Eastern Democratic Republic of Congo: does gender matter? *European Review of Agricultural Economics*, *43*(5), 841-874.

Lamontagne-Godwin, J., Cardey S., Williams F. E., Dorward P. T., Aslam N., and Almas M. 2019. Identifying gender-responsive approaches in rural advisory services that contribute to the institutionalisation of gender in Pakistan, *Journal of Agricultural Education and Extension*, 25:3, 267-288.

Lamontagne-Godwin, J., Williams F., Bandara W. M. P. T., & Z. Appiah-Kubi Z. 2017. Quality of extension advice: a gendered case study from Ghana and Sri Lanka, *Journal of Agricultural Education and Extension*, 23:1, 7-22.

Lecoutere, E., Spielman D., and Van Campenhout B. 2019. Women's empowerment, agricultural extension, and digitalization: Disentangling information and role model effects in rural Uganda. IFPRI Discussion Paper 1889. Washington, DC: International Food Policy Research Institute.

Malapit. H., Quisumbing A., Meinzen-Dick R., Seymour G., Martinez E. M., et al. 2019. Development of the project-level Women's Empowerment in Agriculture Index (pro-WEAI). *World Development* 122: 675–692.

McKenzie, D. 2012. Beyond baseline and follow-up: The case for more T in experiments, *Journal of Development Economics*, 99(2): 210-221. https://doi.org/10.1016/j.jdeveco.2012.01.002.

Olney, D.K., Pedehombga, A., Ruel, M.T. and Dillon, A., 2015. A 2-year integrated agriculture and nutrition and health behavior change communication program targeted to women in Burkina Faso reduces anemia, wasting, and diarrhea in children 3–12.9 months of age at baseline: a cluster-randomized controlled trial. *Journal of Nutrition*, 145(6), 1317-1324.

Picciano MF. 2003. Pregnancy and Lactation: Physiological Adjustments, Nutritional Requirements and the Role of Dietary Supplements. *Journal of Nutrition,* 133:1997S-2002S.

Quisumbing, A., Ahmed A., Hoddinott J., Pereira A., and Roy S. 2021. Designing for empowerment impact: Experimental evidence from the Agriculture, Nutrition, and Gender Linkages (ANGeL) Project in Bangladesh. *World Development 146:*

Quisumbing, A.R. and Doss C.R. 2021. Gender in agriculture and food systems. In *Handbook of Agricultural Economics*, Vol. 5., Ch. 82, Barrett C.B. and Just D.R., eds. Amsterdam: Elsevier.

Ragasa, C., Aberman N.-L., Mingote C. A. 2019. Does providing agricultural and nutrition information to both men and women improve household food security? Evidence from Malawi. *Global Food Security* 20: 45-59

Rahman, S., 2009. Whether crop diversification is a desired strategy for agricultural growth in Bangladesh? *Food Policy*, *34*(4), pp.340-349.

Romano J.P. and Wolf M., 2005. Stepwise Multiple Testing as Formalized Data Snooping, *Econometrica* 73(4): 1237-1282.

Ruel, M.T., Alderman, H., 2013. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 382, 536–551.

Ruel, M.T., Quisumbing, A.R. and Balagamwala, M., 2018. Nutrition-sensitive agriculture: what have we learned so far? *Global Food Security*, 17, 128-153.

Saito, K.A., Weidemann, C.J., 1990. Agricultural extension for women farmers in Africa. World Bank discussion papers 103 Washington, D.C.

Shaheen, N. 2013. *Food Composition Table for Bangladesh.*

Sibhatu, K.T. and Qaim, M., 2018. Meta-analysis of the association between production diversity, diets, and nutrition in smallholder farm households. *Food Policy*, 77, 1-18.

Sraboni, E., Malapit, H.J., Quisumbing, A.R. and Ahmed, A.U., 2014. Women's empowerment in agriculture: What role for food security in Bangladesh? *World Development*, 61, 11-52.

Waid JL, Bogard JR, Thilsted SH, Gabrysch S. 2017. Estimates of average energy requirements in Bangladesh: Adult Male Equivalent values for use in analyzing household consumption and expenditure surveys. Data in Brief [Internet] Elsevier Inc.; 2017.

Warren, A. M., Frongillo E. A., Nguyen P. H, Menon P.2020. Nutrition Intervention Using Behavioral Change Communication without Additional Material Inputs Increased Expenditures on Key Food Groups in Bangladesh, *The Journal of Nutrition* 150 (5): 1284–1290, https://doi.org/10.1093/jn/nxz339

Younus, M. 2018. Case Studies from the Agriculture, Nutrition, and Gender Linkages (ANGeL) Project. Powerpoint presentation at the seminar on Agriculture, Nutrition, and Gender Linkages (ANGeL) Results Dissemination. Dhaka, Bangladesh, June 6, 2018.

