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Can a Combined Agriculture and Nutrition Behaviour Change Intervention Improve Women's Empowerment? A Mixed Methods Feasibility Study in Rural Bangladesh

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Can a Combined Agriculture and Nutrition Behaviour Change Intervention Improve Women’s Empowerment? A Mixed Methods Feasibility Study in Rural Bangladesh

Abstract

Many agricultural and home gardening interventions aim to improve the nutritional status of women and children in low- and middle-income countries by focusing on women as the recipients of the intervention and make assumptions that women will be empowered as a result. This paper examines the potential impact of an intervention study that combined home garden training and support, and nutrition behaviour change communication, with a social safety net payment, on women’s empowerment in rural Bangladesh. We assessed the implementation of this study in terms of feasibility, acceptability, and practical application. Twenty in-depth interviews were conducted with randomly selected women that took part in the study. Qualitative data was coded using thematic analysis (Braun & Clarke 2006) and the results presented using the following five indicators: control over use of income, input into productive decisions, respect among household members, self-efficacy, and input into nutrition and health care decisions. Our study showed that a combined nutrition-specific (nutrition counselling) and nutrition-sensitive (agricultural training and unconditional cash transfer) intervention, delivered on a mobile platform, to women from low-income families in rural Bangladesh was feasible and acceptable. The study further revealed evidence on behaviour change across five key indicators related to women’s empowerment. The study highlights the potential for such an intervention to impact women’s empowerment and provides insight for the aid in the design of larger-scale trials implemented in similar settings.

Keywords

women’s empowerment, feasibility, nutrition-sensitive agriculture, behaviour change communication, mHealth, social safety net, qualitative methods, in-depth interviews

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Can a Combined Agriculture and Nutrition Behaviour Change Intervention Improve Women's Empowerment? A Mixed Methods Feasibility Study in Rural Bangladesh

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Many agricultural and home gardening interventions aim to improve the nutritional status of women and children in low- and middle-income countries by focusing on women as the recipients of the intervention and make assumptions that women will be empowered as a result. This paper examines the potential impact of an intervention study that combined home garden training and support, and nutrition behaviour change communication, with a social safety net payment, on women's empowerment in rural Bangladesh. We assessed the implementation of this study in terms of feasibility, acceptability, and practical application. Twenty in-depth interviews were conducted with randomly selected women that took part in the study. Qualitative data was coded using thematic analysis (Braun & Clarke 2006) and the results presented using the following five indicators: control over use of income, input into productive decisions, respect among household members, self-efficacy, and input into nutrition and health care decisions. Our study showed that a combined nutrition-specific (nutrition counselling) and nutrition-sensitive (agricultural training and unconditional cash transfer) intervention, delivered on a mobile platform, to women from low-income families in rural Bangladesh was feasible and acceptable. The study further revealed evidence on behaviour change across five key indicators related to women's empowerment. The study highlights the potential for such an intervention to impact women's empowerment and provides insight for the aid in the design of larger-scale trials implemented in similar settings.

Keywords: women's empowerment, feasibility, nutrition-sensitive agriculture, behaviour change communication, mHealth, social safety net, qualitative methods, in-depth interviews

Introduction

There are significant linkages between nutrition outcomes and women's empowerment (Cunningham, Ruel et al. 2015, FAO 2019, Heckert, et al. 2019). The nutrition sensitivity of interventions, such as nutrition-sensitive agricultural programs, can be further enhanced when they improve women's empowerment (Ruel & Alderman, 2013). Women's empowerment, a complex and dynamic notion, can be conceptualized, in simple terms, as the ability to exercise agency and to make strategic life choices (Kabeer, 2005). Nutrition-sensitive interventions address underlying determinants of malnutrition; approaches include agricultural programs, cash transfers, and nutrition education. When combining nutrition-sensitive approaches with

nutrition-specific interventions, nutrition-focused outcomes have enhanced impact and scalability (Ruel et al., 2018). The Lancet Maternal and Child Nutrition series highlighted three ways in which nutrition-sensitive interventions could impact women working in agriculture: by improving women's control and access to resources, work balance (both positive and negative) and time needed for agricultural activities, and women's health and nutrition, that is, exposure to pesticides or an imbalance between energy intake and expenditure (Ruel & Alderman, 2013). According to Ruel et al. (2018), nutrition-sensitive agriculture programs have more successful nutritional outcomes when combined with nutrition behaviour change communication and focus on improving women's empowerment.

