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Research

Perceptions and experiences of an intervention to improve diets of women and young children in Ghana

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Background

Efficacious integrated intervention strategies to address the drivers of malnutrition at multiple levels are hardly implemented at scale, although opportunities for cross-sectoral action exist. In 2020, the Improved Feeding Practices (IFP) Project was implemented in Ghana to improve the dietary diversity and well-being of women of reproductive age (15-49 years) and children >2 years.

Objective

This paper reports the perceptions and experiences of project beneficiaries and the lessons learned from the IFP project.

Methods

Using a socio-ecological framework, data from the IFP project documents (n=8) and in-depth interviews with key stakeholders, including local government officers, and direct and indirect beneficiaries (n=61), were triangulated to construct an evidence-based overview of the implementation of the complementary strategies of the IFP project. The interviews explored respondents' knowledge, experiences of the project activities, and perceptions of how the project affected their lives. The data were analysed and synthesized thematically using ATLAS.ti.

Results

The IFP project envisaged an impact pathway through promoting community- or home-based nutrient-rich crop production and poultry to enhance diet quality, child care and feeding practices. Multi-sectoral partners facilitated training and service delivery at community, farm, facility, and household levels. Beneficiaries reported an overall positive experience of participating in the project, including enhanced dietary knowledge, capacity to produce and use eggs and orange fleshed sweet potatoes (OFSP), earned revenues, and access to nutritious foods. Caregivers reported that the IFP project contributed to enhancing children's diet quality, reduced disease incidence, and improved child growth. Community-level program implementers experienced capacity strengthening. The dry season, increased poultry feed input prices, diseases (such as fowl pox, Newcastle and smallpox), and poultry deaths, limited the scale of benefits. Key implementation lessons include leveraging local resources to produce poultry feed at home, crossbreeding local and commercial poultry, and enhancing disease management, leading to improved potential for project sustainability.

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Conclusions

Overall, the communities reported a positive experience of an integrated nutrition-sensitive agriculture (NSA) intervention, leading to improved diets of households, women of reproductive age, and young children >2 years. These strategies can be adapted for use in other to improve women's and children's dietary diversity in similar settings, giving due consideration to lessons learned.

INTRODUCTION

Undernutrition remains a major health and development challenge, raising doubts about the prospect of achieving the Sustainable Development "zero hunger" goal by 2030, especially in resource-deprived settings (IFPRI 2019). Child undernutrition results from the interplay of multiple causes, including poverty, insufficient dietary intake and diversity, inadequate care and feeding, lack of a hygienic living environment, and limited access to health services (UNICEF 2020). In the first 1,000 days from conception, undernutrition increases child morbidity and mortality, with a high risk of dying even from common infections (Black et al. 2013). Furthermore, undernutrition in childhood adversely affects physical and cognitive development, learning potential and negative reproductive outcomes among adults, perpetuating an intergenerational vicious cycle of inadequate nutrition, poor health, and low productivity (Grantham-McGregor et al. 2007).

Inadequate complementary feeding practices harm children's health and growth in the first two years of life (Issaka et al. 2015; Masuke et al. 2021). This period has been recognized as the 'critical window of opportunity' for the promotion of optimal growth, health, and development of young children (WHO and PAHO 2003). Children may become stunted if they do not receive enough quality complementary foods after six months of age, even if they receive optimum breastfeeding (Black et al. 2008).

Recent evidence demonstrates a marginal improvement in the nutritional status of women and children over the past decade. Stunting rates and numbers among young children have decreased relatively faster than wasting (Global Nutrition Report 2020). However, the rate and number of malnourished children remains unacceptably high in Sub-Saharan Africa and South Asia.

Food insecurity and inadequate caregiving are priority driving forces of stunting. The Lancet Series on maternal and child nutrition in 2021, highlighted the usefulness of combining nutrition-specific and nutrition-sensitive strategies to address child and maternal malnutrition (Cesar et al. 2021). While the evidence on nutrition-specific interventions is generally robust, the evidence on integrated interventions continues to evolve (Ruel et al. 2018). It is recognized, globally, that more research evidence is needed to demonstrate further, the pathways by which integrated nutrition and agriculture interventions can be scaled up through community-based platforms for optimal nutrition outcomes. Increasing the coverage of effective nutrition and agriculture interventions is recognized as a public health priority (Marquis et al. 2018; Colecraft, et al. 2022; Kumar et al. 2018). Thus, there is a need to increase the opportunities at community levels, for utilizing community-based delivery platforms to scale up innovative and feasible integrated strategies within low-resource contexts (Boedecker et al. 2019).

In Ghana, maternal and child malnutrition remains a public health concern (Annim and Frempong 2018; Christian et al. 2016). Although stunting reduced sharply between 2008 and 2014 (28% to 19%), the decline has since stagnated (19% in 2014 to 18% in 2022) (Ghana Statistical Service et al. 2023). There is also high inequality in malnutrition rates across the country. For example, anaemia rates among young children in the Northern region (69%) is twice the rate in the Greater Accra region (36%) (Ghana Statistical Service et al. 2023). Multiple factors have been identified as drivers of stunting in Ghana, including poor/ineffective health system interventions and initiatives that promote optimal infant and young child feeding (Yawson et al. 2017). This situation warrants context-appropriate intervention strategies to catalyse further decline in stunting rates. There is also a need to focus on increasing sustainable access to nutrient-dense meals targeting hard-to-reach communities, especially in Ghana's middle and northern regions, where malnutrition rates are highest.

World Vision Ghana (WVG) in collaboration with the Ghana Health Service (GHS), the Ministry of Health, Ministry of Finance, and the Ministry of Food and Agriculture, implemented a project called Improved Feeding Practices (IFP) for the first one thousand days (1,000 days) between 2020 and 2023. The IFP project was funded by Japan Social Development Fund through the World Bank. Activities of the project were carried out in 70 communities across three selected districts, namely, Kassena-Nankana West, Sekyere East, and Kintampo South. The IFP project aimed to improve the dietary diversity and feeding practices of women of reproductive age (including pregnant and lactating women) and children under two years, thus focusing on the first one thousand days of life.

This paper explores the perceptions and experiences of the project through the eyes of the beneficiaries and community-based partners engaged in project implementation. The current analysis outlines the processes that enabled a community-based intervention of this nature to be deployed to mostly, hard-to-reach and resource-poor settings. The current study further constructs a theory of change for the IFP project, describing how the resources of the project were translated into the outcomes reported herein. The paper explores beneficiaries' perceptions and experiences of processes and strategies used to implement the project activities, beneficiary perspectives on the impact of the project, and the lessons that were learned as a guide for similar projects in the future.

This paper is the first of four publications that focus on the activities implemented in the IFP project. The second paper examines the promotion and distribution of locally

produced micronutrient powder, KOKO Plus, that was distributed in the study communities. The third paper reports on activities related to the production of nutrient-rich crops and raising poultry by beneficiaries to complement household food. The fourth paper evaluates the entire IFP project using evidence from the baseline and endline surveys as well as interviews with key partners and beneficiaries.

METHODS

STUDY DESIGN

This study used a mixed-methods approach combining evidence from in-depth interviews and reviewing project documents and reports generated by WVG before and during implementation. Eight documents were identified and reviewed, including the project proposal, project implementation manual, baseline study report, two annual progress reports, and project log frame. The document review provided evidence of the project's purpose, sequence of activities, partnerships, failures, successes, and progress indicators. The document analysis was used to a theory of change to clarify the pathway by which project activities might enable progress toward intended goals.

DESCRIPTION OF THE IMPROVED FEEDING PRACTICES PROJECT

There were three main components of the project. Component 1 focused on access to micronutrient powder (MNP) for young children to improve their diet quality. In Ghana and other African countries, MNPs have been reported to improve children's eating behaviours, micronutrient intake and health outcomes (Kyei-Arthur et al. 2020; Greffeuille et al. 2023). The MNPs were delivered through existing community-based social enterprise platforms. To achieve this, WVG identified and trained Village-Based Entrepreneurs (VBEs) who were part of an existing program known as Savings for Transformation (S4T). S4T was intended to deliver the MNPs through their existing networks through demand creation and social enterprises, in their respective communities. Details of component 1 activities and outcomes are presented in the second paper in the series of papers from the IFP project (Donkor et al. 2024).

