

**ENAM IN AFRICA: ENHANCING CHILD NUTRITION  
THROUGH ANIMAL SOURCE FOOD MANAGEMENT**

**NARRATIVE SUMMARY**

Formative research in three regions of Ghana documented a perceived lack of income as the primary constraint to households' ability to incorporate adequate amounts of animal source foods (ASF) in young children's diets. Financial and technical support for caregivers' income generation activities (IGA) were identified as a priority for enhancing ASF intakes among 2-5 years old in the project's six intervention communities. A qualitative review of micro-credit/finance activities in Ghana was completed during the first year of the ENAM project which provided recommendations for the implementation of micro-credit/finance interventions. These recommendations included involvement of beneficiaries in the selection of IGA; extending credit facilities to individuals within solidarity groups where members serve as guarantors for each other's loans; and weekly repayment schedule for loan recuperation. Most of ENAM activities in the second year have focused on implementing these recommendations and establishing micro-credit programs for caregivers of 2-5 year-old children in our intervention communities. The project assisted caregivers of 2-5 year-old children in selecting viable IGA, developing intervention packages (entrepreneurial and nutrition education program with the intervention caregivers) for the different IGA selected, forming credit and savings associations (CSA) comprising of 4-8 solidarity groups (SG) of 3-5 caregivers in each of the intervention communities; and extending loan/credit facilities to the individual caregivers within the groups. For the nutrition education component an educational flip-chart for use with the intervention caregivers was completed and implemented during the project's second year. The entrepreneurial education program was initiated

and is anticipated to be completed early in the third year of the project. Research activities during the second year included completion of intervention-specific baseline data collection on selected caregiver/child pairs in the project's intervention and control communities, and the first of three planned quarterly follow-up data collections in one study area. Additionally, the Ghana-based graduate students completed their field data collection in the ENAM project communities and are in the process of analyzing their data. The Ugandan graduate student successfully defended his research proposal and has begun his data collection in the Kamuli District in Uganda. The US- and Ghana-based PIs and the program manager traveled to Uganda to assess the Ugandan student's progress in his field data collection and to meet with key personnel from Makerere University and some NGOs to discuss potential for future collaborations on ASF-related issues. The project has initiated support for two additional Ghanaian graduate students (one is pursuing a masters degree in Agricultural Economics and the other a degree in Nutrition) to develop research projects on ENAM project-related topics. Finally, the ENAM project developed a proposal and course outline for a nutrition extension course entitled 'Nutrition, Sustainable Livelihoods, and Extension' that will introduce students to nutrition and extension concepts within the sustainable livelihoods framework. The course proposal was submitted to the Faculty of Science academic board for review and has been approved. It will be offered through the Department of Nutrition and Food Science at University of Ghana, Legon as a third year (level 300) undergraduate course, starting August 2007.



## RESEARCH

The Workplan for 2005-2006 included four principal areas of activity. The development of each of these activities is discussed in the text below

1. Administrative set-up of GL-CRSP project in Ghana
2. Development of community-based activities to improve interventions
3. Training
4. Curriculum (Nutrition Extension) development

### **Activity One: Administrative set-up of GL-CRSP project in Ghana and establishment of liaisons with organizations to support grant activities**

**Problem Statement and Approach.** There was an effort to establish partnerships with institutions that were working in the research areas and had relevant experiences in extension and development. In addition, there was recognition that the University of Ghana provides a valuable institutional resource in sub-Saharan Africa in the area of community-based nutrition and agriculture extension. The project is working to develop linkages between the University of Ghana and other universities and non-governmental organizations (NGO) in Ghana and Uganda to improve child nutrition. This has occurred through educational (student and professorial) exchanges, and collaboration on research and community development activities.

**Planned activities.** The project sought to establish liaisons with governmental and NGOs to support grant activities. This included continued communication to develop collaborations with 1) governmental NGOs working in the study area (especially, MOFA, Ghana Health Services, Adventist Development and Relief Agency (ADRA)- working in the Central Region, and Heifer International - working in the Brong-Afaho Region); 2) initiate collaborations between University of Ghana and Makerere University in Uganda, 3) establish linkages with NGOs in Uganda.

**Importance.** Collaborations between the project and activities of other institutions will help efficiently use available resources, strengthen project activities,

widen their outreach, and maximize the effectiveness of the interventions.

**Plans to accomplish activity.** The Ghana-based staff (led by Drs. Colecraft and Sakyi-Dawson) scheduled meetings throughout the year with the Ghanaian NGOs to discuss collaboration opportunities. The regional officers were responsible for interacting with the local ministerial staff to involve them in project activities. Dr. Marquis arranged the September 2006 trip to Uganda to examine collaborative efforts between University of Ghana and Makerere University and the NGO, Volunteer Efforts for Development Concerns.

**How the problem model has been modified based on last year's activity.** The problem model has not been modified.

**Progress.** Collaborative efforts are in progress between the ENAM project and institutions.

**Planned outputs and completion of tasks.** The planned outputs were 1) discussions with governmental and non-governmental organizations about collaborative field efforts in Ghana and Uganda and 2) joint-institution proposals for community-based activities in Ghana and Uganda.

**Activities with Ghanaian institutions.** We had expected to train MOFA staff so that they would play a more direct role in the education component of the intervention. However, this proved to be unsustainable as MOFA did not have the resources to permit their staff to be in our intervention communities on a weekly basis. Thus, the project continues to interact with MOFA and share our resources with them (as well as with Ghana Health Services), but the weekly educational activities are carried out by ENAM staff.

The plans to partner with NGOs that had experience in community development and running interventions on IGA in our study areas were not able to be fully realized because of limitations with the core ENAM budget last year. However, additional funds became available through the USAID gender initiative and a proposal was submitted and approved to fund two specific NGO-collaborative activities.

1) The ENAM project has an on-going micro-credit component that has facilitated the formation

of women's groups to access grants and loans from the project to engage in IGA to enhance caregiver households' incomes. Currently the loans are provided directly by the project and loan repayments deposited in group accounts opened for the women's group with the local rural bank. A sustainable revolving fund with the rural banks that can disburse loans to the women is needed. The additional activities that were approved for the final project year will develop a link with the rural bank system and provide further training to the women's groups to understand their rights and responsibilities in working with the banks and effective management of their businesses. These activities will be completed through a consultation with Freedom from Hunger, Ghana which has extensive experience in establishing sustainable micro-credit systems through their trademark Credit Savings with Education program.

2) Heifer, International has extensive experience in developing poultry and small livestock IGA. The additional funds will be used to allow Heifer to expand their activities into our study communities to work with the women's groups in the ENAM project.

*Collaborations with Ugandan institutions.* Drs. Marquis, Colecraft and Sakyi-Dawson travelled in September to the Iowa State University Sustainable Rural Livelihood's Program (SRL) study district (Kamuli, Uganda) to review the ENAM master's student project and meet the Uganda-based faculty and staff working with the project. Discussions occurred with VEDCO staff as well as faculty at Makerere University to examine intra-continental research and education opportunities for the ENAM project.

1) Joint research collaborations with VEDCO: VEDCO is the lead institution in Uganda for the SRL program that aims to improve rural lives through development focused on agriculture, health, and business. Since June 2006, VEDCO has been providing the local infrastructure (regional office, use of transport vehicles, staff assistance, and community entrance) through which the ENAM-supported master's student, Samuel Oluka, is collecting his data on animal source food use for young children. Oluka's research will be informative to VEDCO on specific issues of interest to them, including

child nutrition and sanitation needs in the district. VEDCO trains and supports community nutrition and health workers and agriculture extension agents throughout the district and is interested in further collaborations with the ENAM project.

Makerere University is an active member of the SRL program in the Kamuli district. The Food Science and Technology department met several times with the visiting faculty to discuss common research interests. In addition, Dr. Charles Muyanja is serving as the local mentor for Samuel Oluka while he is in the field. Discussions were held to explore mechanisms of increasing the student exchange between the University of Ghana and Makerere University with the FST department head as well as with the coordinator of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM, Professor Adipala Ekwamu). Membership in RUFORUM would allow students to pay local tuition, thus increasing the possibility of student exchange.

#### **Activity Two: Development of community-based activities to improve interventions**

**Problem Statement and Approach.** An important objective for the second year was to support caregivers' IGA to enhance household ASF security. The first step to achieving this was to identify and select (based on established criteria) appropriate caregivers' IGA to support in each intervention community. Participatory processes were used that allowed for caregivers of 2-5 years old children in each intervention community to actively participate in the selection of IGA to be supported by the ENAM project in their communities.

**Planned activities.** The IGA selection activities included 1) identifying IGA that caregivers of 2-5 year-old children were already doing in the intervention communities; 2) documenting the caregivers' suggestions of other possible IGA for their communities based on four main criteria (access to inputs, access to market, profitability, and potential for the IGA to influence child nutrition through inclusion of ASF in household meals); 3) review of caregivers' IGA (ongoing and suggested) by the project management team and initial selection of

IGA to support based on the four above criteria and potential to show impact on household ASF-food security and children's diets within the time frame of the project; and 4) final selection of IGA by management team following cash flow analysis to assess profitability, and assessment of feasibility of new IGA (i.e., those IGA not already being done in the community).

**Importance.** A major thrust of this project is to improve household income through the support of caregivers' IGA. The process of IGA selection has implications for sustainability and success (with respect to improving incomes). Caregivers' active participation in this process was intended to garner a sense of ownership of the IGA to enhance sustainability. The management review of potential IGA and the evaluation based on cash flow analyses allowed us to select the most viable IGA from among those recommended by caregivers, and enhance the

potential for improved income.

**Plans to accomplish activity.** The community-based activities were planned to be carried out by the project field officers (one in each intervention region). It was planned that the field officers would be trained in participatory approaches in October 2005 to enhance their capacity to implement the activities. The activities would be initiated in the coastal communities which would serve as the training sites for all of three field officers. It was anticipated that the IGA selection process would be completed in each of the six intervention communities by the end of January 2006.