Bangladesh has made significant progress in reducing food insecurity; however, around one in four remain food-insecure, with nearly one-third of children under the age of five stunted due to chronic malnutrition (National Institute of Population, Training et al. 2020). Nearly 13% of Bangladeshi women are underweight and experience chronic energy deficiency (National Institute of Population, Training et al. 2020). In South Asia, including Bangladesh, gender discrimination, and inequitable food allocation for women and children within households is a key contributing factor in sustained high rates of malnutrition (Quisumbing, 2007). In rural Bangladesh, men go to the marketplace to buy food and women cook food and prepare meals for the family, eating least and last (Blum, et al. 2019; Lentz, 2018).

In 2019, the World Bank reported 36% of Bangladeshi women worked in paid labour (*World Bank Indicators - Labor force participation rate, female (% female population 15+; Bangladesh, 2019)*). With restrictions on mobility and limited access to the workforce due to gender-based constraints, women in Bangladesh can face limited control over economic resources and have restricted spending power and limited decision-making ability. Social protection such as cash transfers targeted at women can encourage women's economic empowerment and enhance decision-making ability, with the overarching supposition that control over cash will lead to greater investment in children's health and education (de la O Campos, 2015; Ruel & Alderman, 2013). When women are engaged in nutrition-sensitive programs that utilize social safety nets, aspects of women's empowerment can improve, such as changes in gender roles, and intrahousehold bargaining power (Ruel & Alderman, 2013).

The home gardens, the area directly around the household, can make a vital contribution to the diet of rural poor by increasing vegetable production, dietary diversity, and intake for households (Ferdous et al., 2016). Evidence shows that involving women in agricultural activities can improve dietary diversity and household food security and has the potential to cultivate empowerment (Cunningham, Ploubidis et al., 2015; Cunningham, Ruel et al., 2015). However, the communal value placed on the restriction of women in public spheres remains one of the greatest challenges to increasing women's choices in agriculture, from production and access to services, and marketing (Hillenbrand, 2010).

Women living in rural areas have shown an interest in home gardens as they use land around the household (which is convenient), do not involve travel, and can potentially allow balance with childcare and other household duties. Hellen Keller International's (HKI) training program on home gardening promotes women's empowerment via small-scale agriculture and aims to improve women's and children's nutrition outcomes (Hillenbrand, 2010). Hillenbrand (2010) reports that, despite women's empowerment not being an explicit aim of the HKI program, changes in gender-based power dynamics occurred; for example, intra-household relations changed with an increase in women's participation in household decision-making (Haselow et al., 2016). The widespread applicability, popularity, and acceptance of home garden programs in Bangladesh may also be due to programs deliberately not challenging existing gender norms and patriarchal power structures (Hillenbrand, 2010; Patalagsa et al., 2015). A recent study reported that a home garden and nutrition program in Bangladesh positively contributed to women's empowerment, showing increases in control over the use of

income, greater influence in decision-making regarding garden activities and household food choices, and a greater sense of self-efficacy and recognition in the community (Patalagsa et al., 2015).

When evaluating lessons learned from nutrition-sensitive agriculture, Ruel et al. (2018) noted that mostly observational studies reported the linkages and mediating role of women's empowerment with nutrition and agriculture). A trial in Bangladesh examined the association between agricultural production, nutrition outcomes, and gender, and established that combined interventions had greater impact than isolated ones, with women's empowerment improving for all participants (Ahmed et al., 2020). These findings illustrate the synergies between gender, nutrition, and agriculture.

We conducted a mixed methods pilot study that aimed to assess the feasibility and acceptability of an intervention package combining home garden training and nutrition behaviour change communication, with a social safety net payment among poor households in rural Bangladesh. Nutrition behavior change communication encourages change and helps to promote behaviours that foster health and wellbeing and can improve nutrition knowledge, practice, and potentially health outcomes (Briscoe & Aboud 2012; Hoddinott et al., 2018). The overall results have been published elsewhere (Alam et al., 2020). This paper analyses the feasibility outcomes of the project related to change in women empowerment.