Appendix A. Gender and homophily in extension services

The evidence that gender-based homophily matters to the uptake of extension messages has previously been explored in the context of providing more effective agriculture extension to women (see, for example, Saito and Weidemann 1990). More recent work evaluating the impact of the gender of the extension worker has focused mostly on agricultural messages and technology adoption. This work has almost exclusively been on Africa, because it is easier to identify impacts of same gender agents on agricultural outcomes in farming systems where men and women farm separate plots within the same household (Quisumbing and Doss 2021); the exceptions, in Sri Lanka and Pakistan, are mostly descriptive studies (Lamontagne-Godwin et al. 2017; Lamontagne-Godwin et al. 2019). For example, a randomized control trial in Mozambique suggests that women farmers were more likely to learn about agricultural techniques in communities in which there was a woman messenger or contact farmer, in addition to a male one (Kondylis, Mueller, Sheriff, & Zhu, 2016). Similarly, a program in Ethiopia found that when extension agents were given gender training and taught to work with women farmers, the regularity of contact with extension agents increased by approximately 10% points for women, both those living in male-headed households and those living in female headed households (Buehren, Goldstein, Molina, & Vaillant, 2019). Lecoutere et al. (2019) find, using a field experiment on video-based extension on maize farming in Uganda, that varying the recipient of extension advice (woman or man alone, or extension provided jointly) as well as the modality of extension delivery (female actor, either alone or with a male actor, or male actor alone) affects knowledge, adoption, and productivity outcomes. They find that targeting women with extension videos has a positive effect on their knowledge of agronomic practices, participation in agricultural decision making, and increased maize yields, quantities and sales by women. However, portraying women as successful farmers and role models in the videos produces mixed results, with role-model effects working differently for women and men.

Although extension systems in Asia are similarly male-dominated, there has been relatively little work comparing the effectiveness of men or women agricultural extension workers in the region; most studies focus on differential access of men and women farmers to extension services, possibly because of the difficulty of finding enough women extension workers to include in the study. For example, a study in Pakistan on gender-responsive practices in rural advisory services originally intended a 50:50 split of male/female extension workers but ended up interviewing five women out of 116 extension workers (LaMontagne-Godwin et al. 2019). Comparing extension advice provided by male and female "plant doctors" in Ghana and Sri Lanka, LeMontagne-Godwin et al. (2016) find no correlation between the proportion of male/female plant doctors and queries brought in by male and female farmers; however, in Sri Lanka, where there are almost even numbers of female and male plant doctors, providing more choice to farmers, significantly more female farmers bring their crops to female plant doctors.

Supplementary Appendix

Table S1: Description of ANGeL nutrition training

	Nutrition training
Length of training period	17 months
Number of sessions	19
Topics covered	• Functional roles played by different types of food • Importance of a balanced diet • Micronutrients (vitamin A, iron, iodine, and zinc) and sources of food containing these • Age-appropriate complementary foods • Optimal breastfeeding practice • Maternal nutrition and care • Safe food preparation and preservation, hygiene, and handwashing
Training format	Lectures, interactive discussions, games, and cooking demonstrations
Who was invited to attend	Husbands and wives

Table S2: Correlates of Attrition

Variables	Coefficient (Std. error)
T(SAAO)	0.011
	(0.009)
T(APK)	0.013
	(0.008)
Experienced flooding	-0.130***
	(0.020)
Age of household head	0.000
	(0.000)
Household head is female	-0.002
	(0.023)
Average schooling attainment, men 18y or older	-0.001
	(0.001)
Average schooling attainment, women 18y or older	-0.001
	(0.001)
Number of adults	0.003
	(0.003)
Dependency ratio	0.007
	(0.005)
Wealth index	0.003*
	(0.002)
Household has fishpond	0.007
	(0.009)
Land operated (ha)	0.001
	(0.003)
Mobile phones owned, number	-0.005
	(0.005)
Household owns television	-0.022**
	(0.011)
Received extension visit related to crops	0.013**
	(0.006)
Received extension visit related to livestock, poultry, fish	0.016
	(0.012)
Household has electricity	0.011
	(0.009)
Constant	1.077***
	(0.031)
Observations	2,125
R-squared	0.043

Notes: Outcome variable equals one if household attrited, zero otherwise. Results estimated using a linear probability model. Standard errors adjusted for clustering at block level are in parentheses. *p<.10; **p<.05; ***p<.01. Sample size is 2,125. F statistic on joint significance of treatment covariates is 1.50 with a p-value of 0.23. Controls for location (upazila dummy variables) included but not reported.