Component 2 involved supporting and enabling selected households with young children, to produce and consume diverse nutrient-rich foods. The nutrient-rich foods that were prioritized included fruits, vegetables, animal source foods, and a biofortified food crop (orange-flesh sweet potato). These nutrient-rich foods were subsequently linked with income-generating opportunities. Habib et al., 2024 provide details of the nutrition-sensitive agriculture (NSA) intervention activities in the third paper in the present series of papers of the IFP project.

The third intervention component was designed to leverage various community-based communication channels to increase awareness of optimal diets and dietary diversity through nutrition messaging, and to utilize outcomes from other IFP project components to improve the diets of young children and women of reproductive age (WRA). This component was also intended to provide information that addresses key barriers to success in components 1 and 2 of the project. Implementation of component 3 involved training health workers and community volunteers, developing and disseminating communication materials, and designing and rolling out an interactive radio program to influence social behaviours related to poor feeding practices. Community-level cooking demonstrations were also conducted, focused on changing behaviours and societal norms, which otherwise will adversely affect dietary practices and nutrition of young children and WRA. The GHS led the implementation of Component 3, in partnership with *Lyme Haus*, a local communications company, using social and behavioural change communication (SBCC) programs.

STUDY SETTING

The IFP project was implemented in 21 communities in the district of Kintampo South (KS) in the Bono East Region, 24 communities in Kasena-Nankana West (KNW) in the Upper East Region and 25 communities in Sekyere East (SE) in the Ashanti Region (Figure 1). The average population size across these three districts is about 85,000. Almost two-thirds of SE population (62.1%) resides in urban communities. On the other hand, in KNW and KS, about 80% live in rural communities. Across all three districts, baseline evidence of the project showed that consumption of diverse diets among WRA was uncommon (Saha Consulting and Services Ltd., 2021). The three districts had pre-existing WVG programs, including the S4T program, which involved setting up and building the capacity of Village Savings and Loans Associations.

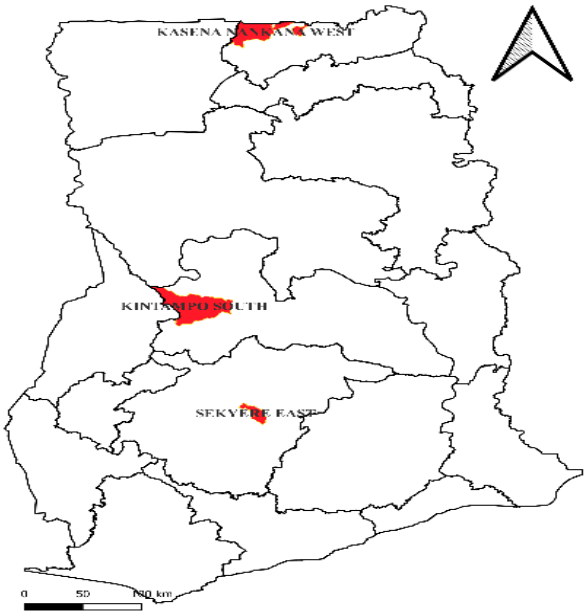


Figure 1. Districts which participated in the Improved Feeding Practices Project

SAMPLING AND DATA COLLECTION

Stakeholder groups from each district were interviewed, as follows:

1. Government officers (agriculture extension officers, community health nurses and nutrition officers),
2. Seven WVG staff and the three district project coordinators who had been hired by WVG, the national project coordinator for the IFP and the monitoring and evaluation officer

3. Project beneficiaries from two communities in each district,
4. Relatives of project beneficiaries,
5. Community volunteers,
6. Village based entrepreneurs and
7. Male "champions." (these are male community volunteers trained to support the IFP project's implementation).

As shown in Table 1, a total of 61 in-depth interviews were conducted, mostly face-to-face, at workplaces or homes; two were conducted virtually via Zoom. These interviews explored the beneficiaries' awareness and experiences of the project activities, and their perception of the impact of the interventions on their lives, livelihoods, and their families' health and wellbeing. Evidence was also obtained on the processes utilized for mobilizing the community, delivering interventions, overcoming barriers, and leveraging opportunities. Data were also gathered on respondents' perspectives about the lessons learned from implementing the project activities.

During community-level interviews, only the interviewer and participant were present for each interview to ensure confidentiality. They lasted 30-60 minutes and were audio-recorded. Due to the key roles played by the GHS and the Department of Agriculture, selected personnel who participated in the implementation from their agencies were interviewed in all districts. Interviews with project implementers and partners were longer (between 1 and 1.5 hours) and were also audio-recorded.

A team of public health experts, a population scientist, and a dietician with a combination of quantitative and qualitative analytical expertise conducted an analysis of the IFP data assessment. The interviews were conducted after two training sessions. The enumerators were trained on the interview guides, community entry and interviewing best practices prior to carrying out the interviews.

Table 1. Profile of project beneficiaries and other stakeholders interviewed

Stakeholders/participants	World Vision Ghana	**Districts**						
		Sekyere east		**Kintampo South**		**Kassena-Nankana**		**Total**
		Ahwerewa	Ahensan	Kwabia	Akora	Pungbisi	Bambesi	
Project manager	1	-	-	-	-	-	-	**1**
Project coordinator/Officer	3	-	-	-	-	-	-	**3**
Beneficiaries (Mothers)	-	3	3	3	3	3	3	**18**
Village-Based Entrepreneurs	-	1	1	1	1	1	1	**6**
Men (Husband to a mother beneficiary)	-	1	1	1	1	1	1	**6**
Community Health Nurse	-	1		-	-	1		**2**
Community Health Officer	-	-	-	1		-	-	**1**
District Director of Agriculture	-	1		1		1		**3**
District Nutrition officer (Ghana Health Service)	-	1		1		1		**3**
Agriculture extension officers	-	1		1		1		**3**
Community Health Volunteers	-	1	1	1	1	1	1	**6**
Male champions	-	1	1	1	1	1	1	**6**
Monitoring and Evaluation officer, WVG	1	-	-	-	-	-	-	**1**
Other WVG staff	2	-	-	-	-	-	-	**2**
Total	**7**	**18**		**18**		**18**		**61**