**How the problem model has been modified based on last year's activity.** As described below, we had planned to implement different IGA strategies to compare those that provided financial loans (e.g., for traders) to those that provided inputs (e.g., chicks for poultry and eggs) that could then be shared with

Table 1. Primary activities of caregivers engaged in different IGA in the ENAM intervention communities (%)

Caregivers' ongoing IGA	Coastal savannah zone WINNEBA		Forest transitional zone TECHIMAN		Northern savannah zone NAVRONGO	
	Warabebe (rural) (N=28)	Nsuekyire (N=59)	Fiaso (rural) (N=91)	Forikrom (N=68)	Gia (rural) (N=58)	Wuru (N=36)
Farming staples for sale			48.4 (44) <sup>1</sup>	61.8 (42)	12.1 (7)	
Growing/sale of vegetables					15.5 (9)	38.9 (14)
Fish mongering/smoking	7.1 (2)	6.8 (4)			22.4 (13)	
Other fish business <sup>2</sup>	78.6 (22)	3.4 (2)				
Petty trading (non-foods)	7.1 (2)	33.9 (20)	20.9 (19)	17.7 (12)	12.1 (7)	11.1 (4)
Selling of foodstuffs		18.6 (11)	13.2 (12)	4.4 (3)	3.4 (2)	28.8 (10)
Selling of cooked food	7.1 (2)	20.3 (12)			10.3 (6)	2.8 (1)
Processing/sale (charcoal, oil, rice parboiling, alcohol)		3.4 (2)	8.8 (8)	2.9 (2)	20.7 (12)	16.7 (6)
Cosmetics/soap making			2.2 (2)			
Service (hairdressing, dress making)		13.6 (8)	6.6 (6)	13.2 (9)	3.4 (2)	2.8 (1)

<sup>1</sup>% (n)

<sup>2</sup>Services (such as assisting with the pulling of the fishing net, or sorting caught fish) provided to fishermen and fishmongers in exchange for fish.

Table 2a. Rankings of IGA based on access to input and markets, profitability and potential to impact child nutrition in Winneba (coastal savannah) area intervention communities.

Rank order	WARABEBA (RURAL)	NSUEKYIRE (SEMI-RURAL)	
	all wealth ranks	low wealth	medium/high wealth
1st	fish smoking	fish smoking	petty trading
2nd	petty trading	trade in foodstuffs	trade in foodstuffs
3rd	trade in foodstuffs	Petty trading (non-food)	fish smoking
4th	poultry		
5th	trade in firewood		

Table 2b. Rankings of IGA based on access to input and markets, profitability and potential to impact child nutrition in Techiman (transitional forest) area intervention communities.

Rank order	FIASO (RURAL)		FORIKROM (SEMI-RURAL)	
	low wealth	medium/high wealth	low wealth	medium/high wealth
1st	farming	petty trading	petty trading	petty trading
2nd	petty trading	farming of staples	farming of staples	farming of staples
3rd	trade in foodstuffs	poultry	gari processing	goat/sheep rearing
4th		soap/cream making	goat/sheep rearing	making tie/dye cloth
5th		trade in foodstuffs	soap/cream making	
6th		fish smoking	poultry	

Table 2c. Rankings of IGA based on access to input and markets, profitability and potential to impact child nutrition in Navrongo (northern savannah) area intervention communities.

Rank order	GIA (RURAL)		WURU (SEMI-RURAL)	
	low wealth	medium/high wealth	low wealth	medium/high wealth
1st	fish smoking	petty trading	trade in foodstuffs	fish mongering
2nd	trade in foodstuff	trade in foodstuffs	fish mongering	trade in foodstuffs
3rd	petty trading	farming of staples	goat/sheep rearing	petty trading
4th		fish smoking	vegetable gardening	goat/sheep rearing
5th			poultry	poultry
6th			brewing of local alcoholic beverage	selling of prepared food
7th				brewing of local alcoholic beverage

new groups. However, the plans for implementing poultry farming had to be abandoned because of the concern for avian flu in Ghana. After reports of avian flu in Nigeria emerged, the sale of day-old chicks was banned by the Ghanaian government. Community groups changed their IGA activities and only financial loans have been implemented to date. For women starting in fish smoking, grants also covered the cost of smoking trays.

**Progress.** Selection of caregivers IGA was completed by mid-January 2006.

#### ***Planned outputs and completion of tasks***

1. *Training of project field officers* in participatory approaches was carried out October 24-26, 2005. The training was facilitated by a consultant recommended by Women in Agricultural Development, a subdivision of the Ministry of Food and Agriculture. The training included a one-day didactic session, one-day of field application in one of the intervention communities in Winneba, and one-day of debriefing and evaluation. A final report on the training activities was completed by the field officers and training consultant.

2. *Community activities to identify potential IGA for support.* Between October and December 2005 a series of community meetings were completed with caregivers of 2-5 year-old children in each of the six intervention communities (Warabeba and Nsuekyire in Winneba area; Fiaso and Forikrom in Techiman area; Gia and Wuru in Navrongo area). The outputs of these meetings were a community-specific listing of IGA in which caregivers were already engaged, other possible IGA that caregivers selected for their communities, and caregivers' rankings of the most appropriate IGA for their communities based on the four criteria indicated above. With the exception of the rural coastal savannah community, caregivers were grouped into low and medium/high wealth rank for these meetings. In the rural coastal savannah community, the number of medium/high wealth rank caregivers was relatively small and therefore the caregivers were not divided into groups by economic status.

The number of caregivers who attended the IGA assessment meetings in the different intervention communities ranged from 28 for Warabeba (rural

community in the coastal savannah zone-Winneba area) to 91 for the Fiaso (rural community in the forest transitional zone-Techiman). Caregivers of 2-5 year-old children in the six intervention communities were engaged in 10 different categories of IGA (Table 1). The lowest diversity of IGA was in the rural community of the coastal savannah study area where caregivers were engaged in four different kinds of IGA; the greatest number of different IGA that caregivers were involved in was eight, in the rural community of the northern savannah study area. The only ASF-related IGA that the caregivers attending the meetings were engaged in was fish mongering/smoking and other fish related activities. Almost 80% of caregivers of 2-5 year-old children in the rural coastal savannah community were engaged in fish-related IGA where they received quantities of fish for the services they provided (mainly assisting with pulling the fishing net, sorting out fish after the catch, and or carrying fishing equipment from one point to another). In the forest transitional communities, farming was the most common IGA among the caregivers, followed by petty trading. Interestingly, cultivation and sale of fresh vegetables by caregivers was exclusive to the Northern Savannah communities which experience the lowest frequency of rainfall compared to the other two study areas; the caregivers in these communities were farming along dams in or near their communities.

The caregivers' rankings of IGA they perceived to be the most appropriate IGA for their communities are given in Table 2a-2c. A total of 13 different IGA were recommended and ranked by caregivers of 2-5 year-old children who participated in the meetings in the three study areas. ASF-related IGA that were included were fish mongering/smoking, goat/sheep rearing, and poultry. For the caregiver groups where goat/sheep rearing and poultry were recommended, the caregivers ranked these IGA very high with respect to market, profitability and capacity to influence child nutrition in the home because of the high sale value of the animals. However, these IGA were ranked very low compared to the other suggested IGA for the criteria access to inputs, because they were perceived to require considerably high start-up capital.

3. *ENAM management review and selection of*

*caregivers' IGA.* The IGA rankings by caregivers were reviewed by the project management team. The initial selection of IGA from among those ranked by the caregivers was: fish mongering/smoking, poultry, trade in firewood, and trade in foodstuffs for the Winneba area communities; poultry and trading for the Techiman area communities; and poultry, fish mongering/smoking, and trading in foodstuffs for the northern savannah communities. Following the cash flow analyses on the initial IGA selections, trade in firewood was dropped as a possible IGA for the Winneba area communities due to high transportation costs to transport firewood from the nearest woodlot farmers to the communities. For poultry, it was decided that the project would support the keeping of chickens for production of eggs. The management team had some concerns about the feasibility of poultry rearing in the coastal savannah communities because of possible lack of access to feed or feed ingredients. Community feasibility assessment for poultry as an IGA was completed for the Winneba communities by the two project co-investigators (Canacoo and Ahunu) with expertise in animal science. Based on the results of this feasibility assessment, it was recommended that poultry be promoted in Nsuekyire (semi-rural community) but not Warabeba. The main reason for the recommendation not to promote poultry in Warabeba was lack of sufficient interest of the caregivers. While poultry was not among the initially ranked IGA in Nsuekyire, further interactions with individual caregivers showed a few were willing to try it if they were provided with the start-up capital required.

**Activity Two: Development of community-based activities to improve interventions -- Development of Micro-credit and education intervention packages**

**Problem statement and approach.** Support for IGA to increase caregivers' income security was to be accomplished through provision of micro-credit facilities to caregivers of 2-5 year-old children. This financial support was linked to entrepreneurial training and education on the importance of ASF in children's diets and other child feeding topics.

**Planned activities.** Prior to implementation of the selected IGA in the intervention communities, we planned to develop a micro-credit package for each selected type of IGA. Planned activities for the entrepreneurial and nutrition education components included development of education modules for use with the caregivers.

**Importance.** The development of micro-credit packages for the different IGA selected was necessary to appropriately tailor the ENAM project's financial support to specific IGA and also to the different needs of the caregivers. The cash flow analyses for the different IGA types showed differences in costs of inputs and other expenses, as well as differences in expected revenues for different IGA. Caregivers opting for the different IGA, therefore, would require different levels of financial support. Tailoring for individual caregivers was necessary because they had different levels of experience and assets for any given IGA and therefore different support needs. Linking the IGA/micro-credit component with entrepreneurial training provided the opportunity to help caregivers improve their business practices and hence realize the full benefits of the micro-credit support they receive through the project. The essence of providing the caregivers with nutrition-related information and education was to enhance the likelihood that increased income from the IGA would go toward improving household ASF availability and utilization for 2-5 year-old children.

**Plans to accomplish activity.** The management team planned to review the cash flow analysis for each of the IGA selected and develop a financial support package. The support package would specify: required inputs if any to be provided by the caregivers, grant amount (if any) to be provided to the caregivers, repayable loan amount to be provided by the ENAM project, savings requirements, interest on loans, repayment schedule, and conditions for participation. It was planned that the Ghana-based PI would provide the leadership for the development of the entrepreneurial training component and the program manager would provide the leadership for the nutrition education component. The developed materials would be field tested and the field officers trained in their delivery.