Table S3: Balance
We have two treatment arms and 15 control variables. We estimate a multinomial logit where the base category is the control group and assess whether the estimated coefficients are jointly statistically significant. Since not all treatment groups are found in each upazila, upazila dummy variables are not included below. Only three variables are statistically significant, and we do not reject the null that all control variables are jointly zero.

Treatment Group	Variable	Coefficient	Standard Error
T(SAAO)			
	Experienced flooding	-0.456	0.56
	Age, household head	-0.009	0.01
	Household head is female	0.500	0.51
	Average schooling attainment, men 18y or older	0.021	0.02
	Average schooling attainment, women 18y or older	-0.014	0.03
	Number of adults	-0.005	0.07
	Dependency ratio	-0.051	0.12
	Wealth index	-0.050	0.08
	Household has fishpond	-0.295	0.29
	Land operated (ha)	0.103	0.11
	Mobile phones owned, number	0.156*	0.08
	Household owns television	0.018	0.20
	Received extension visit related to crops	0.068	0.29
	Received extension visit related to livestock, poultry, fish	-0.819**	0.41
	Household has electricity	-0.152	0.37
	Constant	0.194	0.72
T(APK)			
	Experienced flooding	-0.736	0.60
	Age, household head	-0.010	0.01
	Household head is female	0.168	0.44
	Average schooling attainment, men 18y or older	-0.001	0.02
	Average schooling attainment, women 18y or older	0.002	0.03
	Number of adults	-0.098	0.08
	Dependency ratio	-0.090	0.11
	Wealth index	0.051	0.09
	Household has fishpond	-0.438	0.31
	Land operated (ha)	0.092	0.12
	Mobile phones owned, number	0.084	0.11
	Household owns television	-0.314	0.26
	Received extension visit related to crops	-0.024	0.23
	Received extension visit related to livestock, poultry, fish	-0.178	0.46

Treatment Group	Variable	Coefficient	Standard Error
	Household has electricity	-0.735*	0.40
	Constant	1.424	0.86

Notes: Standard errors adjusted for clustering at block level are in parentheses. *p<.10; **p<.05; ***p<.01. Sample size is 2,069. F statistic on joint significance of all covariates is 1.30 with a p-value of 0.19.

Table S4: Access and experience with training sessions

	T(SAAO)	T(APK)	T(SAAO) = T(APK)
	(N = 1274)	(N = 1254)	p-value
Distance (km) of the training venue from home (one way)			
Mean (SD)	0.54 (0.79)	0.52 (0.58)	0.55
Median (Q1, Q3)	0.2 (0.2, 0.5)	0.5 (0.2, 0.6)	
Distance (minutes) of the training venue from home (one way)			
Mean (SD)	11.3 (12.46)	10.8 (10.07)	0.31
Median (Q1, Q3)	8.0 (5.0, 15.0)	10.0 (5.0, 15.0)	
How did you generally travel to the training? (%)			0.12
Walking	95.1	96.1	
By rickshaw	0.5	0.6	
By van/nosimon/korimon	1.7	0.7	
By boat	0.1	0.0	
Combination of rickshaw/van/Boat or Other	3.6	2.7	
What kind of difficulty did you face when coming to the training sessions? (%)			0.06
No difficulty	90.5	93.1	
Rain	5.3	4.9	
Vehicle was not available	0.8	0.4	
Road condition was bad	2.7	1.0	
Husband/Wife was not willing to come	0.1	0.2	
Household members created obstacle, Other	0.7	0.6	
Where did the training sessions take place? (%)			<0.01
Inside a well-ventilated closed room	52.7	31.0	
Courtyard/open space	45.6	67.9	
Inside a damp closed room, Other	1.8	1.2	
How were the contents of the training sessions? (%)			<0.01
Very informative	80.3	86.2	
Moderately informative	18.8	13.4	
Most of the contents were already known	0.5	0.2	
Topics were difficult to understand, other	0.4	0.3	
How did you like the way of delivery of the trainer? (%)			0.03
Very communicative and understandable	79.7	82.7	

	T(SAAO)	T(APK)	T(SAAO) = T(APK)
	(N = 1274)	(N = 1254)	p-value
Moderately communicative and understandable	19.5	16.9	
Delivery was too fast to understand	0.7	0.1	
Trainer was reading out the manual and was not explaining, other	0.1	0.4	
Do you think the trainer was well prepared for the training? (%)			0.49
Trainer was very well prepared	83.5	82.8	
Well-prepared	15.2	16.2	
Moderately or not prepared	1.3	1.1	
Did you always understand what was taught? (%)			0.74
Always	54.2	51.5	
Mostly	36.9	39.4	
Often	8.1	8.4	
Seldom, never	0.8	0.6	
When you did not understand the content, did you ask the trainer to repeat or explain? (% responding yes)	90.7	92.1	0.24
When you asked the trainer to explain again, how did s/he react? (% responding trainer repeated happily)	94.2	97.5	<0.01
Who did you discuss/share information from the training sessions with? (%)			.
Spouse	95.6	96.5	0.30
Fellow Trainees	94.7	96.5	0.04
Other household members or relatives	94.2	95.5	0.17
Neighbors	85.0	85.2	0.89
Friends	46.4	45.2	0.58
Community members	7.0	10.6	<0.01
Other	0.2	0.3	0.64
Did not discuss/share with anyone	1.6	1.1	0.28