DATA ANALYSIS

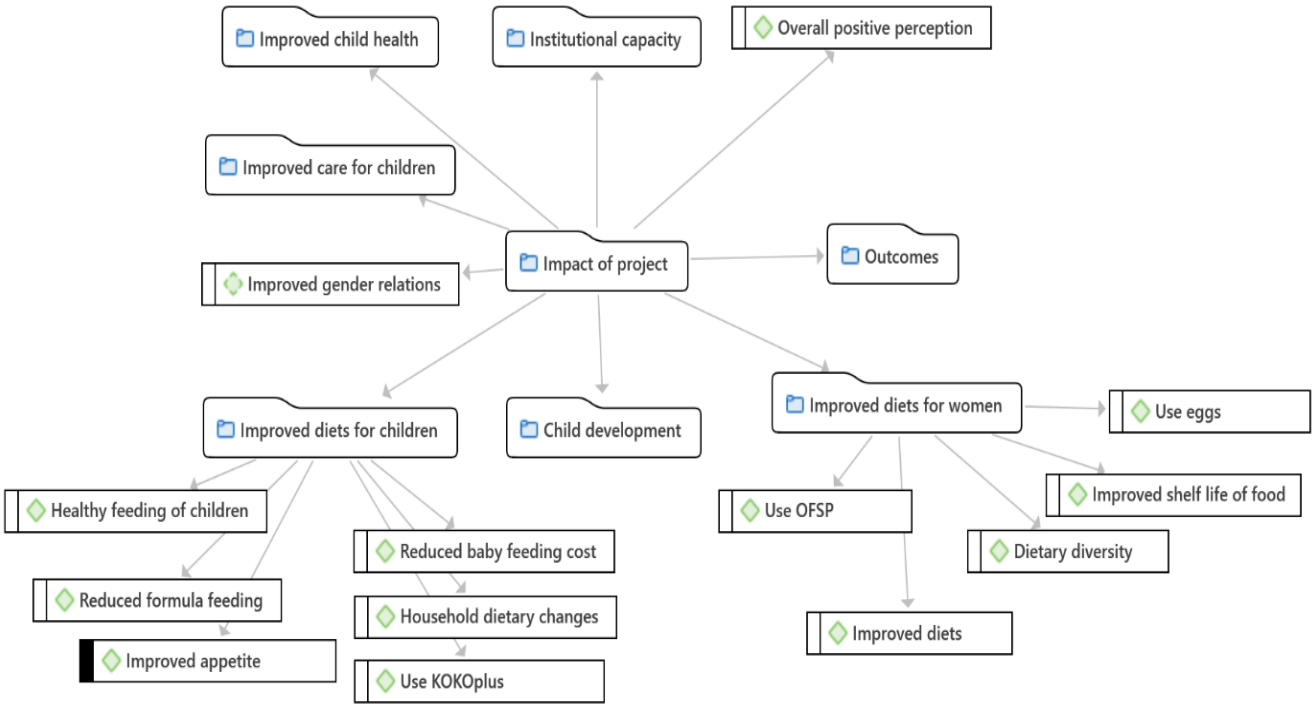
A data-source triangulation approach was used for this study (Carter et al. 2014). All the interviews were transcribed verbatim from the audio recordings. Thematic analysis was performed (Attride-Stirling 2001; Braun and Clarke 2006) using ATLAS.ti. Seven analysts worked on the transcripts. Each transcript was coded by a pair of analysts. The codes from each transcript were compared through an iterative process of discussion and rereading of the text to achieve consensus and to provide a deeper understanding of the data. The initial findings were discussed with WVG program implementers to ensure validity.

During the first stage of analysis, the analytic framework was guided by a coding frame with two sections: 1) a section on pre-existing *deductive codes* derived from the review of WVG project reports and previous nutrition and agriculture studies conducted in Ghana (Christian et al. 2019; Marquis et al. 2018) and 2) an open-ended section of *inductive codes* that emerged from the transcripts. Some of the deductive codes derived from the WVG reports included agricultural inputs, training on infant and child feeding practices and exclusive breastfeeding. These codes were identified in the transcripts during the coding process.

The second stage of analysis involved creating linkages between codes, themes, and quotes. This analysis stage was guided by the socio-ecological framework and the constructed theory of change. The socio-ecological framework is a comprehensive approach to understanding health behaviours and practices, including dietary behaviours (Sallis et al. 2008; Glanz et al. 2008). It accounts for the interaction of personal and environmental factors on behaviour by examining the intra-personal, interpersonal, community, institutional and structural level factors that influence dietary perceptions and habits (Townsend and Foster 2011). The individual-level factors include knowledge, attitudes and personal attributes that influence dietary intake and nutrition awareness. The interpersonal level refers to formal and informal social support systems and networks influencing behaviour, such as family, peers, and neighbours. The societal level includes policies and norms at the national, state or local levels that support healthy eating behaviours (Boatemaa, et al. 2018a). The socio-ecological approach outlines all the causes of malnutrition identified in the UNICEF framework on the determinants of maternal and child nutrition (UNICEF 2020).

Adopting the socio-ecological lens provided an opportunity to understand the impact of the IFP project on multiple social determinants of the diets of women and young children. The analysis focused on how the IFP project empowered and enhanced the capacity (individual-level factors) of the beneficiaries to improve their dietary intake, and for families and the broader community (Table 2). The analysis and data collection examined the impact of IFP components (training, NSA and MNP) on nutrition knowledge and dietary intake. A set of codes that addressed outputs, for example, were pulled together into an organising theme. Figure 2 shows the steps from developing quotes into codes into sub-themes and organizing themes.

Figure 2. Coding tree of the impact of the improved feeding project



RESULTS

THEORY OF CHANGE OF THE IFP PROJECT

This theory of change was developed by the evaluation team based on the review of project documents and validated by the WVG staff. The IFP Project aimed to improve dietary practices among 5,520 targeted women of reproductive age (including pregnant and lactating women) and 4,900 children under two. The primary intended impact of the project was improved dietary diversity among women and children, and improved micronutrient adequacy among young children (Figure 3). The project's impact was to be measured by comparing outcome indicators at baseline and end line. The impact pathways envisaged was the self-consumption pathway coming from own production, and market/income pathway coming from household purchases for improving dietary and feeding practices.

Training of service providers was a critical component of the project. The training focused on the three components of the intervention: micronutrient food fortification, nutrition communication, and household NSA. WVG adopted a training-of-trainer approach for local institutional staff. Through partners such as the GHS, District Assemblies, District Agriculture Department, Business Advisory Centre, Environmental Protection

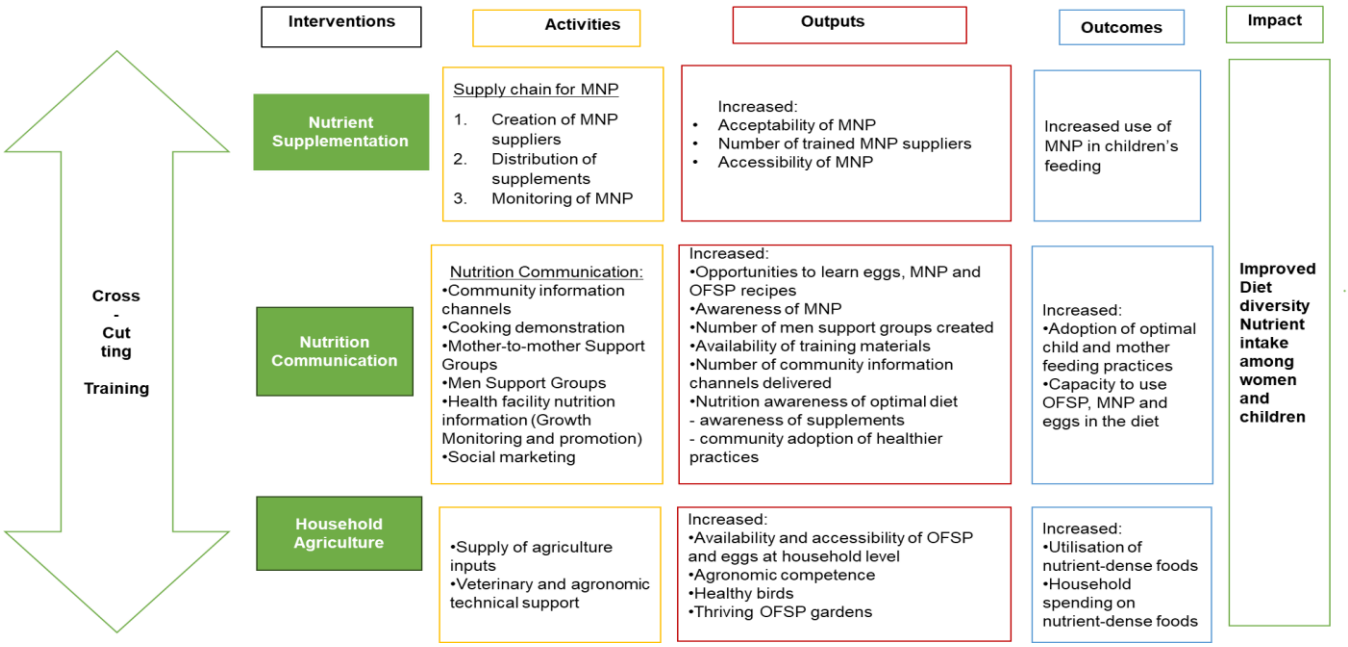
Agency, community-based organizations and consultants, there was the identification and prioritization of capacity gaps that formed the basis for training. Integrated interventions were designed and deployed to address the identified problems. For example, the Community Health Volunteers of GHS participated in four workshops on infant and young child feeding and community-based growth promotion.