Table 3. Maximum levels of financial support for selected income generation activities for ENAM project intervention caregivers (1US\$ = 9,100 Ghanaian cedis)

A. POULTRY	
<b>Type of financial support:</b> grant and repayable loan	
<b>Prerequisites:</b> Interested caregivers must construct their own chicken coop according to the design provided by the project by the proposed loan disbursement date before they can receive the loan. The project will provide some key items as a 'grant' for construction of the coop.	
<b>The grant and repayable loan components of the support package per person are as follows:</b>	
Support Categories	Monetary Value (Ghanaian ¢)
<b>GRANT</b>	
Wire mesh for coop construction	125,000
Pest/ rodent guard (prepared)	20,000
Roofing sheets for coop construction	160,000
Water trough	12,000
4 bags of feed	560,000
Medication (1 year supply)	100,000
<b>Total grant amount</b>	<b>977,000</b>
<b>REPAYABLE LOAN</b>	
20 point-of-lay chickens	900,000
<b>Maximum disbursement</b>	<b>1,877,000</b>

**Progress.** Financial support packages were completed for fish smoking, poultry, and trading as IGA for the Winneba area intervention communities. Results from the cash flow analysis for similar activities in the Techiman (trading and poultry) and Navrongo (poultry/guinea fowl, fish smoking, trading) areas were not very different from those obtained for the Winneba area and therefore the support packages developed for the Winneba area were used for the other areas as well. Activities were initiated for the development of entrepreneurial education program for the caregivers and will be completed early in the 3rd year of the project. Nutrition education

B. FISH SMOKING		
<b>Prerequisites:</b> Caregivers interested in the fish smoking business who do not presently have a 'Chorkor-style improved smoking oven' must build one (demonstration provided by the project) before they can receive the loan. The project will provide 10 smoking trays as a grant for interested individuals new to the business or who construct the improved oven for the first time. Those already involved in fish smoking and using the improved type smoker will only receive a repayable loan. <b>The grant and loan products for the 2 categories are as follows:</b>		
Support Categories	Monetary value Ghanaian cedis (¢)	
	New <sup>1</sup>	Veteran
<b>GRANT</b>		
Fish smoking trays (10)	875,000	0
Repayable loan amount	500,000	800,000
<b>Maximum disbursement</b>	<b>1,375,000</b>	<b>800,000</b>
<sup>1</sup> New=caregivers entering into fish smoking business for the first time or those who need to construct new improved smoking oven ; Veteran=caregivers already engaged in fish smoking business using improved smoking oven		

C. Trading	
<b>Prerequisites:</b> None	
Caregivers interested in trading related IGA will receive a repayable loan of up to 500,000 cedis.	
Support categories	Monetary value Ghanaian cedis (¢)
Repayable loan amount	500,000
<b>Maximum disbursement</b>	<b>500,000</b>

modules, including a flip chart developed with the assistance of the Ghana Health Services, were field tested for the nutrition education component.

Planned outputs and completion of tasks:

1. *Support packages.* Financial support packages were completed for the three different IGA selected for the project's intervention communities (Table 3). In addition eligibility requirements and conditions associated with the support packages were specified (Table 4).

2. *Nutrition educational materials.* A nutrition education flip chart was developed and field tested.

Table 4. Eligibility requirements and loan terms for participants in ENAM project interventions in selected communities in the Winneba, Techiman, and Navrongo areas of Ghana

Eligibility requirements:
<ul style="list-style-type: none"> <li>• Must be caregiver of a child 1y 9 mo to &lt;5 y old</li> <li>• Both caregiver and child must be resident in the community</li> <li>• Caregiver must become a member of EMAM project IGA Credit and Savings Association (CSA) to be formed in the community</li> <li>• Must be appraised for a loan by other caregivers in the CSA.</li> <li>• Must fulfill all prerequisites associated with a particular IGA</li> <li>• Caregivers' spouse must agree to her participation</li> <li>• Must agree to all the terms of the assistance package</li> </ul>
Micro-credit loan terms
<ul style="list-style-type: none"> <li>• Must form a solidarity group with 3-4 other caregivers to join the ENAM Project CSA (e.g., group of solidarity groups)</li> <li>• IGA financial package represents maximum grant/loan amounts set for each IGA. Actual amount to be received will depend on loan appraisal by other participating caregivers (solidarity group).</li> <li>• The loan cycle will run for a period of 16 weeks (loan amount may be increased during next loan cycle depending on performance)</li> <li>• Interest will not be charged on loans within the first year of loan cycles (for the first 3, 4-month loan cycles)</li> <li>• Save 20% of loan amount by end of loan cycle</li> <li>• Weekly repayment of loan amount and savings. The amount of weekly payments (loan and savings) will be calculated for each caregiver depending on the loan that she amount receives</li> <li>• Weekly meeting attendance for entrepreneurial or nutrition education and loan repayment</li> <li>• Must participate in periodic data collection by ENAM project staff.</li> <li>• New loans for individual caregivers contingent on 100% loan repayment by all CSA members</li> </ul>

The flip chart is made up of lesson plans with associated illustrations. The lesson plans were developed by the program manager with input from the ENAM project team members; illustrations for the lessons were done by a consultant from the Ghana Health Services (Health Promotion Unit). The broad topic areas covered by the flip chart are: 1) facts about your 2-5 year-old child; 2) benefits of animal source foods; 3) the balanced plate; and 4) feeding and making the meal time enjoyable. The flip chart was tested in a non-participating community in the Winneba area. All three field officers participated in the Winneba field testing as part of their training. The field officers from the Techiman and Navrongo study areas subsequently tested the flip chart in non-participating communities in their respective areas. The flip chart was revised based on observations made during the field testing. Copies of the final

flip chart were reproduced and distributed to the field officers.

3. *Entrepreneurial education materials.* The entrepreneurial education was initiated with training of the project field officers on entrepreneurial principles using materials adapted from 'Manual for supplementing mothers' income (a solution to child labor)' {a publication from International Centre for Entrepreneurship and Career Development, 1999}. Field officers provided input for the development of entrepreneurial modules based on their own experiences in their field sites. During a project update trip by two of the US-based team members the entrepreneurial education was critically reviewed and broad topic areas for modules were agreed on. Three initial lesson plans based on these modules were developed by the project field supervisor and field tested. We engaged the services of a consultant in September 2006

to complete the development lessons plans based on the defined topics. A draft of the entrepreneurial training manual has been completed.

**Activity Two: Development of community-based activities to improve interventions -- Implementation**

**Problem Statement and Approach.** Implementation of the ENAM project interventions to support caregivers was to be accomplished through delivery of the project's support packages to eligible caregivers in groups within the intervention communities.

*Planned activities.* These included 1) promotion of the fish smoking, poultry and trading as IGA that the project would support in the intervention communities, 2) facilitation of group formation

by interested and eligible caregivers for delivery of the interventions, 3) baseline data collection on specific intervention variables, 4) initiation of the first cycle of credit support activities in each of the communities, and 5) follow-up data collection.

**Importance.** Most of the planned activities for this section were to enable adequate preparation of the project field officers and caregivers of 2-5 year-old children for effective implementation of the project interventions. In addition, the intervention-specific baseline and follow-up data collection was important to provide a means of measuring improvements in outcomes of interest as a part of the research component of the project.

**Plans to accomplish the activity.** The project field officers were to be the primary implementers of the project's micro-credit activities and therefore it was planned that they would be trained in key aspects of micro-credit and micro-finance service delivery. Promotion of the selected IGA in the intervention communities would involve: 1) mentoring of interested caregivers by other caregivers within or outside the community who were perceived by community members as successful in the selected IGA and 2) community-wide training for poultry and fish smoking activities. Following these activities the field officers were to facilitate caregiver group formation in the intervention communities. Before initiating the first cycle of micro-credit disbursements it was planned that baseline data on specific aspects of the micro-credit intervention including the education components would be collected. Data collection tools were to be developed based on the interventions and associated research questions specified in the project Work Plan for Year 2. It was planned that the baseline data collection instruments would be used to collect follow-up data every four months. Following completion of the data collection activities the first cycle of financial support activities was to be initiated. It was planned that implementation of intervention activities, including data collection and micro-credit disbursements would be staggered with activities initiating in Winneba, followed by Techiman, and then Navrongo. Micro-credit disbursements were planned to take place in March 2006 for the Winneba sites and May 2006 for the Techiman and Navrongo sites. Record keeping forms were to be

developed for monitoring of the interventions as part of the data collection activities.

**Progress.** Training of the field officers in micro-credit/micro-credit programming was completed on February 13, 2006. Promotion activities for the caregiver IGA were completed between February 25, 2006 in the Winneba communities and June 29, 2006 in the Navrongo communities. Training for poultry was completed only in the Winneba area because shortly after the Winneba training, avian flu became a concern in Ghana and caregivers were unwilling to pursue poultry as an IGA and the government placed a ban on the importation of day old chicks. As a result of this setback, the project was only able to promote fish smoking and trading (with emphasis on ASF-related activities where possible) as IGA. The initiation of the first cycle of micro-credit disbursements was delayed in all the sites because the group formation processes in the communities took longer than was anticipated. In addition, the field officer for Navrongo resigned and had to be replaced causing further delays in the progress of activities in the intervention communities in the north. The first cycle of micro-credit disbursements were initiated May 16<sup>th</sup> and 19<sup>th</sup>, 2006 for the Winneba area study communities; July 6<sup>th</sup>, 2006 for the Techiman area communities; and August 4<sup>th</sup> and 5<sup>th</sup>, 2006 for the Navrongo area study communities.

**Planned outputs and completion of tasks.** We had originally thought to train MOFA and GHS staff on the assumption that facilitation of the community intervention activities could be incorporated into on-going outreach activities of agriculture extension (MoFA) and nutrition outreach (GHS) workers working in the intervention districts. However this was not possible as the project interventions require intensive ongoing facilitation and monitoring which the agriculture extension and nutrition workers could not add to their own activities. In addition, the extension staff spent less time in the communities than desired because of limited resources. Therefore it was decided that the project field officers (one for each of the 3 regions) would be the primary implementers of the project interventions, and their training needs were considered the priority for year 2.

Figure 1. Community-wide training in fish smoking and the construction of a prototype improved fish smoking oven took place at the Winneba and Navrongo sites. One hundred and forty-three community members participated in the training. Photo by Grace Marquis.



1. *Training field officers for implementation of the project's micro-credit activities:* Training was accomplished through a 3-day workshop facilitated by the credit coordinator for the Upper Manya Krobo Rural Bank who was contracted by the ENAM project. Topics covered during the training were; formation of credit and savings associations (CSA) at the community level; development of group rules and by-laws, adult education principles, and record keeping.

2. *Promotion of project IGA:* Caregivers with 2-5 year-old children who were interested in the selected IGA to be supported in their communities were mentored by successful caregivers in the particular IGA (one mentor for each IGA) in their community through question and answer sessions facilitated by the project field officers in each intervention community. Promotion activities concluded with training in fish smoking (Winneba and Navrongo communities) and poultry keeping (Winneba). The trainings were open to all community members. A prototype fish smoking oven (Figure 1) and a chicken coop were constructed with community members during the trainings for fish smoking and poultry, respectively. A total of 80 adult females and 6 adult males and 53 adult females and 4

adult males participated in the fish smoking activities in the Winneba and Navrongo areas, respectively; 87 females and 7 adult males participated in the poultry training activities in the Winneba area.

3. *Community savings associations (CSA):* In each intervention community, one CSA was set up that was made up of 4-8 solidarity groups of 3-6 caregivers each. After meeting all eligibility requirements for the ENAM project, caregivers' participation was determined by their selection into solidarity groups by other caregivers. The caregivers developed rules and by-laws (including fines for tardiness and absence at meetings) for participation in the CSA and elected leaders (president, secretary, assistant

secretary, treasurer, community organizer, assistant organizer, and porter) for the group.