Table S5: Women's perception of training sessions

	T(SAAO)	T(APK)	T(SAAO) = T(APK)
	(N = 624)	(N = 614)	p-value
Were the training sessions helpful?			
Yes very helpful	97.6	99.5	0.02
If yes, how were the trainings helpful?			
Post-training increase in income	12.5	6.8	<0.01
Learnt new agricultural practices	23.9	8.6	<0.01
Care of children and nutrition	84.5	86.5	0.34
Maternal care and nutrition	69.6	73.4	0.16
Intra-household relationship improved	5.1	5.8	0.61
Household health status improved	12.7	16.6	0.06
Children's health improved	19.2	21.2	0.39
Do you feel that you have gained more respect/status within your household?			0.01
Yes	74.6	81.9	
No	7.0	5.2	
No, because I have always been respected	18.4	12.9	
Do you feel more confident in making decisions about spending money?			0.02
Yes	77.7	83.4	
No, I do not feel more confident	4.5	4.5	
No, because I had enough confidence before	17.8	12.0	
Do you feel that you have gained more respect within the community?			0.34
Yes	71.9	75.3	
No	11.8	11.3	
No, because I have always been respected	16.3	13.4	
Did the group participation result in solidarity/close ties among participants?			<0.01
Yes	89.5	95.5	
Did participation in the program interfere with your domestic responsibilities?			0.02
Yes	30.9	24.7	
Do you meet with any new friends after training? (% Yes)	87.0	91.5	0.01

Table S6: Men's perception of training sessions

	T(SAAO)	T(APK)	T(SAAO) = T(APK)
	(N = 637)	(N = 627)	p-value
Were the training sessions helpful?			0.88
Yes very helpful	91.3	92.1	
If yes, how were the trainings helpful?			
Post-training increase in income	25.9	16.9	<0.01
Learnt new agricultural practices	52.6	34.1	<0.01
Care of children and nutrition	72.7	81.9	<0.01
Maternal care and nutrition	40.7	43.7	0.33
Intra-household relationship improved	4.0	5.3	0.35
Household health status improved	9.3	9.8	0.81
Children's health improved	6.3	6.1	0.90
Do you feel that you have gained more respect/ status within your house?			0.16
Yes	75.0	70.0	
No	8.5	9.4	
No, because I have always been respected	16.5	20.6	
Do you feel more confident in making decisions about spending money?			0.76
Yes	75.6	74.2	
No, I do not feel more confident	7.6	7.3	
No, because I had enough confidence before	16.8	18.5	
Do you feel that you have gained more respect within the community?			0.14
Yes	72.3	68.0	
No	11.3	10.9	
No, because I have always been respected	16.5	21.2	
Did the group participation result in solidarity/close ties among participants?			0.17
Yes	85.8	88.6	
Does participation in the program interfere with your domestic responsibilities?			0.38
Yes	51.4	48.7	
Do you meet with any new friends after training? (% Yes)	78.2	81.3	0.21

Table S7: Knowledge and adoption of improved agricultural production practices: crops, livestock, fish. By sex

WOMEN

	(1)	(2)	(3)		(4)	(5)	(6)
	Score on test of knowledge of improved:				Any adoption, improved		
	Agricultural practices	Livestock practices	Fishpond practices		Agricultural practices	Livestock practices	Fishpond practices
Treatments							
T(SAAO)	0.869***	0.594***	0.038		0.090***	0.070**	0.010
	(0.175)	(0.202)	(0.071)		(0.031)	(0.030)	(0.017)
T(APK)	0.583***	0.427**	0.085		0.049*	0.062***	-0.000
	(0.129)	(0.200)	(0.059)		(0.027)	(0.023)	(0.013)
P values on equality of treatments							
T(SAAO) = T(APK)	0.09	0.39	0.56		0.22	0.78	0.56
Mean, control group	5.4	8.9	2.0		0.16	0.17	0.11
Observations	2,061	2,069	2,061		2,061	2,061	2,061
R-squared	0.234	0.271	0.187		0.152	0.238	0.117