At the community level, the project created a supply chain to distribute MNPs. The local VBEs were trained and subsequently supplied with KOKO Plus, a locally manufactured MNP, for commercial distribution within the communities (n=70), based on a social-marketing principle to sustain the intervention beyond the project. KOKO Plus provides at least 50% of the recommended nutrient intake for micronutrients and 62% for utilizable protein. The sale of MNP was promoted through social and behaviour change communication activities implemented via various community platforms, including child welfare clinics, community meetings/durbars, radio stations, community information centres and market days. Some of the activities used in promoting KOKO Plus were songs, skits, and drama.

Table 2. Levels of socioecological model across components of the Improved Feeding Practices Project

Socio-ecological level	Improved Feeding Practices Project Components			
	Activities	**Outputs**	**Outcomes**	**Impact**
Individual	1. Training 2. Nutrition-Sensitive Agriculture 3. Nutrition messaging	1. Acceptability of MNP 2. Nutrition-Sensitive Agriculture inputs	1. Nutrition awareness 2. Capacity to produce and use eggs and OFSP 3. Improved finances 4. MNP Use	1. Child growth 2. Optimal feeding of children 3. Household dietary changes 4. Reduction of childhood disease incidence
Interpersonal	1. Training 2. Nutrition messaging	1. Mother-Mother Support Groups 2. Father-Father Support Groups 3. Community durbars	1. Improved finances 2. Household dietary changes 3. Nutrition awareness	
Community	1. Supply chain to distribute MNP 2. Nutrition messaging 3. Supply of Nutrition-Sensitive crops for production	1. MNP Suppliers 2. Nutrition –sensitive crop supply	1. Capacity to produce and use eggs and OFSP 2. Availability of eggs, OFSP and MNP at the community level	
Structural	1. Training 2. Nutrition messages 3. Provision of logistics for institutions	1. Availability of logistics	1. Institutional capacity strengthening 2. Improved and available services from institutions	

Figure 3. Improved Feeding Practices project pathways to impact



The nutrition messaging was designed to address norms, knowledge, attitudes, and beliefs that influence behaviours across the four levels of the socio-ecological framework (Table 3). It utilized cooking demonstrations, mother-to-mother support groups, father-to-father support groups, and social marketing through "house-to-house" nutrition

education with technical support from the World Vision Ghana. Nutrition messaging focused on the importance of a diverse diet for all household members using the "four-star diet" (staples, legumes and seeds, fruits and vegetables, and animal source foods), exclusive breastfeeding, complementary feeding practices of young children, nutrition during pregnancy, and continued breastfeeding until two years. All group sessions were held separately in each intervention community on market days, during child welfare clinics, and at religious centres. WVG also used community information centres and radios to promote messages. The radio messages (See Table 3.) were developed by Lyme Haus.

PARTICIPANT'S PERCEPTION, AND EXPERIENCE OF PROJECT COMPONENTS

The participants reported their experiences of IFP activities which provided the data used in estimating outputs, including having access to MNP in their communities through the VBEs. They also added that the MNP had a lower price in their communities than at the district capital. A community health nurse said:

Table 3. Sample messages for the nutrition messages

Orange-fleshed sweet potatoes (OFSP)	MNP	Healthy eating
1. Use OFSP leaves for stew e.g. okra stew; vegetable stew, etc 2. Add the root/tubers to banku, fufu, soups and potage	1. Add 1 sachet of KOKO Plus a day to either porridge, stew or soup for the child, from age 6 months 2. Do not take KOKO Plus raw	1. Consume an egg at least once a day (especially mothers, infants and adolescents) 2. Consume food from the 'four-star diet' - legumes such as groundnuts and beans - staples such as yam, plantain and OFSP

Initially, the KOKO Plus was at Sekyere East and not yet at Ahwerewa. It will be difficult for someone to pick a car to Efijase to buy KOKO Plus, but now, when the World Vision came, they took some of the mothers through training and they are selling it, which helps. (SE, Community Health Nurse).

All the beneficiaries interviewed received the NSA interventions. Most of them were multiple beneficiaries, they had received inputs for poultry, orange-fleshed sweet potatoes (OFSP) and fruit trees. For example, the poultry beneficiaries received between 20 and 25 laying birds, poultry feed, water and feed trays, medications for vaccination, dewormers and vitamins, and roofing sheets. The participants were given pawpaw, mango and moringa seedlings to plant in their backyards.

"*We are beneficiaries of all the interventions. We received birds for rearing, OFSP vines for cultivation, and some mango and pawpaw seedlings for cultivation*". (KS, Akora, Beneficiary).

Both the program implementers and beneficiaries reported that they had received training as part of the project. The program implementer training sessions were organised for agriculture extension officers, officers of the Women in Agricultural Development, GHS staff, volunteers, village-based entrepreneurs and male champions. The officers mentioned that they had been trained for one week at the beginning of the project. They had also received refresher training during the implementation phase. The GHS personnel who were trained included staff with training in nutrition, health promotion, public health nursing, health information and community health nursing, as well as their District Directors of Health. The trainees received training on complementary feeding, infant and young child feeding, exclusive breastfeeding, continuous breastfeeding for up to two years and beyond, the Four-Star Diet, hygiene, community-based growth promotion, and monitoring and SBCC (including how to counsel clients). The agriculture extension personnel received training on OFSP cultivation and poultry rearing. The VBEs received training in record keeping, entrepreneurship, sales and how to use the MNP. One hundred and twenty-one VBEs were trained in all; 47 in KNW, 49 in SE and 22 in KS. A VBE from Bembesi in KNW said:

"They took us through training for one week and taught us how to mix the KOKO Plus and how a child is supposed to take one sachet a day, so they took us through all that for one week before they came back to the community" (KNW, VBE).

Beneficiaries received training on project activities through the trained community volunteers, health professionals and agriculture extension workers. They reported receiving training on how to clean poultry coops, feed the birds, formulate poultry feed, and identify sick birds for treatment. They were also trained on OFSP value chains, including cultivation, pest and disease management, nutrient requirements, harvesting, storage, and utilization. A total of 1,510 farmers were trained across the three districts, including 824 females and 686 males. In 2022, 1066 beneficiaries (720 females and 364 males) were trained on how to incorporate OFSP leaves and roots into local diets. One Agriculture Director reported that:

"We trained them on how to plan and use OFSP. That is, how to fortify the crop into their diets so we, for instance, taught them how to prepare OFSP mpihu (potage), fufu (boiled and pounded casava and plantain) *rice fortified with OFSP, banku* (corn and/or casava) *fortified with OFSP etc. We didn't introduce any different foods; we just taught them to fortify their local foods with OFSP."* (KS, Agric Director).

The beneficiaries reported receiving nutrition messages in diverse ways including messages delivered through community centres, child welfare clinics, community information centres, mother-to-mother support groups, father-to-father-support groups, and radio stations. The messages were on breastfeeding and appropriate complementary feeding.

"*We didn't know the ways children eat, my first child like this, when I gave birth to her, when she was one month, I started feeding her solid food. The presence of World Vision in our lives have made us aware that a child is supposed to be 6 months before the child is fed with food and water.*" (SE Ahensan, Beneficiary).

PERCEIVED IMPACT OF THE IFP PROJECT

Six themes were derived regarding the perceived impact of the project: 1) overall positive perception, 2) outcomes, 3) improved care for children, 4) improved diets for children 5), improved diets for women, and 6) institutional capacity. This is depicted in Figure 2.

OVERALL PERCEPTION AMONG BENEFICIARIES AND IMPLEMENTERS

Both the beneficiaries and program implementers had a positive perception of the project activities. The program implementers indicated that the project provided an opportunity to refresh their competence. In addition, the supplies provided to the GHS were considered vital to service delivery, since these were inadequate in their facilities. A nutrition officer summarised the impact as:

"*I think the training we received under the project broadened our knowledge in the areas of maternal health and child nutrition. To some of us who are already in the system, it's been a refresher course for us but to the new entrants, they've gained valuable knowledge.*" (KS, Nutrition Officer).

The beneficiaries also had a positive perception of the project. They used positive words such as "*happy", "impressed",* and *"joy"* to summarise their overall impression of the project. They mentioned that the project had "*helped*" and "*benefitted*" them as represented by the quote below:

"*I am really impressed with the project so far*" (SE Ahensan, Beneficiary).