4. *First 16-week cycle of micro-credit loans:* The loan amount received by each member of a solidarity group was determined by the members of the group through a loan appraisal process facilitated by the project field officers. A total of 136 caregivers of young children received loans. The distribution of wealth rank, selected IGA and loan amounts received by the caregivers in each study locale is summarized in Table 5a.

5. *Monitoring forms for weekly CSA meetings:* Record keeping ledgers and forms were used to monitor caregivers' loan repayments, savings and attendance at weekly education sessions. At the end of the project's second year, the two CSAs in the Winneba had completed the first 16 week loan cycle; attendance and loan repayment performance of the caregivers are provided in Table 5b. Loan repayment rate was 100% for all caregivers in the two CSAs; savings contributions by the rural community CSA members surpassed the 20% (of loan amount) target set by the project, whereas the semi-urban caregivers save < 10%. Further training and education is needed.

6. *Intervention-related baseline data collection:*

Table 5a. Distribution of caregivers' wealth rank, selected IGA and loan amount received

CSA location	# of groups	Caregiver wealth rank			IGA selected		Loan amount in cedis <sup>1</sup>	
		Low	Medium	High	Fish smoking	trading	<500,000	≥500,000
<b>WINNEBA</b>								
Rural	3	4 (31) <sup>2</sup>	9 (69)	0 (0)	5 (39)	8 (61)	2 (15.4)	11 (84.6)
Semi-urban	4	9 (60)	6 (40)	0 (0)	3 (20)	12 (80)	4 (26.7)	11 (73.3)
<b>TECHIMAN</b>								
Rural	7	10 (38)	16 (62)	0 (0)	0 (0)	26 (100)	7 (26.9)	19 (73.1)
Semi-urban	8	15 (58)	11 (42)	0 (0)	0 (0)	26 (100)	2 (7.7)	24 (92.3)
<b>NAVRONGO</b>								
Rural	8	20 (63)	11 (34)	1 (3)	10 (42)	14 (58)	32 (100)	0 (0)
Semi-urban	6	19 (79)	4 (17)	1 (4)	17 (53)	15 (47)	24 (100)	0 (0)

<sup>1</sup>1US\$=9100 Ghanaian cedis; <sup>2</sup>n (%)

Intervention baseline data collection was completed in all sites. Initial results will be presented at the Experimental Biology meetings in Washington D.C. in April 2007.

7. *Preliminary analysis of baseline data.* Data were collected on caregiver/child pairs participating in the ENAM interventions (IP) and two different types of controls: 1) caregiver/child pairs in the intervention communities who did not receive an ENAM project loan (IC) and 2) caregiver/child pairs from the control communities (CC). Effort was made to select control caregivers who matched the IP participants on wealth rank and primary occupation. This was not always possible due to the small sample of caregivers with young children in the communities. Important differences observed between control and intervention caregivers at baseline will be included in the longitudinal analyses. All analyses described below adjusted for small cell numbers with Fisher's Exact Test using SAS software.

#### **Selected demographic characteristics**

**Winneba (coastal savannah area):** None of the three categories of caregivers belonged to 'high' wealth rank households (Table 6a). There were no significant differences in the major occupation of caregivers; At least 66% of the control and intervention caregivers were engaged in ASF related economic activities. In the semi-rural communities,

control caregivers in the intervention community tended to be more likely than the intervention and control community caregivers to be engaged in ASF-related IGA (Table 6b).

**Techiman (transitional forest area):** Approximately 85% of intervention caregivers in the rural Techiman community were traders compared to 50% or less

Table 5b. First micro-credit loan cycle performance of Winneba area CSA members

Winneba CSA locale	Weekly meeting attendance <sup>1</sup>	Loan repayment	Mean savings (as percent of loan amount taken)
Rural	71.2 ± 5.6, 75	100%	26.0 ± 1.8, 28
Semi-urban	70.5 ± 5.5, 75	100%	7.1 ± 2.5, 2

<sup>1</sup>Mean ± SD, median

for the control caregivers ( $p < 0.001$ ; Table 6c). There were no significant differences between the intervention and control caregivers in the selected variables presented for the semi-rural community. A maximum of 20% of caregivers were engaged in ASF-related IGA (Table 6d).

**Navrongo (northern savannah area):** Over 50% of the caregivers in the rural intervention community were engaged in an ASF-related IGA compared to less than 16% among the control caregivers ( $p < 0.0001$ ; Table 6e). There were no differences in the household wealth rank of the caregivers but more IP caregivers worked in the fish business



Table 6a, 6b. Selected demographic characteristics of caregivers in Winneba: rural (left); semi-rural (right).

Characteristic	Community classification				P-value	Characteristic	Community classification				P-value
	IP (N=13) <sup>1</sup>	IC (N=13)	CC (N=22)				IP (N=15) <sup>1</sup>	IC (N=15)	CC (N=30)		
<b>RELATION TO INDEX CHILD</b>					0.1243	<b>RELATION TO INDEX CHILD</b>					0.8819
Mother	46.15 (6) <sup>2</sup>	53.85 (7)	77.27 (17)			93.33 (14) <sup>2</sup>	85.71 (12)	83.33 (25)			
Grandmother	30.77 (4)	30.77 (4)	22.73 (5)			6.67 (1)	14.29 (2)	13.33 (4)			
Other relative	23.08 (3)	15.38 (2)	0.00 (0)			0.00 (0)	0.00 (0)	3.33 (1)			
<b>HOUSEHOLD WEALTH RANK</b>					0.0472	<b>HOUSEHOLD WEALTH RANK</b>					0.9039
Low	38.46 (5)	84.62 (11)	50.00 (11)			53.33 (8)	60.00 (9)	53.33 (16)			
Medium	61.54 (8)	15.38 (2)	50.00 (11)			46.67 (7)	40.00 (6)	46.67 (14)			
High	0 (0)	0 (0)	0 (0)								
<b>MAJOR OCCUPATION</b>					0.1892	<b>MAJOR OCCUPATION</b>					0.1220
Crop farming	0.00 (0)	7.69 (1)	0.00 (0)			26.67 (4)	26.67 (4)	46.67 (14)			
Fish business	23.08 (3)	46.15 (6)	50.00 (11)			20.00 (3)	13.33 (2)	0.00 (0)			
Trader	76.92 (10)	38.46 (5)	36.36 (8)			46.67 (7)	53.33 (8)	30.00 (9)			
Other incl.	0.00 (0)	0.00 (0)	9.09 (2)			0.00 (0)	0.00 (0)	10.00 (3)			
Not working	0.00 (0)	7.69 (1)	4.55 (1)			6.67 (1)	6.67 (1)	13.33 (4)			
ASF IGA	76.92 (10)	75.00 (9)	66.67 (14)	0.5035		35.71 (5)	50.00 (7)	15.38 (4)	0.0606		

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n)

Table 6c, 6d. Selected demographic characteristics of caregivers in Techiman: rural (left), semi-rural (right).

Characteristic	Community classification				P-value	Characteristic	Community classification				P-value
	IP <sup>1</sup>	IC	CC				IP <sup>1</sup>	IC	CC		
<b>RELATION TO INDEX CHILD</b>					0.7334	<b>RELATION TO INDEX CHILD</b>					0.5395
Mother	84.62 (22) <sup>2</sup>	84.62 (22)	90.38 (47)			100.00(26) <sup>2</sup>	92.31 (24)	88.46 (46)			
Grandmother	11.54 (3)	7.69 (2)	3.85 (2)			0.00 (0)	3.85 (1)	3.85 (2)			
Other relative	3.85 (1)	7.69 (2)	5.77 (3)			0.00 (0)	3.85 (1)	7.69 (4)			
<b>HOUSEHOLD WEALTH RANK</b>					<0.0001	<b>HOUSEHOLD WEALTH RANK</b>					0.8503
Low	34.62 (9)	15.38 (4)	57.69 (30)			53.85 (14)	65.38 (17)	59.62 (31)			
Medium	65.38 (17)	84.62 (22)	36.54 (19)			46.15 (12)	34.62 (9)	38.46 (20)			
High	0.00 (0)	0.00 (0)	5.77 (3)			0.00 (0)	0.00 (0)	1.92 (1)			
<b>MAJOR OCCUPATION</b>					<0.0001	<b>MAJOR OCCUPATION</b>					0.7414
Crop farming	7.69 (2)	42.31 (11)	65.38 (34)			38.46 (10)	50.00 (13)	57.69 (30)			
Fish business	0.00 (0)	3.85 (1)	1.92 (1)								
Trader	84.62 (22)	50.00 (13)	23.08 (12)			46.15 (12)	38.46 (10)	30.77 (16)			
Other incl.	7.69 (2)	0.00 (0)	3.85 (2)			11.54 (3)	7.69 (2)	5.77 (3)			
Not working	0.00 (0)	3.85 (1)	5.77 (3)			3.85 (1)	3.85 (1)	5.77 (3)			
ASF IGA	26.92 (7)	12.00 (3)	10.20 (5)	0.2034		20.00 (5)	12.00 (3)	12.24 (6)	0.6567		

<sup>1</sup>IP=intervention caregiver receiving ENAM loan;

IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n)

Table 6e, 6f. Selected demographic characteristics of caregivers in Navrongo: rural (left), semi-rural (right).

Characteristic	Community classification				P-value	Characteristic	Community classification				P-value
	IP <sup>1</sup>	IC	CC	P-value			IP <sup>1</sup>	IC	CC	P-value	
<b>RELATION TO INDEX CHILD</b>					0.8583	<b>RELATION TO INDEX CHILD</b>					0.2811
Mother	93.94 (31) <sup>2</sup>	100.00 (30)	93.22 (55)			Mother	91.67 (22) <sup>2</sup>	77.27 (17)	86.36 (38)		
Grandmother	3.03 (1)	0.00 (0)	5.08 (3)			Grandmother	4.17 (1)	22.73 (5)	11.36 (5)		
Other relative	3.03 (1)	0.00 (0)	1.69 (1)			Other relative	4.17 (1)	0.00 (0)	2.27 (1)		
<b>HOUSEHOLD WEALTH RANK</b>					0.2166	<b>HOUSEHOLD WEALTH RANK</b>					0.8471
Low	69.70 (23)	90.00 (27)	78.69 (48)			Low	75.00 (18)	86.36 (19)	77.27 (34)		
Medium	30.30 (10)	10.00 (3)	19.67 (12)			Medium	16.67 (4)	9.09 (2)	18.18 (8)		
High	0.00 (0)	0.00 (0)	1.64 (1)			High	8.33 (2)	4.55 (1)	4.55 (2)		
<b>MAJOR OCCUPATION</b>					<0.0001	<b>MAJOR OCCUPATION</b>					0.0223
Crop farming	21.21 (7)	46.67 (14)	81.97 (50)			Crop farming	45.83 (11)	27.27 (6)	29.55 (13)		
Fish business	39.39 (13)	6.67 (2)	0.00 (0)			Fish business	8.33 (2)	9.09 (2)	2.27 (1)		
Trader	33.33 (11)	30.00 (9)	11.48 (7)			Trader	45.83 (11)	59.09 (13)	36.36 (16)		
Other incl.	0.00 (0)	3.33 (1)	1.64 (1)			Other	0.00 (0)	0.00 (0)	18.18 (8)		
Not working	6.06 (2)	13.33 (4)	4.92 (3)			Not working	0.00 (0)	4.55 (1)	13.64 (6)		
ASF IGA	54.84 (17)	15.38 (4)	5.17 (3)	<0.0001		ASF IGA	25.00 (6)	14.29 (3)	18.42 (7)	0.6808	

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n)

( $p < 0.0001$ ). Among semi-rural caregivers, there were no significant differences between the caregivers with respect to the relationship of the caregiver to the index child, household wealth rank and whether or not the caregiver was engaged in an ASF-related IGA. There were significant differences in the major occupation of the caregivers.