MEN

	(1)	(2)	(3)		(4)	(5)	(6)
	Score on test of knowledge of improved:				Any adoption, improved		
	Agricultural practices	Livestock practices	Fishpond practices		Agricultural practices	Livestock practices	Fishpond practices
Treatments							
T(SAAO)	1.017***	1.259***	0.076*		0.191***	0.138***	0.095***
	(0.174)	(0.202)	(0.043)		(0.031)	(0.025)	(0.021)
T(APK)	0.863***	0.998***	0.159***		0.158***	0.123***	0.050**
	(0.169)	(0.185)	(0.043)		(0.032)	(0.031)	(0.020)
P values on equality of treatments							
T(SAAO) = T(APK)	0.42	0.15	0.09		0.36	0.64	0.03
Mean, control group	5.8	8.0	2.5		0.12	0.09	0.11
Observations	1,929	1,929	1,929		1,929	1,929	1,929
R-squared	0.209	0.198	0.184		0.182	0.142	0.178

Note: Estimates are intent-to-treat. Standard errors adjusted for clustering at block level are in parentheses. *p<.10; **p<.05; ***p<.01. All specifications include as independent variables the treatment indicators and the control variables listed in the notes to Table 1. Controlling for the familywise error rate (FWER) using the method described by Romano and Wolf (2005) does not alter the pattern of statistical significance described here.

Table S8: Assessing robustness to exclusion of control variables

Table S8A: Nutrition, agricultural knowledge, and adoption of improved practices: Women

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	Nutrition knowledge, percent correct	Agriculture knowledge, percent correct	Any adoption, improved agricultural practices	Number, improved agricultural practices		Nutrition knowledge, percent correct	Agriculture knowledge, percent correct	Any adoption, improved agricultural practices	Number, improved agricultural practices
	No controls					Controls included			
Treatments									
T(SAAO)	3.484***	5.768**	0.143**	0.721**		3.257***	4.608***	0.094***	0.502***
	(1.021)	(2.243)	(0.068)	(0.313)		(0.663)	(1.201)	(0.031)	(0.159)
T(APK)	3.802***	1.212	0.035	0.040		4.162***	3.434***	0.075***	0.274**
	(0.878)	(1.789)	(0.053)	(0.216)		(0.671)	(1.007)	(0.026)	(0.112)
Observations	2,060	2,069	2,061	2,061		2,060	2,069	2,061	2,061
R-squared	0.038	0.029	0.017	0.026		0.167	0.266	0.223	0.233

Notes: Estimates are intent-to-treat from OLS models. Standard errors adjusted for clustering at block level are in parentheses. *p<.10; **p<.05; ***p<.01. "No controls" includes only treatment status. "Controls included" include as independent variables the treatment indicators, baseline values for the outcome variable (except for those outcomes relating to agricultural knowledge and practice) and the following control variables: age and sex of household head, mean education levels of males and females 18 and older, number of adults, dependency ratio, wealth index, land owned at baseline, fishpond owned at baseline, baseline access to information as measured by (baseline) number of mobile phones owned, ownership of television, received extension visit for crop production, received extension visit for livestock or fish production, household has access to electricity, and baseline upazila.

Table S8B: Nutrition, agricultural knowledge, and adoption of improved practices: Men

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	Nutrition knowledge, percent correct	Agriculture knowledge, percent correct	Any adoption, improved agricultural practices	Number, improved agricultural practices		Nutrition knowledge, percent correct	Agriculture knowledge, percent correct	Any adoption, improved agricultural practices	Number, improved agricultural practices
	No controls					Controls included			
Treatments									
T(SAAO)	5.814***	9.018***	0.270***	1.087***		4.894***	7.351***	0.244***	0.868***
	(1.165)	(2.008)	(0.052)	(0.260)		(0.698)	(1.078)	(0.037)	(0.157)
T(APK)	3.780***	4.664**	0.157***	0.555**		4.240***	6.312***	0.182***	0.711***
	(1.334)	(1.929)	(0.056)	(0.229)		(0.781)	(0.973)	(0.037)	(0.158)
Observations	1,738	1,929	1,929	1,929		1,638	1,929	1,929	1,929
R-squared	0.039	0.057	0.059	0.042		0.198	0.255	0.199	0.189

Notes: See Table S8_A.

Table S8C: Field crops

	(1)	(2)		(3)	(4)
	No controls			Controls included	
	Simpson Diversification Index	Number, non-rice field crops		Simpson Diversification Index	Number, non-rice field crops
Treatments					
T(SAAO)	-0.025	-0.100		0.006	0.035
	(0.037)	(0.131)		(0.019)	(0.082)
T(APK)	0.014	0.083		0.007	0.041
	(0.043)	(0.165)		(0.020)	(0.091)
Observations	1,825	2,069		1,825	2,069
R-squared	0.004	0.003		0.397	0.272

Notes: See Table S8_A.