PERCEPTION OF PROJECT OUTCOMES AMONG BENEFICIARIES

The respondents reported 1) nutrition awareness, 2) increased capacity to produce and use eggs and OFSP, 3) improved finances and 4) production and access to nutritious food. Nutrition awareness, capacity to produce and use eggs were individual level outcomes. Improved finances and production and access to nutritious foods were both individual, household and community level outcomes.

NUTRITION AWARENESS

The respondents also mentioned nutrition awareness. They reported knowledge of how to cook, nutritional content of food items, breastfeeding, early initiation of breastfeeding and exclusive breastfeeding. Most of the respondents reported learning how to not overcook green leafy vegetables such cocoyam leaves (*Colocasia esculenta*) and OFSP leaves. They also reported learning how to include different ingredients in a meal while avoiding the use of commercial spices. Regarding OFSP, the participants reported knowledge of recipes for preparing the leaves and the roots. The respondents also reported awareness of nutrients and the need to have nutrient-rich diets, as reflected by this quote:

"You can add it [OFSP leaves] to Kotomire stew, banku, okro stew and all other stew dish you want to prepare. When you are using the OFSP leaves you need not to add bouillon cube but it will taste very sweet. The reason why I give it to my child is due to the nutrients it possesses. When I give the raw corn porridge to my child he will not have any nutrients, it only contains starch but when you put in KOKO Plus the child will gain nutrients" (SE Ahensan, Beneficiary).

"The project has really been helpful to us because the training has imparted knowledge in the whole community. Through the food demonstration, the different types of food which can be combined in order to get certain nutrients is known. So today, when you call a community member to ask him questions about the nutrients in certain foods, they can tell you everything. The community members know the roles of the nutrients in the human body. (KNW, Community Health Nurse).

There was mention of awareness of the value of improved breastfeeding behaviours. The participants, reporting that they understand the value of early initiation, exclusive breastfeeding and breastfeeding until 2 years as represented below:

"A sister of mine gave birth and after 3 months she gave the child food, but after I went to learn, I realized that's not how it is done. I learnt how we are to breastfeed the children for 6 months before introducing water and other things. We were taught on how to breastfeed the child for the child to be comfortable" (SE Ahwerewa, Male Champion).

INCREASED CAPACITY TO PRODUCE AND USE EGGS AND OFSP

Most of the respondents reported that their agricultural knowledge and skills improved due to the training they received through IFP. For most of the beneficiaries, this was their first-time experience in poultry, OFSP and fruit crop production. In terms of knowledge gained, they reported the ability to produce poultry feed, identify, and treat poultry diseases:

"We, for instance, had no knowledge about poultry farming but now thanks to the intervention, I have become very knowledgeable" (KS, Akora, Indirect Beneficiary).

IMPROVED INCOMES

Although this was not intended by the project, most of the beneficiaries reported increase in incomes. They mention generating additional income from selling the eggs. The additional income influenced their standard of living as they were able to pay their debts, tuition fees of their wards and save. According to them, the savings were used to buy feed and supplies to continue production and to start other businesses. The VBEs also reported increased income from selling the MNP as displayed below:

"It's very profitable. I make 20.00 Cedis profit per pack and that is very helpful to me because I use it to meet certain household needs. I am also able to save some of the money I make from the sales of the product." (KS, Akora, VBE).

IMPROVED CHILD CARE AND HEALTH SEEKING BEHAVIOR

Some of the participants who were pregnant at the time indicated that they experienced improved care for themselves and their children because of participating in antenatal and child welfare clinics. Respondents indicated

awareness of the importance of pregnant women attending clinics for monitoring of both the baby and mother. One respondent indicated that:

"Before the IFP project, pregnant women rarely visited the clinic. Therefore, they had no advice on how to care for themselves and their babies, So, when the women get pregnant, they don't attend the hospital; at times, the unborn children get infected with sickness and even die at times, but all these things [IFP project activities] have come to solve this problem". (SE, Male Volunteer).

IMPROVED DIET OF YOUNG CHILDREN AND HOUSEHOLDS

Some respondents reported feeding their children better because of what they learned from the IFP project. There were five codes under this theme 1) healthy feeding of children, 2) household dietary changes, 3) MNP use which resulted in 4) reduced baby feeding cost and 5) reduced formula feeding.

HEALTHY FEEDING OF CHILDREN

The healthy feeding of children was associated with their nutrition awareness. The beneficiaries reported early initiation of breastfeeding, exclusive breastfeeding, breastfeeding until 2 years for their penultimate child. Also, they mention an increase in frequency of feeding for the children.

"*When I gave birth to my first child, I didn't know, so after 2 weeks, I fed my child with food, so after the lessons, I waited for 6 months before giving my child food and water, those teachings were really dear [to] my heart."* (SE, Ahwerewa, Beneficiary)

HOUSEHOLD DIETARY CHANGES

Respondents also indicated changes in the household diet. They reported the inclusion of eggs, OFSP leaves and roots into their meals. Which was not the case before the intervention.

One respondent shared that:

"We can regularly incorporate eggs in our meals which was not the case prior to my joining the project. We can now afford to take an egg a day each if we so choose due to the poultry intervention." (KS, Beneficiary).

Another indicated that *"Before, I was unable to buy enough eggs for my kids, but now we can eat eggs whenever we want. My kids now get the protein they need from the eggs produced by the chickens."* (SE, Ahensan Beneficiary).

"*I've incorporated eggs in our meals, especially for the children because we now have access to eggs, and we eat the leaves from the vine of the OFSP, which was something we never did before. In fact, we didn't even regard it as food [previously]"* (KNW, Pungbisi, Beneficiary).

The use of eggs in children's meals also happened at the community level. Poultry beneficiaries in each community contributed eggs every month that was donated to children participating in CWC. This initiative promoted increased egg consumption and encouraged more mothers to attend CWC sessions.

"Pregnant women and children who visited the clinic with anaemia cases benefited because we gave eggs to help treat anaemia". (KNW Pungbesi Beneficiary).

MNP USE, REDUCED FORMULA FEEDING AND REDUCED BABY FEEDING COST

The parents reported adding MNP to children's meals. According to them the MNP was less expensive compared with formula. They also commented that feeding children became less expensive although they were feeding their children nutritious foods.

For example, a respondent shared that "*something like KOKO Plus, if you put that in their porridge, it gives them strength and good health, it also prevents the mother from buying expensive things and saving money, the KOKO Plus has also been helpful"* (SE, Ahensan Beneficiary).

IMPROVED CHILD HEALTH AND DEVELOPMENT

Two main codes were identified under this subtheme 1) reduction of disease incidence and 2) child growth.

REDUCTION OF CHILDHOOD DISEASE INCIDENCE

According to the respondents, there was a reduction in childhood diseases such as diarrhoea, anaemia, and kwashiorkor. The respondents testified that they had not been to the hospital nor bought medication for childhood diseases for more than a year, as noted below:

"*My baby no longer has diarrhoea or anaemia. But this wasn't the case prior to becoming a beneficiary of the project*" (KS, Akora, Beneficiairy).

"One of my children had been attending the hospital every week due to that his hospital booklet have been filled up because of the frequent visit but when World Vision came to educate us and as we practiced and followed it, I can last for nine months without sending my child to the hospital. It has really helped me when I followed their teachings." (SE, Ahensan, Beneficiary).

CHILD GROWTH

Respondents reported weight gain and overall growth of their children because of the project. Beneficiaries attributed these changes and improvements to the introduction and use of the MNP as well as the diversified diet the children had access to:

"KOKO Plus has improved my baby's health and weight that's why I give it to him. His weight has improved tremendously, and I can attest to this because when we attend weighing (child welfare clinic) and he is weighed, I see the difference between his weight before he started taking KOKO Plus and now that he's taking KOKO Plus." (KS Kwabia, Beneficiary).