**Food Security.** Caregivers' responses to food security questionnaire items are summarized in Tables 7a-7f.

**Winneba:** In both the rural and semi-rural communities there were no significant differences between the caregivers with respect to the two ASF-related food security items (Tables 7a and 7b). At least 54% and 57% of rural and semi-rural caregivers, respectively indicated that they had sometimes or often been unable to have enough ASF in the family meals for their 2-5 year-old child to get some on his/her plate in the last month

**Techiman:** Approximately 30% to 45% of the rural and semi-rural caregivers in Techiman had been often or sometimes unable to include any ASF in the family meals they ate in the last month (Tables 7c and

7d). In the semi-rural communities, 2-5 year-old children of intervention caregivers were more likely to have eaten less meals than usual sometime during the past month compared to the two categories of control caregivers (42.3% vs 11.5% and 30.8%;  $P = 0.0454$ ).

**Navrongo:** In both rural and semi-rural communities there were no significant differences between caregivers with respect to the two ASF-related food security questions (Tables 7e and 7f). At least 78% of caregivers in the Navrongo area communities had sometimes or often been unable to include ASF in their family's meals in the last month.

#### **Food/ASF Expenditures.**

**Winneba:** At least 90% of the rural and semi-rural caregivers had purchased food ingredients for cooking in the week preceding the interview and the majority (at least 92%) had used ASF to prepare meal(s) in the last week (Tables 8a and 8b). There were no significant differences between the caregivers (in both rural and semi-rural communities) in the total amounts of money spent on ASF and the

Table 7a. Household Food/ASF Security: rural communities in Winneba area.

Food security statement	Caregiver classification			
	IP <sup>1</sup> (N=13)	IC (N=13)	CC (N=22)	P-value
<b>IN THE LAST MONTH WE..</b>				
<b>couldn't prepare the kind of foods we will want to eat for good health.</b>				
<i>Often / Sometimes true</i>	84.6 (11) <sup>2</sup>	100.0(13)	77.3( 17)	
<i>Never true</i>	15.4 (2)	0.0(0)	22.7 (5)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.2002
<b>have been worried that our food would run out before we get more</b>				
<i>Often / Sometimes true</i>	92.3 (12)	92.3(12)	81.8(18)	
<i>Never true</i>	7.7 (1)	7.7(1)	18.2(4)	0.6310
<b>have been unable to feed our child the kinds of food they need to be healthy</b>				
<i>Often / Sometimes true</i>	100.0 (13)	92.3 (12)	81.8 (18)	
<i>Never true</i>	0.0 (0)	7.7 (1)	18.2 (4)	0.3559
<i>Refused to answer/ does not know</i>				
<b>have been unable to feed our child enough to satisfy his/her hunger</b>				
<i>Often / Sometimes true</i>	76.9(10)	84.6(11)	45.5(10)	
<i>Never true</i>	23.1(3)	7.7(1)	54.5(12)	
<i>Refused to answer/ does not know</i>	0.0(0)	7.7(1)	0.0(0)	0.0136
<b>have been unable to have enough ASF in the household meals for our old child to get some on his/her plate</b>				
<i>Often / Sometimes true</i>	61.5(8)	76.9(10)	54.6(12)	
<i>Never true</i>	30.8(4)	23.1(3)	45.5(10)	
<i>Refused to answer/ does not know</i>	7.7(1)	0.0(0)	0.0(0)	0.3371
<b>have been unable to have any ASF in the household meals we ate</b>				
<i>Often / Sometimes true</i>	23.1(3)	23.1(3)	50.0(11)	
<i>Never true</i>	76.9(10)	76.9(10)	50.0(11)	0.1459
<i>Refused to answer/ does not know</i>				
<b>IN THE LAST MONTH adults in household reduced or skipped meals</b>	30.8(4)	53.9 (7)	54.6 (12)	0.3496 <sup>3</sup>
<i>Almost every day</i>	0.0 (0)	0.0 (0)	0.0 (0)	
<i>2-3 days a week</i>	0.0(0)	14.3(1)	25(3)	
<i>Once a week or less</i>	75.0(3)	85.7(6)	41.7(5)	
<i>don't know/refused to answer</i>	25(1)	0.0(0)	33.3(4)	0.2992 <sup>4</sup>
<b>IN THE LAST MONTH child sometimes ate less meals than usual</b>	61.5(8)	84.6(11)	50.0(11)	0.1551 <sup>3</sup>
<i>Almost every day</i>	0.0(0)	0.0(0)	9.1(1)	
<i>2-3 days a week</i>	0.0(0)	0.0(0)	36.4(4)	
<i>once a week or less</i>	62.5(5)	90.9(10)	36.4(4)	
<i>don't know/refused to answer</i>	37.5(3)	9.1(1)	18.2(2)	0.0270 <sup>4</sup>

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> P-value is in reference to reducing food or skipping meals; <sup>4</sup> P-value is in reference to those who said 'yes' for the skipped/reduced meals, how often did it happened

Table 7b. Household Food/ASF Security: semi-rural communities in Winneba area.

Food security statement	Caregiver classification			
	IP <sup>1</sup> (N=16)	IC (N=14)	CC (N=30)	P-value
<b>IN THE LAST MONTH WE...</b>				
<b>couldn't prepare the kind of foods we will want to eat for good health.</b>				
<i>Often / Sometimes true</i>	87.5 (14) <sup>2</sup>	78.6 (11)	86.7 (26)	
<i>Never true</i>	12.5 (2)	21.4 (3)	13.3 (4)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.8003
<b>have been worried that our food would run out before we get more</b>				
<i>Often / Sometimes true</i>	87.5(14)	71.4(10)	100.0(30)	
<i>Never true</i>	12.5(2)	28.6(4)	0.0(0)	0.0057
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0(0)	0.0(0)	
<b>have been unable to feed our child the kinds of food they need to be healthy</b>				
<i>Often / Sometimes true</i>	62.5(10)	71.4(10)	90.0(27)	
<i>Never true</i>	31.3(5)	28.6(4)	10.0(3)	
<i>Refused to answer/ does not know</i>	6.3(1)	0.0(0)	0.0(0)	0.0926
<b>have been unable to feed our child enough to satisfy his/her hunger</b>				
<i>Often / Sometimes true</i>	56.3(9)	42.9(6)	80(24)	
<i>Never true</i>	43.8(7)	57.1(8)	16.7(5)	
<i>Refused to answer/ does not know</i>	0.0(0)	0.0(0)	3.3(1)	0.0306
<b>have been unable to have enough ASF in the household meals for our old child to get some on his/her plate</b>				
<i>Often / Sometimes true</i>	62.5(10)	57.1(8)	83.3(25)	
<i>Never true</i>	37.5(6)	42.9(6)	16.7(5)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.1306
<b>have been unable to have any ASF in the household meals we ate</b>				
<i>Often / Sometimes true</i>	37.5(6)	21.4(3)	46.7(14)	
<i>Never true</i>	62.5(10)	78.6(11)	53.3(14)	0.2755
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	
<b>In the last month adults in household reduced or skipped meals</b>	68.8(11)	42.9(6)	83.3(25)	0.0245 <sup>3</sup>
<i>almost every day</i>	9.1(1)	0.0(0)	0.0(0)	
<i>2-3 days a week</i>	0.0(0)	0.0(0)	8.0(2)	
<i>once a week or less</i>	72.7(8)	83.3(5)	64.0(16)	
<i>don't know/refused to answer</i>	18.2(2)	16.7(1)	28.0(7)	0.7407 <sup>4</sup>
<b>In the last month child sometimes ate less meals than usual</b>	56.3(9)	57.1(8)	80.0(24)	0.1481 <sup>3</sup>
<i>almost every day</i>	11.1(1)	0.0(0)	0.0(0)	
<i>2-3 days a week</i>	0.0(0)	0.0(0)	8.3(2)	
<i>once a week or less</i>	77.8(7)	100.0(8)	66.7(16)	
<i>don't know/refused to answer</i>	11.1(1)	0.0(0)	25(6)	0.3105 <sup>4</sup>

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> P-value is in reference to reducing food or skipping meals; <sup>4</sup> P-value is in reference to those who said 'yes' for the skipped/reduced meals, how often did it happened



Table 7c. Household Food/ASF Security: rural communities in Techiman area.