Table S8D: Homestead agricultural production diversification

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	No controls					Controls included			
	Number, homestead garden crops	Any egg production	Any dairy production	Any fish production		Number, homestead garden crops	Any egg production	Any dairy production	Any fish production
Treatments									
T(SAAO)	0.061	0.046	0.020	0.014		0.005	0.034	0.023	0.004
	(0.222)	(0.033)	(0.031)	(0.052)		(0.125)	(0.026)	(0.020)	(0.030)
T(APK)	0.336	0.053*	0.045	-0.011		0.151	0.068***	0.062**	-0.001
	(0.277)	(0.030)	(0.037)	(0.052)					
Observations	2,069	2,069	2,069	2,069		2,069	2,069	2,069	2,069
R-squared	0.007	0.003	0.002	<0.001		0.294	0.118	0.197	0.207

Notes: See Table S8_A

Table S8E: Homestead production and consumption
No controls

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	Production					Consumption			
	Fruit and vegetables	Eggs	Dairy	Fish		Fruit and vegetables	Eggs	Dairy	Fish
Treatments									
T(SAAO)	0.162	0.220	0.100	0.170		0.160	0.250	0.123	0.155
	(0.190)	(0.186)	(0.183)	(0.258)		(0.180)	(0.182)	(0.158)	(0.233)
T(APK)	0.138	0.255	0.196	0.021		0.076	0.202	0.220	0.031
	(0.246)	(0.173)	(0.205)	(0.263)		(0.217)	(0.165)	(0.181)	(0.237)
Observations	2,069	2,069	2,069	2,069		2,069	2,069	2,069	2,069
R-squared	0.002	0.003	0.001	0.001		0.002	0.003	0.002	0.001

Controls included

	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
	Production					Consumption			
	Fruit and vegetables	Eggs	Dairy	Fish		Fruit and vegetables	Eggs	Dairy	Fish
Treatments									
T(SAAO)	-0.058	0.169	0.139	0.080		-0.033	0.187	0.146	0.050
	(0.102)	(0.139)	(0.109)	(0.125)		(0.091)	(0.123)	(0.100)	(0.118)
T(APK)	0.110	0.409***	0.320**	0.136		0.106	0.385***	0.311**	0.105
	(0.100)	(0.132)	(0.130)	(0.105)		(0.097)	(0.114)	(0.123)	(0.095)
Observations	2,069	2,069	2,069	2,069		2,069	2,069	2,069	2,069
R-squared	0.277	0.147	0.211	0.311		0.273	0.148	0.203	0.274

Notes: See Table S8_A

Table S8F: Household diet

	(1)	(2)	(3)		(4)	(5)	(6)
	No controls				Controls included		
	Dietary Diversity Score	Log per capita caloric acquisition	Log household Global Diet Quality Score		Dietary Diversity Score	Log per capita caloric acquisition	Log household Global Diet Quality Score
Treatments							
T-N	0.179	0.039*	0.068***		0.163**	0.028*	0.061***
	(0.194)	(0.023)	(0.023)		(0.080)	(0.016)	(0.010)
T-A	0.247	0.027	0.034		0.332***	0.020	0.050***
	(0.194)	(0.021)	(0.024)		(0.095)	(0.015)	(0.012)
Observations	2,069	2,074	2,074		2,069	2,069	2,069
R-squared	0.006	0.004	0.024		0.271	0.109	0.285

Notes: See Table S_A.

Table S8G: Individual intakes
All individuals

	(1)	(2)	(3)		(4)	(5)	(6)
	No controls				Controls included		
	Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score		Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score
Treatments							
T-SAAO	0.010	-0.009	0.083*		0.003	-0.001	0.055**
	(0.024)	(0.008)	(0.042)		(0.015)	(0.006)	(0.021)
T-APK	0.013	0.0001	0.052		0.002	-0.001	0.090***
	(0.022)	(0.009)	(0.039)		(0.013)	(0.006)	(0.020)
Observations	5,490	5,490	5,490		5,490	5,490	5,490
R-squared	0.057	0.73	0.061		0.19	0.77	0.21

Males

	(1)	(2)	(3)		(4)	(5)	(6)
	No controls				Controls included		
	Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score		Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score
Treatments							
T-SAAO	0.014	0.013*	0.080*		0.008	0.012	0.055**
	(0.029)	(0.007)	(0.044)		(0.021)	(0.007)	(0.021)
T-APK	0.013	0.008	0.058		-0.004	0.008	0.090***
	(0.026)	(0.006)	(0.041)		(0.016)	(0.006)	(0.022)
Observations	2,501	2,501	2,501		2,501	2,501	2,501
R-squared	0.046	0.78	0.056		0.16	0.78	0.21