In one community, a nutrition officer attributed a decrease in the prevalence of underweight for children to the introduction of the project. She shared that:

"In 2019 for instance, the underweight prevalence rate was 3.6% but with the introduction of the project in 2020, the prevalence rate was reduced to 3.4%, then to 1.1% in 2021

when the project was in full swing and then 1.0% in 2022 and is still the current underweight prevalence rate in the district." (KS, Nutrition Officer)

CAPACITY STRENGTHENING AT THE INSTITUTIONAL LEVEL

Improved institutional and individual capacity was recognized as a benefit of the IFP project. This was a structural level impact of the project. A community health nurse shared that everything she was taught was information that she took back to her community. One respondent shared that:

"…I have gone for workshops in CHMC (Community Health Management Committee), CVA, so all are teachings they've given us which I in particular use in helping my community." (SE, Community Health Nurse).

Agriculture extension officers also reported receiving training that they shared with farmers within the communities. This is illustrated by a volunteer:

"*We were trained by World Vision in the OFSP cultivation and poultry rearing so we go to the communities and further train the farmers on proper bookkeeping or record keeping, how to properly take care of the poultry, how to detect diseases and how to isolate sick birds if there's any disease in the poultry management."* (KS, Agriculture Extension Officer)

IMPLEMENTATION CHALLENGES

WVG provided the beneficiaries with inputs that they would require for the agriculture interventions. Three main challenges emerged from poultry production, after the initial supply of inputs was exhausted. There were: bird mortality, bird morbidity, and steep increases in the price of poultry feed. Many interview respondents reported that they lost some of the birds they received from WVG to diseases/infection. Unfortunately, the beneficiaries did not know about these infections and therefore did not know the appropriate remedy to address them. They also reported that they could not afford the transportation and service charge of consulting with a veterinary specialist. In KS, another layer of the challenge was the delay in response from the veterinarian when he was informed of infections in the poultry.

"*We experienced so many delays whenever we invited a veterinary officer to attend to our sick birds and these delays resulted in the death of many of our birds. They did assist, but their assistance came late because many of the beneficiaries were unable to afford the transportation cost for them to come and treat their sick birds. We were made to understand from the inception of the project that the cost of treatment of diseased birds was to be borne by us and we were given some medicine to treat the birds if they fell sick, but our problems began when we run out of these supplies*" (KNW, Male Champion).

"… the feed wasn't expensive, but the feed shot up just like that. Today a sack of feed is GHS 400, when the fowls eat it for about a week or 10 days, the feed gets finished…so that is the challenge I faced". (SE, Male Volunteer).

Also, there were challenges with OFSP cultivation that were reported. In some of the communities, OFSP cultivation was done in groups. Respondents indicated that working in groups was challenging because not all members would participate in meetings, and member commitment was low. The OFSP vines could also not be preserved and multiplied since they were supplied close to the dry season. The KNW district was the most affected by this seasonality challenge. A beneficiary in Sekyere East said:

"When we were in groups, some of the members didn't come on their scheduled time but if we had shared it everyone would have focused on theirs. People absented themselves because it was in groups but if I do mine personally, I would have focused on it than being in the group." (SE, Ahensan Beneficiary).

"*We were not in the rainy seasons when they brought it, so it didn't mature the way we wanted it.*" (SE Ahewerase Indirect Beneficiary).

For the MNP, the commonly reported challenge was with distribution. Whenever there were supply deficits, it resulted in price increases of the MNP. WVG did not have adequate stock to meet distribution requirements in year 2 for all districts for about two months. This was a result of the production shortage from the producer and increased demand for the product. Secondly, one VBE in KS reported that some customers mentioned stomach upsets and low acceptability of the product. Regarding the SBCC, the only challenge reported was low attendance to meetings and lack of understanding of message content.

LESSONS LEARNED

During the initial stages of the IFP project, attendance at CWCs was low. This significantly affected the number of targeted beneficiaries of the project. To address this, those rearing poultry were asked to bring about 10 eggs to the monthly meetings and share with community members especially mothers of children with anaemia. Egg sharing at CWC significantly increased CWC attendance:

"Even the attendance of weighing [child welfare clinics] was very low but due to the World Vision intervention, the numbers at weighing have increased astronomically, sometimes they even have to be split into groups to enable the nurses effectively attend to all of them. This is because they know that they will at least get eggs at the weighing" (KS Agriculture Extension Officer).

The mothers had concerns about buying the MNP. Some community members saw the VBEs only seeking to sell the products and make money. The project asked the nurses to recommend the MNP to mothers and this resulted in significant increase in acceptability, purchase, and use of the MNP.

Three of the lessons learned were important to the sustainability of the project

1) mother-to-mother support group (MTMSG) details 2) crossbreeding of birds and 3) local preparation of poultry feed.

The project implementers noted that community ownership was essential to success. In the KSN, the familiarity of the MTMSG members helped with trust building. Also, the fixed monthly meeting days of the MTMSG regularised the meetings.

Although this was unintended, some the farmers crossed their poultry birds with local cocks to produce fertilised eggs. These eggs were hatched, and beneficiaries were able to increase the initial stock of layer birds beyond what was provided by WVG. This approach was recognized by stakeholders as a solution to ensure sustainability since the crossbreeds are more productive than the local hens and more resilient to infections compared to the layers supplied through the project.

"*Having religiously applied the teachings and training I received, I now have more than one hundred and fifty (150) birds from what I received. I kept incubating the eggs they hatched and so increased my birds.*" (KS, Akora, Male Champion).

A major challenge poultry beneficiaries faced was the cost of feed due to global price hikes and inflation. Therefore, IFP in collaboration with AEAs carried out a feed formulation training across all 3 project districts. The objective was to train farmers to prepare their own feed using the right ingredients and the right proportions at a minimal cost. According to the 2022 annual report, this training benefited 643 farmers (F=399, M=244). Participants reported that they now formulate their own feed in groups with the supervision of AEAs or project volunteers.

DISCUSSION

The IFP project is an integrated nutrition intervention designed to improve the diets of young children within the first 1000 days, and women of reproductive age in Ghana. The current study examined the experiences and perceived impact of the project. The main findings were that beneficiaries attributed their improved knowledge and improved feeding practices to their participation in the IFP project. Further, they linked their acquired enhanced awareness and knowledge about eating a healthy diet as well as their enhanced competence on growing nutritious crops and raising poultry to improvements in their diets and their health. The evidence pointed to a positive perception about the project among the beneficiaries, and suggested that from the perspective of the beneficiaries, the IFP has achieved its goal.

Consistent with others, the current study has demonstrated the potential for nutrition and agriculture integrated interventions to improve nutrition outcomes (Marquis et al. 2018; Passarelli et al. 2020; Reinbott et al. 2016). Nutrition and agriculture integrated interventions have been reported to address all the underlying causes of malnutrition identified by the UNICEF framework (Herforth and Ballard 2016). The current findings, therefore, contribute to validating previous studies and provide evidence for nutrition-sensitive agricultural interventions to include a broader spectrum of nutrition specific objectives and activities to simultaneously address complex multiple causes of malnutrition (Sharma et al. 2021).

We provide two explanations why the IFP was perceived to be associated with improved feeding practices and knowledge. First, the pathways anticipated by the IFP conform to guidelines for designing effective NSA interventions. Figure 3 summarises the impact pathway of the IFP project. The project appeared to successfully promote egg, fruits and OFSP production and consumption among families in the selected districts. Agriculture is pivotal in providing food, livelihoods, and income (Emran et al. 2021; Garret, et al. 2014). However, nutrition outcomes, especially in the first 1000 days are dependent on nutritional knowledge and care practices more than agriculture production (Badasu 2006; Otoo et al. 2009). Considering this complex linkage between agriculture and nutrition, the use of strategic communication approaches to promote changes in knowledge, attitudes, norms, beliefs, and behaviours is highly recommended (Sharma et al. 2021). Therefore, the IFP project developed messages and activities to address both facilitators and barriers to feeding practices at the individual, interpersonal, community and structural levels. Also, the complementarity between different components strengthened the program, similar to other interventions conducted in Ghana (Marquis et al. 2009).