Food security statement	Caregiver classification			
	IP <sup>1</sup> (N=26)	IC (N=26)	CC (N=52)	P-value
<b>IN THE LAST MONTH WE...</b>				
<b>couldn't prepare the kind of foods we will want to eat for good health.</b>				
<i>Often / Sometimes true</i>	53.9(14) <sup>2</sup>	61.5(16)	51.9(27)	
<i>Never true</i>	46.2(12)	38.5(10)	48.1(25)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.7597
<b>have been worried that our food would run out before we get more</b>				
<i>Often / Sometimes true</i>	56.7(15)	42.3(11)	46.2(24)	
<i>Never true</i>	42.3(11)	57.7(15)	53.9(28)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.4999
<b>have been unable to feed our child the kinds of food they need to be healthy</b>				
<i>Often / Sometimes true</i>	69.2(8)	65.4(17)	53.9(28)	
<i>Never true</i>	30.8(8)	34.6(9)	46.2(24)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.3582
<b>have been unable to feed our child enough to satisfy his/her hunger</b>				
<i>Often / Sometimes true</i>	26.9(7)	46.2(12)	32.7(17)	
<i>Never true</i>	73.1(19)	50.0(13)	67.3(35)	
<i>Refused to answer/ does not know</i>	0.0(0)	3.9(1)	0.0(0)	0.2046
<b>have been unable to have enough ASF in the household meals for our old child to get some on his/her plate</b>				
<i>Often / Sometimes true</i>	50.0(13)	61.54(16)	61.5(32)	
<i>Never true</i>	50.0(13)	38.5(10)	38.5(20)	0.5855
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	
<b>have been unable to have any ASF in the household meals we ate</b>				
<i>Often / Sometimes true</i>	38.5 (10)	46.1 (12)	36.5 (19)	
<i>Never true</i>	61.5 (16)	53.9 (14)	63.5 (33)	0.7102
<i>Refused to answer/ does not know</i>	0.0(0)	0.0(0)	0.0 (0)	
<b>In the last month adults in household reduced or skipped meals</b>	42.3(11)	50.0(13)	53.9(28)	0.6303 <sup>3</sup>
<i>almost every day</i>	0.0(0)	7.7(1)	7.1(2)	
<i>2-3 days a week</i>	18.2(2)	7.7(1)	10.7(3)	
<i>once a week or less</i>	45.5(5)	53.9(7)	46.4(13)	
<i>don't know/refused to answer</i>	36.4(4)	30.7(4)	35.7(10)	0.9927 <sup>4</sup>
<b>In the last month child sometimes ate less meals than usual</b>	19.2(5)	26.9(7)	38.5(20)	0.1969 <sup>3</sup>
<i>almost every day</i>	0.0(0)	0.0(0)	10.0(2)	
<i>2-3 days a week</i>	20.0(1)	14.3(1)	15.0(3)	
<i>once a week or less</i>	20.0(1)	42.9(3)	30.0(6)	
<i>don't know/refused to answer</i>	60.0(3)	42.9(3)	45.0(9)	0.9894 <sup>4</sup>

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> P-value is in reference to reducing food or skipping meals; <sup>4</sup> P-value is in reference to those who said 'yes' for the skipped/reduced meals, how often did it happened



Table 7d. Household Food/ASF Security: rural communities in Techiman area.

Food security statement	Caregiver classification			
	IP <sup>1</sup> (N=26)	IC (N=26)	CC (N=52)	P-value
<b>IN THE LAST MONTH WE...</b>				
<b>couldn't prepare the kind of foods we will want to eat for good health.</b>				
<i>Often / Sometimes true</i>	65.4 (17)	61.5 (16)	46.2 (24)	
<i>Never true</i>	34.6 (9)	34.6 (9)	51.92 (27)	
<i>Refused to answer/ does not know</i>	0.0 (0) <sup>2</sup>	3.9 (1)	1.9 (1)	0.3238
<b>have been worried that our food would run out before we get more</b>				
<i>Often / Sometimes true</i>	61.5 (16)	38.5 (10)	65.4 (34)	
<i>Never true</i>	38.5 (10)	61.5 (16)	34.6(18)	0.0686
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	
<b>have been unable to feed our child the kinds of food they need to be healthy</b>				
<i>Often / Sometimes true</i>	53.9 (14)	50.0(13)	63.5(33)	
<i>Never true</i>	46.2(12)	50.0(13)	34.6(18)	
<i>Refused to answer/ does not know</i>	0.0(0)	0.0(0)	1.9(1)	0.6412
<b>have been unable to feed our child enough to satisfy his/her hunger</b>				
<i>Often / Sometimes true</i>	26.9 (7)	19.2 (5)	38.5 (20)	
<i>Never true</i>	73.1 (19)	80.8 (21)	61.5 (32)	0.1969
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	
<b>have been unable to have enough ASF in the household meals for our old child to get some on his/her plate</b>				
<i>Often / Sometimes true</i>	56.0 (14)	46.2 (12)	53.9 (28)	
<i>Never true</i>	44.0 (11)	53.9 (14)	46.2 (24)	0.7482
<i>Refused to answer/ does not know</i>				
<b>have been unable to have any ASF in the household meals we ate</b>	30.8 (8)	38.5 (10)	42.3 (22)	
<i>Often / Sometimes true</i>	69.2 (18)	61.5 (16)	55.8 (29)	
<i>Never true</i>	0.0 (0)	0.0 (0)	1.9 (1)	0.7922
<i>Refused to answer/ does not know</i>	53.9 (14)	19.2 (5)	51.9 (27)	0.01223
<b>In the last month adults in household reduced or skipped meals</b>	7.1(1)	0.0(0)	0.0(0)	
<i>almost every day</i>	0.0 (0)	20.0 (1)	11.1(3)	
<i>2-3 days a week</i>	50.0 (7)	80.0(4)	62.9 (17)	
<i>once a week or less</i>	42.9 (6)	0.0(0)	25.9 (7)	0.20894
<i>don't know/refused to answer</i>	42.3 (11)	11.5 (3)	30.8 (16)	0.04543
<b>In the last month child sometimes ate less meals than usual</b>	9.1 (1)	0.0 (0)	0.0 (0)	
<i>almost every day</i>	18.2 (2)	33.3(1)	0.0 (0)	
<i>2-3 days a week</i>	45.4 (5)	66.7(2)	81.2 (13)	
<i>once a week or less</i>	27.3 (3)	0.0 (0)	18.8 (3)	0.14834
<i>don't know/refused to answer</i>	16.7(3)	42.9(6)	16.7(7)	0.11604

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> P-value is in reference to reducing food or skipping meals; <sup>4</sup> P-value is in reference to those who said 'yes' for the skipped/reduced meals, how often did it happened



Table 7e. Household Food/ASF Security: rural communities in Navrongo area.

Food security statement	Caregiver classification			
	IP <sup>1</sup> (N=33)	IC (N=30)	CC (N=61)	P-value
<b>IN THE LAST MONTH WE...</b>				
<b>couldn't prepare the kind of foods we will want to eat for good health.</b>				
<i>Often / Sometimes true</i>	84.9(28) 2	90.0(27)	98.4(60)	
<i>Never true</i>	15.2(5)	10.0(3)	1.6(1)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.0224
<b>have been worried that our food would run out before we get more</b>				
<i>Often / Sometimes true</i>	90.9 (30)	100.0 (30)	96.7 (59)	
<i>Never true</i>	9.1 (3)	0.0 (0)	3.3 (2)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.2341
<b>have been unable to feed our child the kinds of food they need to be healthy</b>				
<i>Often / Sometimes true</i>	84.9 (28)	96.7 (29)	98.4 (60)	
<i>Never true</i>	12.1(4)	3.3 (1)	1.6 (1)	
<i>Refused to answer/ does not know</i>	3.0 (1)	0.0 (0)	0.0 (0)	0.0511
<b>have been unable to feed our child enough to satisfy his/her hunger</b>				
<i>Often / Sometimes true</i>	93.9(31)	83.3(25)	88.5(54)	
<i>Never true</i>	6.1(2)	16.7(5)	11.5(7)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.3991
<b>have been unable to have enough ASF in the household meals for our old child to get some on his/her plate</b>				
<i>Often / Sometimes true</i>	93.9(31)	93.3(28)	95.1(58)	
<i>Never true</i>	6.1(2)	3.3(1)	4.9(3)	0.7104
<i>Refused to answer/ does not know</i>	0.0(0)	3.3(1)	0.0(0)	
<b>have been unable to have any ASF in the household meals we ate</b>				
<i>Often / Sometimes true</i>	87.9 (29)	90.0 (27)	78.7 (48)	
<i>Never true</i>	12.1 (4)	10.0 (3)	19.7 (12)	
<i>Refused to answer/ does not know</i>	0 (0)	0 (0)	1.6 (1)	0.6386
<b>In the last month adults in household reduced or skipped meals</b>	69.7(23)	66.7(20)	78.7(48)	0.4062 <sup>3</sup>
<i>almost every day</i>	4.4(1)	10.0(2)	2.1()	
<i>2-3 days a week</i>	4.4(1)	0.0(0)	6.25(3)	
<i>once a week or less</i>	65.2(15)	25.0(5)	62.5(30)	
<i>don't know/refused to answer</i>	26.1(6)	65.0(13)	29.2(14)	0.0191 <sup>4</sup>
<b>In the last month child sometimes ate less meals than usual</b>	54.5(18)	46.7(14)	68.9(42)	0.1000 <sup>3</sup>
<i>almost every day</i>	5.6(1)	14.3(2)	2.4(1)	
<i>2-3 days a week</i>	0.0(0)	0.0(0)	4.8(2)	
<i>once a week or less</i>	77.8(14)	42.9(6)	76.2(32)	
<i>don't know/refused to answer</i>	16.7(3)	42.9(6)	16.7(7)	0.1160 <sup>4</sup>

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> P-value is in reference to reducing food or skipping meals; <sup>4</sup> P-value is in reference to those who said 'yes' for the skipped/reduced meals, how often did it happened



Table 7f. Household Food/ASF Security: semi-rural communities in Navrongo area.

Food security statement	Caregiver classification			
	IP <sup>1</sup> (N=24)	IC (N=22)	CC (N=44)	P-value
<b>IN THE LAST MONTH WE...</b>				
<b>couldn't prepare the kind of foods we will want to eat for good health.</b>				
<i>Often / Sometimes true</i>	91.7 (22) 2	81.8 (18)	100.0 (44)	
<i>Never true</i>	8.3 (2)	18.2 (4)	0.0 (0)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.0110
<b>have been worried that our food would run out before we get more</b>				
<i>Often / Sometimes true</i>	100.0 (24)	95.5 (21)	100.0 (44)	
<i>Never true</i>	0.0 (0)	4.5 (1)	0.0 (0)	
<i>Refused to answer/ does not know</i>	0 (0)	0 (0)	0 (0)	0.2444
<b>have been unable to feed our child the kinds of food they need to be healthy</b>				
<i>Often / Sometimes true</i>	95.8 (23)	86.4 (19)	95.5 (42)	
<i>Never true</i>	4.2 (1)	13.6 (3)	4.5 (2)	
<i>Refused to answer/ does not know</i>	0 (0)	0 (0)	0 (0)	0.4131
<b>have been unable to feed our child enough to satisfy his/her hunger</b>				
<i>Often / Sometimes true</i>	91.6 (22)	86.4 (19)	93.2 (41)	
<i>Never true</i>	8.3 (2)	13.6 (3)	4.6 (2)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0 (0)	2.2 (1)	0.5901
<b>have been unable to have enough ASF in the household meals for our old child to get some on his/her plate</b>				
<i>Often / Sometimes true</i>	95.8(23)	95.5(21)	97.7(43)	
<i>Never true</i>	4.2(1)	0.0(0)	2.3(1)	
<i>Refused to answer/ does not know</i>	0.0(0)	0.0(0)	0 (0)	0.5714
<b>have been unable to have any ASF in the household meals we ate</b>				
<i>Often / Sometimes true</i>	91.7(22)	81.8(18)	84.1(37)	
<i>Never true</i>	8.3(2)	18.2(4)	15.9(7)	
<i>Refused to answer/ does not know</i>	0.0 (0)	0.0 (0)	0.0 (0)	0.6344
<b>In the last month adults in household reduced or skipped meals</b>	58.3 (14)	63.6 (14)	81.8 (36)	0.08373
<i>almost every day</i>	7.1 (1)	0 (0)	11.1 (4)	
<i>2-3 days a week</i>	0.0(0)	7.1(1)	2.8(1)	
<i>once a week or less</i>	42.9(6)	50.0(7)	52.8(19)	
<i>don't know/refused to answer</i>	50.0(7)	42.9(6)	33.3(12)	0.74104
<b>In the last month child sometimes ate less meals than usual</b>	41.7(10)	50.0(11)	61.4(27)	0.27933
<i>almost every day</i>	10.0(1)	9.1(1)	7.4(2)	
<i>2-3 days a week</i>	10.0(1)	0.0(0)	7.4(2)	
<i>once a week or less</i>	50.0(5)	72.7(8)	51.9(14)	
<i>don't know/refused to answer</i>	30.0(3)	18.2(2)	33.3(9)	0.6774

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> P-value is in reference to reducing food or skipping meals; <sup>4</sup> P-value is in reference to those who said 'yes' for the skipped/reduced meals, how often did it happened



Table 8a. Caregivers' food/ASF expenditures in the last week: rural community in Winneba.