Females

	(1)	(2)	(3)		(4)	(5)	(6)
	No controls				Controls included		
	Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score		Log caloric intake	Log calorie adequacy ratio	Log Global Diet Quality Score
Treatments							
T-SAAO	.0071	-0.020	0.087*		-0.003	-0.007	0.055**
	(0.022)	(0.013)	(0.042)		(0.014)	(0.009)	(0.023)
T-APK	.015	-0.004	0.046		0.005	-0.003	0.088***
	(0.021)	(0.015)	(0.038)		(0.013)	(0.010)	(0.021)
Observations	2,989	2,989	2,989		2,989	2,989	2,989
R-squared	0.038	0.72	0.065		0.15	0.75	0.21

Table S8H: Empowerment

Women

	(1)	(2)	(3)		(4)	(5)	(6)
	No controls				Controls included		
	Empowerment score	Whether empowered	Total gender attitudes score		Empowerment score	Whether empowered	Total gender attitudes score
Treatments							
T(SAAO)	0.042***	0.072**	0.360		0.035***	0.053**	0.433
	(0.016)	(0.032)	(0.463)		(0.011)	(0.026)	(0.265)
T(APK)	0.040**	0.073*	0.971**		0.034***	0.066**	0.721**
	(0.016)	(0.037)	(0.449)		(0.011)	(0.029)	(0.298)
Observations	1,743	1,743	1,743		1,743	1,743	1,743
R-squared	0.015	0.006	0.010		0.123	0.068	0.151

Men

	(1)	(2)	(3)		(4)	(5)	(6)	(7)	(8)
	No controls				Controls included			No controls	Controls included
	Empowerment score	Whether empowered	Total gender attitudes score		Empowerment score	Whether empowered	Total gender attitudes score	Gender parity	
Treatments									
T(SAAO)	0.030**	0.096**	0.542		0.031***	0.089***	0.609**	0.046	0.020
	(0.014)	(0.044)	(0.333)		(0.010)	(0.032)	(0.248)	(0.041)	(0.029)
T(APK)	0.036**	0.113**	0.300		0.027***	0.084***	-0.010	0.027	0.018
	(0.015)	(0.044)	(0.335)		(0.009)	(0.031)	(0.195)	(0.040)	(0.032)
Observations	1,743	1,743	1,743		1,743	1,743	1,743	1,743	1,743
R-squared	0.014	0.011	0.003		0.131	0.089	0.082	0.002	0.082

Notes: See Table S_A. Estimates are single difference. Sample is restricted to households where both women and men complete the survey modules needed to construct the Pro-WEAI.

Table S9: Adjusting P values for multiple hypothesis tests

Table S9A: Nutrition, agricultural knowledge, and adoption of improved practices: Women

	Domain	Outcome	P Value	Treatment	
				T(SAAO)	T(APK)
(1)	Nutrition and Agriculture Knowledge	Nutrition knowledge, percent correct	Regression P value	<0.0001	<0.0001
			Romano-Wolf P value	0.0010	0.0010
		Agriculture knowledge, percent correct	Regression P value	0.0003	0.0011
			Romano-Wolf P value	0.0010	0.0010
(2)	Any adoption	Any adoption, improved agricultural practices	Regression P value	0.0030	0.0051
			Romano-Wolf P value	0.0010	0.0010
(3)	Number of adopted practices	Number, improved agricultural practices	Regression P value	0.0023	0.0176
			Romano-Wolf P value	0.0010	0.0010

Table S9B: Nutrition, agricultural knowledge, and adoption of improved practices: Men

	Domain	Outcome	P Value	Treatment	
				T(SAAO)	T(APK)
(1)	Nutrition and Agriculture Knowledge	Nutrition knowledge, percent correct	Regression P value	<0.0001	<0.0001
			Romano-Wolf P value	0.0010	0.0010
		Agriculture knowledge, percent correct	Regression P value	<0.0001	<0.0001
			Romano-Wolf P value	0.0010	0.0010
(2)	Any adoption	Any adoption, improved agricultural practices	Regression P value	<0.0001	<0.0001
			Romano-Wolf P value	0.0010	0.0010
(3)	Number of adopted practices	Number, improved agricultural practices	Regression P value	<0.0001	<0.0001
			Romano-Wolf P value	0.0010	0.0010