This group of authors are interested in understanding the impact of public health interventions focusing on women and children, on women's empowerment. In particular, the lead author was involved in this project as part of her PhD research, which focuses on using a gender lens to assess public health interventions and their programmatic impact on women's empowerment. Elizabeth has worked closely with colleagues in Bangladesh and has a keen interest in gender-based inequities across a range of health outcomes, with the intention of improving the health status of women and children in low- and middle-income countries.

This paper will contribute to the knowledge on potential impact of multicomponent interventions using health education, agricultural training, and social safety nets on women's empowerment.

Materials and Methods

Methods and Data Collection

Participants

The characteristics of study participants are shown in Table 1. Approximately half the women were aged 15-24 years (48%), with the other half 25-34 years (47%). Nearly all the women had children under the age of two (90%). Husbands were the main income earners for the family (96%), working in skilled labour (14%) and unskilled labour (41%).

Table 1

Participant and household characteristics

	n=58	
	n	%
Woman's characteristics		
Age of women by category	28	48.3
15-24 years	27	46.6
25-34 years	03	5.2
35-44 years	03	5.2

Age of children by category		
0-23 months	52	89.6
24-59 months	6	10.4
Husband current working status	56	96.5
employed	2	3.5
unemployed	2	3.5
Husband's occupation		
Unskilled labourer	24	41.4
Skilled worker	24	41.4
Small business/trade	6	10.3
Service holder	2	3.4
Other	2	3.4

The Intervention

In this paper we report the findings related to the feasibility and behaviour change of women around women's empowerment; here we have provided a brief summary of the project to give a context to the readers. We conducted a feasibility study in two villages in Kurigram, Northern Bangladesh. A feasibility study is a preliminary assessment of the practicality of broad aspects of a proposed project. The study area is in a food insecure and impoverished region of the country (*Updating Poverty Maps of Bangladesh*, 2015). We mapped and identified households in the study area with women of reproductive age and children under the age of five. This multi-component intervention was developed based on formative research (Bentley et al., 2014). Formative research, conducted during the development phase of the intervention, explores the socio-cultural aspects of the study community to create a deeper understanding and inform the study design. We developed a community-based intervention that combined agricultural training with a focus on home gardens and nutrition BCC activities that aimed to improve maternal and child nutrition. Nutrition BBC activities included fortnightly household visits from trained nutrition counsellors to counsel them and their husbands on the appropriate diet for pregnant and lactating women and children. The counsellors used a smartphone app with embedded text, videos, and pictorial messages to aid in the nutrition counselling. Group counselling sessions were also supplied to the women and their husbands and mothers-in-law during the first month of the intervention. The intervention ran for a total of six months.

Households were determined to be eligible based on information from the Bangladesh Agricultural Extension Programme and were situated in one of the most food insecure and impoverished areas in the country (Alam et al., 2020). Households in the study areas were listed, mapped, and screened to identify the poorer households with women of reproductive age and children under five. In August of 2017, we enrolled sixty eligible households in the study via a mobile phone registration. We provided each woman with a mobile phone; this enabled the low-income families to communicate with agricultural extension workers and the community nutrition program. Project agriculture workers provided information to women and family members using a smartphone app to illustrate homestead gardening techniques, selection of crops, and the nutritional aspect of crops. Trained agriculture workers visited each household to provide training for the woman and her husband on homestead gardening support. A trained

nutrition counsellor made fortnightly house visits to counsel women and husbands, using the smartphone app (text, video, and pictorial format) to convey messages on diet during pregnancy, breastfeeding, and for children under five. The phones had the bKash (largest mobile banking in Bangladesh) mobile banking app installed, and this facilitated the monthly payment of an unconditional cash transfer (BDT1200 / GBP10 / USD12) to each woman enrolled in the study. We assessed the feasibility and acceptability of combined agriculture-nutrition education and counselling and unconditional cash transfer intervention in a mixed methods pilot study using in-depth interviews and key-informant interviews. The detail design of the pilot intervention has been published (Alam et al., 2020).