Second, nutrition is seen as an outcome that requires multisectoral actors and initiatives (Gillespie et al. 2015; Kennedy et al. 2016). The IFP established partnerships to facilitate the project delivery at the facility, household, and community levels. At the structural level, weak integration of nutrition services, poor coordination and inadequate pre-service and in-service training for the multiple actors involved in nutrition programs has been a consistent barrier to nutrition programs in Ghana (Gongwer and Aryeetey 2014; Yawson et al. 2017), South Africa (Boatemaa et al. 2018b; Hendriks and Olivier 2017; Kushitor et al. 2022), Zambia (Drimie et al. 2014), and other countries. Therefore, working with existing government institutions to deliver agriculture, health, education, social protection and livelihood empowerment services addresses the interlinked underlying causes of malnutrition (Gillespie et al. 2015). This is important in Ghana, where access to the health and agriculture services of government institutions is limited in rural areas (Abdallah and Abdul-Rahaman 2016; Colecraft, et al. 2022; Dotse-Gborgbortsi et al. 2023).

Overall, the findings of this study provide qualitative evidence of connecting NSA to improved feeding practices and nutrition outcomes. However, there are some limitations. Firstly, the findings of this study could have been influenced by social desirability bias. The participants of the study were implementers and beneficiaries of the IFP. Like most evaluation projects, the project implementers might have felt that the study was questioning their abilities and the effectiveness of their jobs. The beneficiaries might have also provided answers they thought the project wanted because they have benefitted from the project. However, our study findings are consistent with previous studies. Secondly, there are external factors that effect change within the pathways anticipated for the project which this study was unable to examine. However, the participants did not discuss these external factors when they discussed their experiences and impacts of the project.

CONCLUSION

This study has provided a theory of change for an intervention that integrated nutrition and agriculture

strategies to improve feeding practices of women in the reproductive age group and children under 2 years. This study, in tandem with others, suggests that integrated agriculture and nutrition interventions increases access to diverse foods, income generating activities, and improved infant, and young child feeding. The approach outlined in this study can be adapted to inform the design and implementation of integrated nutrition and agriculture interventions in similar settings. Most importantly scaling up this project is possible through the GHS and the District Agriculture Departments. The GHS, through refresher training and communication tools to MTMSG, Male Champions and Community Health Volunteers, can sustain and scale up the house-to-house nutrition education. The District Agriculture Department could also scale up, particularly by exploring alternative methods for preserving and multiplying OFSP vines during the dry season.

AUTHOR CONTRIBUTIONS

SBK, CVE and RA contributed to the study design. Data collection tools were designed by CE, SBK and RA. Initial analysis and coding were conducted by SBK and CE. SBK and CE wrote the first draft of the manuscript with routine critical reviews by RA. All authors then critically reviewed the following versions. All authors have read and approved the final version of the paper and its submission.

CONFLICT OF INTEREST

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REFERENCES

Abdallah, A., and A. Abdul-Rahaman. 2016. "Determinants of access to agricultural extension services: Evidence from smallholder rural women in northern Ghana." *Asian Journal of Agricultural Extension Economics & Sociology* 9 (3): 1–8. https://doi.org/10.9734/ajaees/2016/23478

Annim, Samuel Kobina, and Raymond Boadi Frempong. 2018. "Effects of access to credit and income on dietary diversity in Ghana." *Food Security* 10 (6): 1649–63. https://doi.org/10.1007/s12571-018-0862-8

Attride-Stirling, J. 2001. "Thematic networks: An analytic tool for qualitative research." *Qualitative Research* 1 (3): 385–405. https://doi.org/10.1177/146879410100100307

Badasu, Delali M. 2006. "Child care among Ewe migrants in Accra: A cases of crisis." *Research Review Supplement*. Vol. 16. Accra.

Black, R. E., L. H. Allen, Z. A. Bhutta, L. Cualfied, M. D Onis, M. Ezzati, C. Mathers, and J. Rivera. 2008. "Maternal and child undernutrition: global and regional exposures and health consequences." *Lancet* 371: 243–60. https://doi.org/10.1016/s0140-6736(07)61690-0.

Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, Ezzati M, Grantham-McGregor S, Katz J, Martorell R, Uauy R; Maternal and child nutrition study group. maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet*. 2013 August, 3;382(9890):427-451. doi: https://doi.org/10.1016/S0140-6736(13)60937-X.

Boatemaa, S., D.M. Badasu, and A. de-Graft Aikins. 2018a. "Food beliefs and practices in urban poor communities in Accra: Implications for health interventions." *BMC Public Health* 18 (1): 1–12. https://doi.org/10.1186/s12889-018-5336-6

Boatemaa, Sandra, Scott Drimie, and Laura M. Pereira. 2018b. "Addressing food and nutrition security in south africa : A review of policy responses since 2002." *African Journal of Agricultural and Resource Economics* 13 (3): 264–79.

Boedecker, Julia, Francis Odhiambo Odour, Carl Lachat, Patrick Van Damme, Gina Kennedy, and Céline Termote. 2019. "Participatory farm diversification and nutrition education increase dietary diversity in western Kenya." *Maternal and Child Nutrition* 15 (3): 1–12. https://doi.org/10.1111/mcn.12803

Braun, Virginia, and Victoria Clarke. 2006. "Using thematic analysis in psychology." *Qualitative Research in Psychology* 3 (2): 77–101. https://doi.org/10.1191/1478088706qp063oa

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., & Neville, A. J. (2014). The use of triangulation in qualitative research. *Oncology Nursing Forum*. https://doi.org/10.1188/14.ONF.545-547

Cesar, G. V., Parul Christian, Luis Paulo Vidaletti, Giovanna Gatica-Domínguez, Purnima Menon, and Robert E. Black. 2021. "Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda." *The Lancet* 397 (10282): 1388–99. https://doi.org/10.1016/S0140-6736(21)00394-9

Christian, A. K., G. S. Marquis, E. K. Colecraft, A. Lartey, O. Sakyi-Dawson, B. K. Ahunu, and L. M. Butler. 2016. "Caregivers' nutrition knowledge and attitudes are associated with household food diversity and children's animal source food intake across difference agro-ecological zones in Ghana." *British Journal of Nutrition* 28 (115): 351–60.

Christian, A. K., G. S. Marquis, E. K. Colecraft, A. Lartey, and R. Soueida. 2019. "Household food insecurity but not dietary diversity is associated with children's mean micronutrient density adequacy in rural communities across Ghana." *Nutrition* 65: 97–102. https://doi.org/10.1016/j.nut.2019.03.006.

Colecraft, Esi K, Grace S Marquis, and Comfort M Pinto. 2022. "Growing and learning together in fostering multisectoral participation for sustaining interventions: lessons from 3 successive integrated multidisciplinary interventions in rural Ghana." *Current Developments in Nutrition* 6 (9): 1–8. https://doi.org/10.1093/cdn/nzac124

Donkor, W.E.S., Babae, P., Duut, C., Gyansa-Lutterodt, M., Agyekum, L., Boadu, I., Gumah, F. and Aryeetey, R. 2024. "Availability, acceptability, and utilization of micronutrient fortification for children 6-23 months in three districts in Ghana." *World Nutrition*, 15(1):32–41. https://doi.org/10.26596/wn.202415132-41

Dotse-Gborgbortsi, Winfred, Andrew J. Tatem, Zoe Matthews, Victor A. Alegana, Anthony Ofosu, and Jim A. Wright. 2023. "Quality of maternal healthcare and travel time influence birthing service utilisation in ghanaian health facilities: a geographical analysis of routine health data." *BMJ Open* 13 (1): 1–10. https://doi.org/10.1136/bmjopen-2022-066792.

Drimie, S., S. Chakrabarty, C. Dube, M. Smit-Mwanamwenge, R. Rawat, and J. Harris. 2014. "Intersectoral coordination for nutrition in Zambia." *IDS Bulletin Special Edition Undernutrition in Zambia*. Sussex, UK.