Variable	Community classification			
	IP <sup>1</sup> (N=13)	IC (N=13)	CC (N=22)	P-value
Purchased ingredients for cooking	100 (13) <sup>2</sup>	100 (13)	90.9 (20)	0.1238
Used ASF to cook	100 (13)	100 (13)	95.0 (19)	0.3089
<b>SOURCE OF ASF USED</b>				0.6278
Purchased	76.9 (10)	76.9 (10)	78.9 (15)	
Home produced	15.4 (2)	23.1 (3)	10.5 (2)	
Gift	7.69 (1)	0.00 (0)	0.00 (0)	
Other	0.00 (0)	0.00 (0)	10.5 (2)	
<b>Total food expenditures (Ghanaian ₵)</b>	37778 ±264713	30000 ±13123	40667 ±16373	0.4204
<b>ASF expenditures (Ghanaian ₵)</b>	15667 ±12062	13200 ±7466	19167 ±9350	0.3622
<b>% expenditures on ASF</b>	40 ± 13	44 ± 15	47 ± 15	0.5456

Table 8b. Caregivers' food/ASF expenditures in the last week: semi-rural communities in Winneba.

Variable	Community classification			
	IP <sup>1</sup> (N=13)	IC (N=13)	CC (N=22)	P-value
Purchased ingredients for cooking	93.3 (14) 2	100 (15)	90.0 (27)	0.5571
Used ASF to cook	92.7 (13)	100.00 (15)	100.00 (27)	0.1346
<b>SOURCE OF ASF USED</b>				0.5810
Purchased	92.3 (12)	93.3 (14)	96.3 (26)	
Home produced	7.69 (1)	6.67 (1)	3.70 (1)	
Gift				
Other				
<b>Total food expenditures (Ghanaian ₵)</b>	34417 ±272613	33667 ± 17696	27880 ± 28127	0.7052
<b>ASF expenditures (Ghanaian ₵)</b>	15417 ±12258	10750 ±4827	10480 ±10847	0.3613
<b>% expenditures on ASF</b>	44 ± 12	34 ± 10	38 ± 17	0.2480

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup>% (n); <sup>3</sup>mean ± standard deviation

proportion of total food expenditures that was allocated to ASF in the past week. Among rural caregivers, nearly 80% of ASF used for cooking in the past week was purchased; among semi-rural caregivers more than 90% of ASF used in the past week for preparing home meals was purchased.

**Techiman:** Caregivers in both rural and semi-rural communities had similar food expenditure patterns (Tables 8c and 8d). However, in the semi-rural CC communities the percentage of total food expenditures that was used for ASF tended to be lower than that for the other two categories of caregivers (32.83 ± 16.99 vs. 43.08 ± 22.25 and

44.71 ± 17.52; P=0.052).

**Navrongo:** In the rural communities, caregivers in the control community were less likely to have used ASF in meals they cooked for the family in the last week; these control caregivers also spent less money than the intervention caregivers on ASF (Tables 8e and 8f). Approximately 36% of ASF used by intervention caregivers was home produced compared to less than 16% for the control caregivers. Among the semi-rural caregivers, the CC caregivers tended to have used a greater proportion of their total food expenditures for ASF.

Table 8c. Caregivers' food/ASF expenditures in the last week: rural community in Techiman.

Variable	Community classification			
	IP <sup>1</sup> (N=26)	IC (N=26)	CC (N=52)	P-value
Purchased ingredients for cooking	88.5 (23) <sup>2</sup>	92.3 (24)	96.2 (50)	0.1964
Used ASF to cook	95.65 (22)	95.83 (23)	98.00 (49)	0.5532
<b>SOURCE OF ASF USED</b>				0.3849
Purchased	100.00 (22)	100.00 (23)	97.96 (48)	
Home produced	0.00 (0)	0.00 (0)	2.04 (1)	
Gift				
Other				
<b>Total food expenditures (Ghanaian ₵)</b>	38895 ±45006 <sup>3</sup>	34773 ±61358	27000 ±31998	0.5757
<b>ASF expenditures (Ghanaian ₵)</b>	16000 ±30328	9318 ±6658	9233 ±10668	0.3022
<b>% expenditures on ASF</b>	43 ± 21	47 ± 20	41 ± 20	0.4556

Table 8d. Caregivers' food/ASF expenditures in the last week: semi-rural communities in Techiman.

Variable	Community classification			
	IP <sup>1</sup> (N=26)	IC (N=26)	CC (N=52)	P-value
Purchased ingredients for cooking	100 (26) <sup>2</sup>	96.2 (25)	92.3 (48)	0.1002
Used ASF to cook	100 (26)	100 (25)	100 (48)	
<b>SOURCE OF ASF USED</b>				0.2183
Purchased	88.46 (23)	92.00 (23)	97.92 (47)	
Home produced	11.54 (3)	4.00 (1)	2.08 (1)	
Gift				
Other	0 (0)	4.0 (1)	0 (0)	
<b>Total food expenditures (Ghanaian ₵)</b>	33722 ±24046 <sup>3</sup>	30905 ±15192	33447 ±85101	0.9873
<b>ASF expenditures (Ghanaian ₵)</b>	12944 ±10143	8952 ±5652	9413 ±9609	0.3004
<b>% expenditures on ASF</b>	43 ±22ab	33 ± 17a	45 ±18b	0.0520

Table 8e. Caregivers' food/ASF expenditures in the last week: rural community in Navrongo.

Variable	Community classification			
	IP <sup>1</sup> (N=33)	IC (N=30)	CC (N=61)	P-value
Purchased ingredients for cooking	100.00 (33) <sup>2</sup>	100.00 (30)	96.2 (59)	0.1950
Used ASF to cook	100.00 (33)	96.67 (29)	89.83 (53)	0.0379
<b>SOURCE OF ASF USED</b>				0.0088
Purchased	60.61 (20)	89.66 (26)	84.91 (45)	
Home produced	36.36 (12)	10.34 (3)	15.09 (8)	
Gift	3.03 (1)	0.00 (0)	0.00 (0)	
Other				
<b>Total food expenditures (Ghanaian ₵)</b>	20211 ±11272 <sup>3</sup>	18120 ±12098	17872 ±12042	0.7589
<b>ASF expenditures (Ghanaian ₵)</b>	7579 ±4260a	5480 ±4529ab	4731 ±3570b	0.0461
<b>% expenditures on ASF</b>	39 ± 14	31 ± 13	32 ±11	0.1925

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup> % (n); <sup>3</sup> mean ± standard deviation



### Activity Three: Training

**Problem Statement and Approach.** The problem model for constraints to ASF in children's diets in Ghana being used by the ENAM project underscores the need for integrated and multidisciplinary approaches to effectively address the issues and hence the need for professionals with training in these approaches. Therefore, providing graduate students with research opportunities to address ASF-related issues within a multidisciplinary framework was an important capacity building objective of the project.

**Planned activities:** Continued support for the Ugandan master's student. Identify University of Ghana master's students in Agriculture or Nutrition to support in their thesis research work.

**Importance:** The student research activities in Uganda provides an opportunity to test the problem model for constraints to ASF in children's diets in Ghana in another African country and assess the potential utility of the model as a framework for addressing ASF-related issues in the Africa region. It also is a mechanism to establish links between institutions in Ghana and Uganda. The involvement of students (Ugandan and Ghanaian) in the project's integrated research activities and the provision of opportunities to interact with the multidisciplinary teams are important to their

professional development and capacity to effectively identify and address nutrition and agriculture issues in communities.

**Plans to accomplish activity:** It was planned that the Ugandan student supported by the project would complete his coursework, write a proposal for his master's thesis research to assess constraints to ASF in children's diets in Uganda, and return to Uganda to initiate his research activities in communities where the Sustainable Rural Livelihoods program (collaboration between Iowa State University, Makerere University, and the agriculture-based NGO, VEDCO) is active. In addition, the project planned to support University of Ghana (at Legon) agriculture and nutrition master's-level students interested in conducting field research on ASF-related topics in the ENAM project communities for their thesis research. The project would provide support (through student advising, financial and logistical support research and a small stipend) for the students to develop proposals and complete their field data collection.

**Progress.** Activities related to the Ugandan student were completed as scheduled. Field research of Ghanaian students from the Department of Nutrition and Food Science was supported over this past year through project funds.

**Planned outputs and completion of tasks:**

Table 8f. Caregivers' food/ASF expenditures in the last week: semi-rural communities in Navrongo.