Qualitative Data Collection

We used in-depth interviews with mothers to capture the richness and individuality of responses. We explored the participants' perceptions and experiences of the intervention. Qualitative methods were used as they are the most appropriate process of systematic inquiry and enable in-depth exploration of the respondents' participation in the intervention. Thematic analysis was used to identify and analyse key themes from the data (Braun & Clarke, 2006).

In this paper, we have reported the findings from the in-depth interviews with randomly selected women (n=20) in registered households and explored their experiences partaking in the intervention. Women were interviewed alone, with no other people present. Data collection guidelines were pre-tested on a sub-sample of women in the study area and used to guide interviews. Flexible guidelines ensured any feedback could be explored in detail. The interviewer made a digital audio recording of each interview which was transcribed in Bangla and translated into English. Spot checks of recordings and transcriptions took place to ensure the quality and accuracy of work by a senior health social scientist (Alam) fluent in Bangla and English. We have also used data from an end of project survey (n=58) where relevant, to complement the qualitative findings.

The Ethical Review Committee of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) approved the study (Ref. PR-16075). Additional ethics approval from the University of Sydney was not required as the icddr,b has an international standards ethics review and therefore a separate ethics approval was not required. Informed consent was obtained from each participant. Before the audio recording interviews, interviewees gave verbal consent which was audio recorded. We assured interviewees that their participation was entirely voluntary, and all information provided would be de-identified, ensuring anonymity and privacy of the information shared.

Conceptual Framework

Our results are organized using The Project Level Women's Empowerment in Agriculture Index (Pro-WEAI) as a framework. The Pro-WEAI measures the empowerment of women, agency, and inclusion in the agriculture sector (Malapit et al., 2019). It is an internationally validated index, developed to adapt to project-specific contexts and has been piloted in Bangladesh (Alkire et al., 2013; Malapit et al., 2019). The Pro-WEAI uses Kabeer's definition of empowerment which focuses on the ability of individuals to make choices; "a process of change during which those who have been denied the ability to make choices acquire such an ability" (Kabeer, 1999 p. 435). Agency, or the ability of the individual to make considered choices, is at the centre of the framework and revolves around interrelated dimensions of resources, agency, and achievements. We did not use the Pro-WEAI tool to collect data; however, we analyzed post programmatic data using this index as a framework to

structure and organize our findings and have coded the qualitative data using the following five indicators:

1. *Control over the use of income*: women and men's control over cash transfer from the intervention and income generated as a result of the intervention (i.e., from home gardens), and decision-making re expenditure.
2. *Input into productive decisions*: the contribution of women and their decision-making ability regarding agricultural production, home gardening, and livelihoods.
3. *Respect amount household members*: intrahousehold relationships and women's communication skills.
4. *Self-efficacy*: a woman's level of confidence, feeling of achievements, and self-satisfaction.
5. *Input into nutrition and health care decisions*: women's utilization of knowledge gained from the intervention and subsequent agency and decision-making ability on health and nutrition choices (Malapit et al., 2019).

Data Analysis

Qualitative data: We transcribed audio-recorded Bangla interviews verbatim using MS Word files. A research assistant translated the transcripts that were checked by the Bangla-speaking last author for accuracy. We used Bernard's framework to conduct thematic analysis (Bernard et al., 2017), with themes generated from the data categorized under several key domains. Initially, we developed a priori codebook based on the interview guidelines and indicators within the Pro-WEAI framework. The first author manually coded one interview following this codebook which was consulted and verified by an experienced qualitative researcher (last author). The first author then manually coded all interviews. Whilst coding, we maintained the flexibility of including any additional relevant themes related to the objective of this study, maintaining both deductive and inductive coding as well as inter-coder reliability. The thematic codes were categorized before being grouped under five themes, each relating to one of five indicators from the Pro-WEAI (Malapit et al., 2019). We then compiled the text about the five indicators in separate files. We coded the transcripts and analyzed the data using MAXQDA software (Software, 2019).