Emran, Shah Al, Timothy J. Krupnik, Sreejith Aravindakshan, Virender Kumar, and Cameron M. Pittelkow. 2021. "Factors contributing to farm-level productivity and household income generation in coastal bangladesh s rice-based farming systems." *PLoS ONE* 16 (9 September): 1–27. https://doi.org/10.1371/journal.pone.0256694

Garret, J., S. Kadiyala, and N. Kohli. 2014. "Working multisectorally to improve nutrition: global lessons and current status in India." New Delhi, India.

Ghana Statistical Service, Ghana Health Service & ICF Macro. 2023. "Ghana demographic and health survey 2022: key indicators report." Accra: Ghana. https://dhsprogram.com/pubs/pdf/PR149/PR149.pdf

Gillespie, S., P. Menon, and A.L Kennedy. 2015. "Scaling up impact on nutrition: What will it take?" 6: 440–51. https://doi.org/10.3945/an.115.008276.

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behaviour and healthy education: Theory, research, and practice*. Jossey-Bass.

Global Nutrition Report. 2020. "2020 Global nutrition report: action on equity to end malnutrition." Bristol UK. https://globalnutritionreport.org/

Gongwer, C. R., and R Aryeetey. 2014. "Implementing nutrition interventions in Ghana at district level: gaps and opportunities." *African Journal of Food, Agriculture, Nutrition and Development* 14 (62): 8615–31. https://doi.org/10.18697/ajfand.62.12915

Grantham-McGregor S, Cheung, Y. B., S. Cueto, P. Glewwe, L. Richter, and B. Strupp. 2007. "Developmental potential in the frst 5 years for children in developing countries." *The Lancet* 369: 60–70. https://doi.org/10.1016/s0140-6736(07)60032-4.

Greffeuille, Valérie, Mamta Dass, Nadia Fanou-Fogny, Jolene Nyako, Jacques Berger, and Frank T. Wieringa. 2023. "Micronutrient intake of children in ghana and benin: estimated contribution of diet and nutrition programs." *Maternal and Child Nutrition* 19 (2): 1–9. https://doi.org/10.1111/mcn.13453

Habib, H.H., Donkor, W.E.S., Konlan, M.B., Babae, P., Agordoh, S.W. and Aryeetey, R. 2024. "Small-scale egg and orange-fleshed sweet potato production and utilisation in selected communities in Ghana: A mixed-methods study." *World Nutrition*, 15(1):42–50. https://doi.org/10.26596/wn.202415142-50

Herforth, A., & Ballard, T. J. (2016). Nutrition indicators in agriculture projects: current measurement, priorities, and gaps. *Global Food Security*, *10*, 1–10.

Hendriks, S. L., and N. J. J. Olivier. 2017. "Review of the south african agricultural legislative framework : Food security implications." *Development Southern Africa* 32 (5): 555–76. https://doi.org/10.1080/0376835X.2015.1044075.

IFPRI. 2019. "Global Nutrition Report 2018." New York. https://globalnutritionreport.org/reports/global-nutrition-report-2018/executive-summary/

Issaka, Abukari I., Kingsley E. Agho, Penelope Burns, Andrew Page, and Michael J. Dibley. 2015. "Determinants of inadequate complementary feeding practices among children aged 6-23 months in Ghana." *Public Health Nutrition* 18 (4): 669–78. https://doi.org/10.1017/S1368980014000834

Kumar, Neha, Phuong Hong Nguyen, Jody Harris, Danny Harvey, Rahul Rawat, and Marie T. Ruel. 2018. "What it takes: Evidence from a nutrition- and gender-sensitive agriculture intervention in rural Zambia." *Journal of Development Effectiveness* 10 (3): 341–72. https://doi.org/10.1080/19439342.2018.1478874

Kushitor, S.B., Scott D., Rashieda D., Casey D., Corinna H., Tafadzwanashe M., Mjabuliseni N., Rob S., and Laura M P. 2022. "The complex challenge of governing food systems : The case of South African food policy." *Food Security*, no. 0123456789. https://doi.org/10.1007/s12571-022-01258-z

Kyei-Arthur, F., Situma R., Aballo J., Mahama A.B., Selenje L., Amoaful E., and Adu-Afarwuah S. 2020. "Lessons learned from implementing the pilot micronutrient powder initiative in four districts in Ghana." *BMC Nutrition* 6 (1): 1–13. https://doi.org/10.1186/s40795-020-00382-3

Marquis, G. S., K. B. Harding, E. K. Colecraft, A. Lartey, O. Sakyi-Dawson, B. K. Ahunu, M. R. Reddy, H. H. Jensen, L. Butler, and Lonergan E. 2009. "Integrating economic and educational intervention activities in the Enam project leads to improved child nutritional status in rural Ghana." *The FASEB Journal* 23 (1): 352.

Marquis, G.S., Esi K. C., Roland K., Bridget A.A., Atuobi-Yeboah A., Pinto C., and Aryeetey R.. 2018. "An agriculture–nutrition intervention improved children's diet and growth in a randomized trial in Ghana." *Maternal and Child Nutrition* 14 (August): 1–10. https://doi.org/10.1111/mcn.12677

Masuke, R., Msuya S.E., Mahande J.M., Diarz E.J., Stray-Pedersen B., Jahanpour O., and Mgongo M. 2021. "Effect of inappropriate complementary feeding practices on the nutritional status of children aged 6-24 months in urban moshi, northern tanzania: cohort study." *PLoS ONE* 16 (5 May): 1–16. https://doi.org/10.1371/journal.pone.0250562

Otoo, G. E., A. A. Lartey, and R. Perez-Escamilla. 2009. "Perceived incentives and barriers to exclusive breastfeeding among periurban Ghanaian women." *Journal of Human Lactation* 25 (1): 34–41. https://doi.org/10.1177/0890334408325072

Passarelli, S., Ambikapathi R., Gunaratna N.S., Madzorera I., Canavan C.R., Noor A.R., Worku A., et al. 2020. "A chicken production intervention and additional nutrition behavior change component increased child growth in Ethiopia: A cluster-randomized trial." *Journal of Nutrition* 150 (10): 2806–17. https://doi.org/10.1093/jn/nxaa181

Reinbott, A., Schelling A., Kuchenbecker J., Jeremias T., Russell L., Kevanna O., Krawinkel M.B., and Jordan I. 2016. "Nutrition education linked to agricultural interventions improved child dietary diversity in rural cambodia." *British Journal of Nutrition* 116 (8): 1457–68. https://doi.org/10.1017/S0007114516003433

Ruel, M.T., Quisumbing A.R., and Balagamwala M. 2018. "Nutrition-sensitive agriculture: What have we learned so far?" *Global Food Security* 17 (January): 128–53. https://doi.org/10.1016/j.gfs.2018.01.002

Sallis, J.F., N. Owen, and E. Fisher. 2008. "Ecological models of health behaviour." In *Health Behavior and Health Education*, edited by K. Glanz, B.K. Rimer, and K. Viswanath, 4th ed., 465–85. San Francisco: John Wiley & Sons.

Sharma, I.K., Di Prima S., Essink D., and Broerse J.E.W. 2021. "Nutrition-sensitive agriculture: A systematic review of impact pathways to nutrition outcomes." *Advances in Nutrition* 12 (1): 251–75. https://doi.org/10.1093/advances/nmaa103

Townsend, N., and Foster C. 2011. "Developing and applying a socio-ecological model to the promotion of healthy eating in the school." *Public Health Nutrition* 16 (6): 1–8. https://doi.org/10.1017/S1368980011002655

UNICEF. 2020. "UNICEF Conceptual Framework on the Determinants of maternal and child nutrition, 2020. a framework for the prevention of malnutrition in all its forms." Geneva. https://www.unicef.org/media/113291/file/UNICEF Conceptual Framework.pdf

WHO, and PAHO. 2003. "Guiding principles for complementary feeding of the breastfed child." https://iris.paho.org/handle/10665.2/752

Yawson, A. E., E. O. Amoaful, L. K. Senaya, A. O. Yawson, P. K. Aboagye, A. B. Mahama, L. Selenje, and V. Ngongalah. 2017. "The lancet series nutritional interventions in ghana: a determinants analysis approach to inform nutrition strategic planning." *BMC Nutrition* 3 (1): 1–8. https://doi.org/10.1186/s40795-017-0147-1