Table S9C: Field crops and homestead agricultural production diversification

	Domain	Outcome	P Value	Treatment	
				T(SAAO)	T(APK)
(1)	Diversification of field crops	Simpson Diversification Index	Regression P value	0.7458	0.7202
			Romano-Wolf P value	0.8312	0.8312
		Number, non-rice field crops	Regression P value	0.6714	0.6598
			Romano-Wolf P value	0.8312	0.8312
(2)	Diversification of homestead food production	Number, homestead garden crops	Regression P value	0.9713	0.1496
			Romano-Wolf P value	0.9990	0.2577
		Any egg production	Regression P value	0.2048	0.0102
			Romano-Wolf P value	0.3417	0.0100
		Any dairy production	Regression P value	0.2494	0.0114
			Romano-Wolf P value	0.3716	0.0110
		Any fish production	Regression P value	0.9055	0.9764
			Romano-Wolf P value	0.9960	0.9960

Table S9D: Homestead production and consumption

	Domain	Outcome	P Value	Treatment	
				T(SAAO)	T(APK)
(1)	Production	Fruit and vegetables	Regression P value	0.5730	0.2797
			Romano-Wolf P value	0.5734	0.4156
		Eggs	Regression P value	0.2305	0.0028
			Romano-Wolf P value	0.4156	0.0020
		Dairy	Regression P value	0.2068	0.0171
			Romano-Wolf P value	0.4156	0.0190
		Fish	Regression P value	0.5254	0.2008
			Romano-Wolf P value	0.5734	0.4156
(2)	Consumption	Fruit and vegetables	Regression P value	0.7195	0.2813
			Romano-Wolf P value	0.7902	0.4116
		Eggs	Regression P value	0.1357	0.0012
			Romano-Wolf P value	0.2358	0.0010
		Dairy	Regression P value	0.1497	0.2358
			Romano-Wolf P value	0.0137	0.0150
		Fish	Regression P value	0.6743	0.2773
			Romano-Wolf P value	0.7902	0.4116

Table S9E: Household diet

	Domain	Outcome	P Value	Treatment	
				T-N	T-A
(1)	Household diet	Dietary Diversity Score	Regression P value	0.0454	0.0009
			Romano-Wolf P value	0.0210	0.0010
		Log per capita caloric acquisition	Regression P value	0.0894	0.1837
			Romano-Wolf P value	0.0480	0.0819
		Log household Global Diet Quality Score	Regression P value	<0.0001	0.0010
			Romano-Wolf P value	0.0001	0.0010

Table S9F: Individual diets

	Domain	Outcome	P Value	Treatment	
				T-SAAO	T-APK
(2)	All individuals, ages 15+	Log caloric intake	Regression P value	0.8613	0.8856
			Romano-Wolf P value	0.9321	0.9321
		Log calorie adequacy ratio	Regression P value	0.8740	0.8414
			Romano-Wolf P value	0.9451	0.9451
		Log Global Diet Quality Score	Regression P value	0.0125	0.0001
			Romano-Wolf P value	0.0010	0.0010
(2)	Males, ages 15+	Log caloric intake	Regression P value	0.7180	0.8104
			Romano-Wolf P value	0.8102	0.8102
		Log calorie adequacy ratio	Regression P value	0.0895	0.2182
			Romano-Wolf P value	0.0909	0.1768
		Log Global Diet Quality Score	Regression P value	0.0146	0.0002
			Romano-Wolf P value	0.0020	0.0010
(3)	Females, ages 15+	Log caloric intake	Regression P value	0.8024	0.6727
			Romano-Wolf P value	0.7962	0.7962
		Log calorie adequacy ratio	Regression P value	0.4257	0.7554
			Romano-Wolf P value	0.3696	0.6144
		Log Global Diet Quality Score	Regression P value	0.0210	0.0002
			Romano-Wolf P value	0.0020	0.0010

Table S9G: Empowerment

	Domain	Outcome	P Value	Treatment	
				T(SAAO)	T(APK)
(1)	Women	Empowerment score	Regression P value	0.0028	0.0039
			Romano-Wolf P value	0.0010	0.0030
		Whether empowered	Regression P value	0.0451	0.0265
			Romano-Wolf P value	0.0180	0.0110
		Total gender attitudes score	Regression P value	0.1084	0.0186
			Romano-Wolf P value	0.0230	0.0090
(2)	Men	Empowerment score	Regression P value	0.0031	0.0063
			Romano-Wolf P value	0.0010	0.0010
		Whether empowered	Regression P value	0.0077	0.0095
			Romano-Wolf P value	0.0010	0.0010
		Total gender attitudes score	Regression P value	0.0169	0.9608
			Romano-Wolf P value	0.0040	0.9530

ALL IFPRI DISCUSSION PAPERS

All discussion papers are available **here**

They can be downloaded free of charge

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
www.ifpri.org

IFPRI HEADQUARTERS

1201 Eye Street, NW
Washington, DC 20005 USA
Tel.: +1-202-862-5600
Fax: +1-202-862-5606
Email: ifpri@cgiar.org