Quantitative data: We used SPSS version 21 to perform descriptive statistical analysis to produce frequency tables. The quantitative data generated was used to complement the in-depth qualitative data. We evaluated the participants' socio-demographic characteristics, receipt and use of cash transfer, women's mobile phone usage, participation in agricultural and nutrition counselling, and type of information received.

Results

Our study revealed evidence of the feasibility of the intervention on behaviour change across five key areas related to women's empowerment: control over use of income, input into productive decisions, respect among household members, self-efficacy, and input into health and nutrition decisions. We have structured our analysis using five Pro-WEAI indicators as a framework to report our results.

Control Over the Use of Income

Income from Intervention

Women received the cash via bKash mobile banking app. Three women reported that they did not have a National Identity card required to set up the account and the bKash account was in the name of their husband or brother. One woman reported that her husband refused to allow her to go to market; he withdrew the funds and handed the money to her. Another woman did not go to the marketplace but stated there was no problem if she so desired to go to market. One would accompany her brother to the marketplace for him to withdraw the funds, while another woman stated convenience as the reason that her husband withdrew the cash.

My husband withdrew it and gave it to me.

Q: Why did your husband withdraw the money? Why not you?

Is there any restriction for you to go to the market? My husband is often in the market, so it's more convenient. I don't have any restrictions (Woman, 20 years).

All women had support from their husbands to collect cash if they were not able to go to the marketplace. Regardless of who withdrew the funds, all women received the cash transfer and stated they controlled and had input into the spending of the funds. Women reported being able to spend the funds as they wished and when needed without permission or objections from their husbands. One woman went as far as asking the interviewer as to why her husband would object.

Everyone has good comments on my receiving money from this project. I can spend money as I wish, my husband says nothing. Now, I can buy anything that I prefer for my child. There is no need to ask for money from my husband. I, myself, spend my own money (Woman, 19 years).

Husbands would spend the money in the marketplace as directed by their wives, with several women instructing their husbands to purchase nutritious foods particularly for young children: items such as milk, eggs, fish, meat, and vegetables. Two women reported using the cash to buy medicine when their child was sick. When asked about planned expenditure for the money, all women stated that they would purchase food and vegetable seeds.

Q: Did your husband withdraw both times?

Yes.

Q: Did he hand the money to you after withdrawing?

Yes.

Q: What did you do with the money?

I told my husband to buy vegetables, fruits from the market, and I bought leaf seeds. Buy and eat vegetables, fish, eggs, meaning any nutritious food. Buy seeds and grow vegetables. And if possible, buy and rear ducks, and chickens (Woman, 22 years).

Income Earned as a Result of the Intervention

The combination of the cash transfer and agricultural training enabled all of the women to establish homestead gardens, which allowed them to earn supplementary income. The

establishment of homestead gardens was primarily the women's domains, managed with support from their husbands and advice and supervision from agricultural counsellors. Several women had successful harvests and the produce grown was eaten by the family. Excess produce was sold at the market, providing an additional income source for the women.

Q: Did vegetable gardening give you any benefit, and did you ever sell farmed vegetables before? Is this the first time?

Yes, we ate vegetables and sold it. No, I didn't do this before; this was the first time I had a good harvest. I could've bought chickens, ducks, goats with a little more money. 2 or 3 thousand taka more (Woman, 22 years).

Our quantitative survey at the end of the project revealed further supporting information. All the women in the survey received a mobile phone from the intervention and successfully received the cash transfer via bKash mobile banking app. Most women reported using the mobile phone to make and receive calls (98%). Many women would withdraw the funds from the BKash agent (40%); however, most withdrawals were made by the husbands (57%). For details see Table 2 below.

Table 2

Cash transfer via bKash mobile banking and mobile phone use

	n=58	
	n	%
Mobile Phones		
Used mobile phones for calls	57	98.3
Sent SMS with mobile phone	2	3.4
Cash		
Received cash via bKash	58	
Woman withdrew cash	23	100
Husband withdrew cash	33	39.7
Relative withdrew cash	5	56.9
Amount of cash received monthly		8.6
1200 Taka cash only	45	77.6
1200 Taka plus service charge	13	22.4
Expenditure of cash		
Purchased seeds	13	22.4
Purchased fertilizer	10	17.2
Purchased foods	53	91.4
Child's education/study	3	5.2
Other (small livestock, fencing, health, medicine, clothes for children)	34	58.6

Input into Productive Decisions

As part of the agricultural training, women were encouraged to establish homestead gardening. This project enabled women to participate, make decisions, and access information that would provide a guide for decisions around production. The women received training and could impart information to their husbands and provide input into various activities such as the establishment of garden beds. Many women worked together with their husbands and other family members to establish garden beds. The women communicated new knowledge by giving instructions to other family members, demonstrating substantial input in the establishment of homestead gardens. One woman when asked about what activities she did not know about before the intervention reported:

I didn't know I had to dig 1.5 feet deep and use manure, fertilizer. The tree roots will be healthy and will better yield fruits.

Q: Did you work alone on the beds or the others helped you?

Mother-in-law, sister-in-law, husband helped me. I told them how to.... No, I told my husband how to make the beds.

Q: Did you teach others around you about these things?

Yes, I told them that if you dig 1.5 feet deep and use dry manure, then you will grow better gourds (Woman, 22 years).

The project agriculture workers facilitated discussions about the benefits from the women's input into decisions regarding market garden production. Men have more control over household decision-making, yet women made decisions about household gardens on a comparatively independent basis. When asked if her husband ever objected to her gardening, one woman communicated that her husband did not object as they did not have to buy vegetables and everyone was happier, as their child could eat them.

Another component of the agricultural training encouraged women to diversify livelihoods and buy chickens or ducks to use for eggs, meat, and additional income. Many women, solely or jointly with husbands, participated in decision-making around raising poultry and other small animals. With the cash transfer or additional funds earned by homestead gardens, several women bought between one to three chickens and others planned to do so.

If we buy chickens, ducks, this project will have more improvements.

Q: Why will rearing chickens, ducks give you benefits?

If chickens and ducks lay eggs, they will hatch, and we can eat and sell them when they grow up. This will give us a huge profit (Woman, 19 years).

In one instance, a woman reported having saved 600 Taka and wanted to purchase a goat. When asked whether she could buy a goat for 600 taka, she replied that she could not, but she would take additional money from her husband. One woman recounted that when her chickens were bigger, she could sell them and give the money to her husband if he found himself in financial trouble.

Respect Among Household Members

In this indicator, we found evidence of changes in intrahousehold relationships. During the first month of the intervention, group nutrition counselling was provided to women and their husbands and mothers-in-law. The agricultural training sessions provided women with new knowledge and skills in a supportive environment. This new standing in the household

empowered women to participate in internal household communications and work with their husbands to achieve goals.

It's not enough that we know, husbands need to know too. The husbands do work.

Q: Did your husband help you with planting the vegetables?

Husband helped...he planted vegetables (Woman, 20 years).

The intervention provided women with a mobile phone to enable communication with the intervention staff. All women reported that they did not own a mobile phone before the intervention, yet their husbands did own a phone. The mobile phone also provided a new asset for the women that enhanced communication channels with family members. One woman reported that the mobile phone now enabled her to talk to her parents. The phone also facilitated an increase in spousal communication. When asked what benefits owning a mobile brought, one woman said:

I got one mobile, I can get messages on the mobile, apa (my sister) can talk to us from Dhaka, and we can get necessary information. I know how to use it. I can talk with mobile, read messages, can talk to my husband... I keep the mobile with me (Woman, 22 years).

Self-Efficacy

The intervention led to a sense of achievement and confidence for many of the women. The social standing of the women in the community changed when neighbors saw what they were doing with gardens and came to ask for information.

People around us are seeing us and growing vegetables.

Q: Is there anyone who didn't receive advice but planted vegetables? Did they come to you for information?

They talked to us and planted (Woman, 22 years).

Satisfaction came from having access to information and achieving home gardening goals: having a good harvest, eating a more diverse array of vegetables, and gaining expertise and ability that the women did not have before. Most women reported that the advice and information they received was important as they had inadequate knowledge, skills, and resources to plant like this before. Many women conveyed an increase in confidence by explaining how they were now able to grow, plant, and harvest vegetables. When asked if the new methods of planting were beneficial, one woman said:

Yes, because we didn't know of this method of planting vegetables before, the vegetables grow better if this method is used. I planted gourd on the sand beds, the yield was extremely high. Yes, I couldn't grow vegetables before, but now I can, and I'm happy (Woman, 20 years).

Women gained knowledge and spoke of their ability to communicate the information. Women saw the advice as essential as due to the knowledge, skills, and self-confidence they acquired.

I couldn't plant like this before. The advice is more important, because we don't know anything...I learned about children's nutrition and getting better yield for vegetables because they (nutrition counsellors) gave me advice. My household has improved with the money. I can feed myself, and my child; they were prevented from undernutrition at least to some extent (Woman, 20 years).

Input into Nutrition and Health Decisions

The nutrition counselling helped formulate an understanding of what vegetables to consume for the nutrition and health of their families, particularly young children. This new information empowered women to have a greater say in health and nutrition-related decisions within the household.

Women had greater input into their own healthcare choices. The mobile app was used to illustrate breastfeeding techniques and the information provided the impetus to make better decisions around their own health care needs.

They (nutrition counsellor) showed us how to breastfeed the child, through mobile phone... If there was any disorder with breasts, I showed them. They said to apply hot press on the breast to make it soft and to wash with hot water before breastfeeding the child (Woman, 25 years).

Several women expressed an understanding of the importance of the health and nutrition counselling messages and the long-term ramifications.

Suppose our children don't get nutrition when they are young. The children are married off at an early age, like 12/14 years of age. I can't give education to the children. Now we can give education and nutrition to the children and improve their lives (Woman, 20 years).

We asked the women which they found more useful – the money, or the advice provided by the program, with many reporting that the advice was more important, as it enabled women to become actively involved in nutrition and health care choices and boosted their decision-making ability.

Advice, because if we didn't get the advice, we wouldn't be able to plant vegetables. If we didn't receive the money, we wouldn't be able to buy seeds... Before, I didn't know that I had to feed the children rice three times a day, that I had to feed them with all kinds of vegetables (Woman, 22 years).

All beneficiaries received counselling from a nutrition counsellor. Most received counselling every week (85%), whilst a few received counselling on a fortnightly basis (15%). When asked about the topics covered, the majority received information on breastfeeding (88%) and complementary feeding (95%). One in five conveyed receiving information on other topics such as nutritious foods.

Discussion

Our feasibility study showed that a combined nutrition-specific (nutrition counselling) and nutrition-sensitive (agricultural training and unconditional cash transfer) intervention, delivered on a mobile platform, to women from low-income families in rural Bangladesh was

feasible and acceptable. The study also indicated potentials of impacts for such a combination of intervention on women's empowerment in a larger trial implemented in similar setting. This study provides insight to aid in the design of larger-scale trials.

Post programmatic analysis revealed evidence that the intervention's behaviour change communication messaging has led to change women's behaviour across five key areas related to women's empowerment. Firstly, women reported an increase in control over the use of direct income from the unconditional cash transfer. Women gained access to financial services by having a mobile banking account (bKash) opened in their name, enabling them to have new equitable access to mobile banking facilities. When women received the cash from bKash mobile banking account, their husbands would mostly withdraw it. In rural Bangladesh, men have greater social mobility and would visit the market more often to do the shopping. Whilst many women could go to the marketplace, community attitudes, social norms, and gender expectations may provide a barrier as women experience inequitable access to markets and financial services. However, women reported that their husbands were cooperative and supportive in obtaining the cash, giving them the funds to spend as they desired. Women gave directions to their husbands as to how to spend the money, demonstrating agency in purchasing decisions.

In poor rural households in Bangladesh, women traditionally have little control over productive resources such as land and money (Patalagsa et al., 2015). A change in power dynamics seemed evident when our data indicated that a woman could sell her chickens and give the money to her husband if he was in financial trouble. Several women reported that they no longer had to ask for money from their husband nor seek permission before spending the funds, indicating autonomy and control over the use of income and illustrating that by being part of the intervention, women were contributing economically to the family finances.

Findings from this study revealed that intrahousehold relationships, and in particular, spousal communication, improved as a result of the intervention. Women shared new skills and knowledge and worked together with their husbands to build garden beds for planting seedlings. The establishment of home gardens would often involve the entire household: husbands, sisters-in-law, and mothers-in-law. Women actively contributed to homestead gardens and described a sense of achievement not possible without the knowledge, skills, and resources they had gained. Women's social standing in the community changed; they had new information to communicate. An increase in self-efficacy and confidence was evident; community members would ask women questions and then plant gardens in similar ways. The contribution and exchange of knowledge and increased capacity fostered a sense of self-worth.

A trial in Burkina Faso evaluated a nutrition-sensitive program consisting of agricultural training, health and nutrition BCC, and promotion of women's access to and use of land via community-focused activities. It found compelling evidence that women's empowerment is a pathway to improve child nutritional status (Heckert et al., 2019). The study revealed evidence that enhanced spousal communication made the largest contribution to a reduction in childhood wasting. Our study also found evidence of improved spousal communication as a result of the behaviour change communication: husbands and wives creating gardens together.

Our intervention supplied phones to women as part of the social transfer and facilitated connectivity and exchange of information. Owning a mobile phone led to an increase in women's communication with husbands and family members, as well as agriculture and nutrition counsellors. Whilst mobile phone ownership in Bangladesh is high, the engendered digital divide is apparent, with 86% of men and 61% of women owning mobile phones, and with women from poorer households even less likely to own a mobile phone (Khatun et al., 2017; Rowntree, 2020). Tran et al.'s (2015) findings align with our study results and highlight that women's lives can be enhanced by mobile phone ownership by way of enhanced

connectivity: communicating with people and financial services and having access to information. Mobile phones can be a vehicle for women to reframe their roles in their households or positions in society, as digital literacy empowers women by newfound connectivity (Tran et al., 2015).

In this study, we found that nutrition counselling empowered women to have greater input into nutrition and health care decisions. After the intervention, women spoke of knowing the importance of eating a range of nutritious foods that provide vitamins and nutrients to keep their children healthy and became actively involved in decisions regarding how often to feed children and the importance of dietary diversity. The advice and training women received fostered agency and led to practical action, enabled by cash transfer. A study from Nepal investigated the relationship between women's empowerment in agriculture and production diversity on maternal and child nutrition outcomes and found positive association between overall empowerment and control over income with greater diversity in maternal diet (Malapit et al., 2015).

We recommend the inclusion of women's empowerment and gender sensitization as an explicit aim for nutrition-focused agriculture interventions, as this is likely to make programs even more effective and lead to improvements in nutrition outcomes (Patalagsa et al., 2015; Ruel et al., 2018). Baliki et al. (2019) analysed the impact of an integrated home garden intervention on vegetable production and consumption in Bangladesh and found positive changes in women's empowerment three years post-program, providing correlational evidence on social impact beyond the agriculture and nutrition sphere of the intervention. This approach is in alignment with The Government of Bangladesh's Second National Nutrition Plan (2016 – 2025), which prioritizes nutrition-sensitive approaches, such as advancing women's empowerment (Bangladesh, 2019).

The interpretation of our study has some limitations. We predominantly used qualitative data and did not interview all family members. Future program analysis should include interviews with men and key household members such as mothers-in-law, to elucidate a more comprehensive understanding of the feasibility of the intervention from a household perspective. This study was a pilot study, and as such, the results are not necessarily replicable or generalizable in nature. To advance these interventions, we need further exploration of the intended and unintended consequences of nutrition-sensitive agriculture interventions on women working in the agriculture sector such as overburdening women with workload, time use, energy expenditure, and balancing household obligations and childcare. However, our study has strength to generate feasibility outcomes that can inform the design of a large-scale trial.

Abbreviations

- BCC – behaviour change communication
- bKash – Bangladeshi Mobile Banking App
- HKI – Helen Keller International
- icddr,b – International Centre for Diarrhoeal Disease Research, Bangladesh
- Pro-WEAI – Project-Level Women's Empowerment in Agriculture Index
- WEAI – Women's Empowerment in Agriculture Index

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