Variable	Community classification			
	IP <sup>1</sup> (N=33)	IC (N=30)	CC (N=61)	P-value
Purchased ingredients for cooking	100.00 (24) <sup>2</sup>	100.00 (22)	100.00 (44)	
Used ASF to cook	100.00 (24)	90.91 (20)	86.36 (38)	0.0642
<b>SOURCE OF ASF USED</b>				0.9433
Purchased	83.33 (20)	85.00 (17)	86.84 (33)	
Home produced	16.67 (4)	15.00 (3)	10.53 (4)	
Gift	0.00 (0)	0.00 (0)	2.63 (1)	
Other				
<b>Total food expenditures (Ghanaian ₵)</b>	27938 ± 195843,ab	33750 ± 17748a	19219 ± 11828b	0.0097
<b>ASF expenditures (Ghanaian ₵)</b>	6250 ± 3606	6750 ± 2769	6210 ± 4115	0.8853
<b>% expenditures on ASF</b>	28 ± 16	24 ± 13	33 ± 11	0.0706

<sup>1</sup>IP=intervention caregiver receiving ENAM loan; IC=control caregiver in intervention community; CC=control caregiver in control community; <sup>2</sup>% (n); <sup>3</sup>mean ± standard deviation

1. *Completion of proposal and initiation of field data collection by Ugandan student:* The Ugandan student, Samuel Oluka, successfully completed coursework towards the Master of Philosophy degree in Nutrition. The student received guidance from ENAM project team members (Lartey, Sakyi-Dawson, Marquis, Colecraft) to develop a proposal to explore constraints to animal source foods in children's diets in a rural community in Uganda. He returned to Uganda in June 2006 to initiate activities for data collection for his thesis work. In September, Marquis, Sakyi-Dawson and Colecraft traveled to Uganda to assess the student's progress in the field data collection, provide needed guidance, and also establish links with Makerere University, VEDCO, and the Sustainable Rural Livelihoods (SRL) program.

2. *Advertising for students:* Letters were sent to the department heads of the Ghana team members requesting for students to be attached to the project for their thesis research.

3. *Completion of proposal write-up and field data collection by a Ghanaian student:* Gladys Adjei received guidance from ENAM project team members (Lartey, Marquis, Sakyi-Dawson, Colecraft) to successfully develop and defend their research proposals. The two proposals were entitled *Contribution of animal source foods to the total dietary intake of children in the Winneba area (Gladys Adjei)*. Gladys has completed her field data collection and is in the process of analyzing her data and writing up the results.

4. *Presentation of results.* An abstract on Gladys Adjei's master's thesis work was submitted to Experimental Biology. The work will be presented by Dr. Colecraft at the April meetings.

#### **Jim Ellis Mentorship Award**

**Problem Statement and Approach.** Research questions were developed that were not within the immediate scope and budget of the original project. The Jim Ellis Fellowship provided an opportunity to expand the project with graduate student research.

**Planned activities:** Support for the field research of two master's students working with the ENAM project – one in Uganda and one in Techiman.

**Importance:** As mentioned above, conducting

similar research in Uganda provides an opportunity to test the problem model in another setting. The second research question, focused on whether the IGA is associated with ASF or not, will help guide future interventions.

**Plans to accomplish the activity:** It was planned that one Ugandan and one Ghanaian student would apply for the Jim Ellis fellowship, and if awarded would conduct original research that informed the project.

**Progress.** Both of the master's students (Oluka and Christian) submitted a Jim Ellis Fellowship proposal and were awarded the fellowship. Christian has completed his field work and Oluka will be finished in December. Christian has submitted an abstract of his study results to the Experimental Biology meetings and will be presenting there in April 2006.

#### **Activity 4. Curriculum (Nutrition Extension) Development**

**Problem Statement and Approach.** There is a lack of systematic training of professionals in extension principles as they related to nutrition practice and little integration of the agriculture and nutrition disciplines. Given the multifaceted nature of nutrition problems and the need for integrated approaches to effectively identify and address these problems, there is a need for the development of academic curricula to train future practitioners in integrated approaches.

**Planned activities:** Develop an undergraduate course as well as continuing education training for current practitioners.

**Importance:** The current nutrition curriculum offered through the Department of Nutrition and Food Science at the University of Ghana can be enhanced through qualitative and interdisciplinary methodological perspectives that offer wider understanding of the role that the Nutrition plays in contributing to sustainable livelihoods. The development of a nutrition extension curriculum for the University of Ghana will expand opportunities within the sub-Saharan African region for training in applied community-based nutrition, public health

and agriculture. It is anticipated that the program will enhance research and outreach capabilities to address ASF and other agriculture, nutrition, and health issues in the region.

**Plans to accomplish activity:** It was planned that the program manager would take the leadership for this activity. Consultations and deliberations were to be held with Dr. Rafael Perez-Escamilla (University of Connecticut, Storrs), the project team members and other stakeholders from governmental and nongovernmental institutions to obtain input into the development of the curriculum. Course materials were to be identified through internet searches and interactions with stakeholders. Finally, it was planned that the developed curriculum would be submitted to the appropriate University of Ghana academic board for approval.

### **Progress.**

#### **Planned outputs and completion of tasks:**

1. *Consultations with Dr. Perez-Escamilla:* The team interacted with Dr. Perez-Escamilla during his visit to Ghana Oct-Nov 2005. He shared his experiences in nutrition extension during a seminar that was attended by students, agriculture, nutrition and food science lecturer and representatives from the Ghana Health Services and Women in Agricultural Development. Deliberations with the project team members (all Ghana-based, and two US-based) yielded the following outcomes:

- The need to form linkages between academia and governmental and non-governmental organizations as well as industry for effective delivery of nutrition outreach services.
- The need for funding to sustain the extension delivery program.
- The use of trained paraprofessionals in the delivery outreach nutrition services
- Several issues were raised as to the practicality for the University of Ghana of the nutrition extension model presented by Dr. Perez-Escamilla. Some of the pertinent issues were:
- The university currently does not have the infrastructure to adopt the model. Specifically, the kind of network linkages with government and non-government organizations and industry are not present. The university currently plays

no role in actual delivery of nutrition services to communities and there is no formal link with organizations and institutions outside the university to translate research undertaken at the university to nutrition intervention programs.

- While it may be possible to pursue the extension model presented, it would be a lengthy process beyond the scope and time frame of the ENAM project.
- A compromise to attaining the ideal of developing a nutrition extension program was to incorporate extension principles in the existing nutrition curricula taught at the Department of Nutrition and Food Science to develop future professionals in the area of nutrition extension.

2. *Interactions with, academic, governmental and non-governmental stakeholders:* A 2-day work group meeting was convened with stakeholders from academic institutions and practitioners from nutrition-, health- and agriculture-based governmental and non governmental agencies to discuss the need for the course and course content. Institutions included: Ghana Health Services, Ministry of Food and Agricultural, University of Ghana, Plan Ghana, World Vision International, Rural Health Training School, Adventist Relief Agency, Christian Rural Aid Network, and Freedom from Hunger. The information from the work-group meeting was synthesized to inform the development of a course outline comprising objectives for the course, credits, topics to be covered, means of evaluation, and teaching materials.

3. *Submission of course description and supporting materials for approval:* Proposal for the course, outline of topics and supporting materials were completed and submitted to the University of Ghana, Faculty of Science academic board. Approval of the course has been obtained. The course will be offered in September 2007.

### **GENDER**

This section addresses the following two questions asked by USAID:

- 1) How will gender relations affect the achievement of sustainable results?

2) How will the proposed results affect the relative status of men and women?

**Research and development activities.** The primary objective of the ENAM project is to improve the nutritional status of young children in sub-Saharan Africa. In Ghana, agriculture production, food preparation and child care, including child feeding, are gender defined. Typically, men provide the starch base of the meal (e.g., corn, millet, sorghum, cassava, yam), and women are responsible for the ingredients that are used in the accompanying sauce/stew (e.g., tomatoes, onions, okra, eggplant) – including any ASF that is used. Women own small animals; however, their ability to slaughter for home consumption or sell the animal for cash may be limited by the need for approval of male adult family members. Our results to date demonstrate that most ASF that is consumed in the home is purchased, not raised. Thus, increasing income of which women maintain control may provide an opportunity for them to purchase ASF and improve the family diet.

Women are the primary child caregivers; however, actual practices may differ from the stereotypes. The ENAM project is carried out among communities with different religions and tribal affiliations. The social-cultural influences have to be evaluated in each region/community to determine how specific gender issues limit or enhance the intervention approaches and the long-term success of the program. This project, with a focus on child well-being, relies heavily on women. The ability of those women to respond and participate depends in part on their own cultural environment. The project has been transparent about its activities to the entire community, and many activities have benefited men and women alike (e.g., training on fish smokers and poultry raising) to increase the acceptance of women's participation. In addition, all participants obtained the approval of their family before receiving a loan.

The project goal will be accomplished through targeted income-generation and skill building activities to caregivers of children 2-5 years of age and their households, as well as interactions with the entire community to sensitize it to the problems, consequences, and solutions for child malnutrition.

Sensitization activities for the entire community help to improve the acceptability of the targeted activities and increase the likelihood that there is social support for the caregivers to engage and sustain the new IGA and child care practices. The interventions work to improve knowledge and skills to enhance access to ASF through income-generation activities and processing and storage technologies for ASF. By strengthening caregivers' economic capabilities and removing their knowledge and skill barriers, the project empowers caregivers to adequately address the nutritional needs of themselves as well as their children.

It is not our intention to change a woman's traditional role in providing food or alter the division of labor in the household but work to increase the level and success of women's participation in economic endeavors, increase their control of their own ASF-related resources, and improve their access to health, agriculture, and other information relevant for their child's health. The research examines the empowerment of women in relationship to food access and child feeding.

**Training activities.** The project provides training through workshops, coursework, and research opportunities for students at the university. The training is for both men and women; a special emphasis is placed on encouraging women who are training in agriculture-related areas to increase the number of women in the field, however we were not successful this past year in identifying such students. Only female and male nutrition students were supported. The program manager position provides Dr. Esi Colecraft, a Ghanaian, an opportunity to work closely with faculty at ISU and the University of Ghana, and establish herself as a young researcher in Ghana. She has been approved as an adjunct faculty member at the University of Ghana and taught one course in the nutrition department during the past semester, and is teaching one class again this semester. Two of the three regional field coordinators are female; all three coordinators have excellent rapport with the caregivers and provide an excellent role model for community residents. Finally, the initiation of the nutrition extension curriculum is expected to help many female students

in the future by opening additional employment opportunities for them.

The research questions that have been described above will be documented through data collection at baseline and at regular time intervals. All data collected at the individual level will account for gender and age as well as other demographic characteristics, such as work activities, educational experience, marital status, parity for adult women, among others. Similar characteristics will be collected for group activities --for example, we will document the age, sex, and other relevant characteristics of those attending training sessions, community-based or formal school educational activities, and other group activities. Individuals may play many different roles within a household or a community, and these roles may change over time or season. Qualitative data will also be collected on participants' perceptions of their roles and how they view any changes with intervention participation.

### POLICY

Interacting with policy makers has been our strategy throughout this grant. Our planning grant included interviews with policy makers at the national, regional, and local levels to elicit their opinions about barriers to ASF and feasible interventions. Our workshops in February 2004 (develop the program model), June 2005 (identify interventions), and July 2006 (identify nutrition extension curricula needs) have included government and non-governmental administrators working in the field of agriculture and health, including representatives of the Ministries of Women and Children's Affairs, Food and Agriculture, and the Ghana Health Services. The Ghana staff has visited with the directors' offices of the Ministry of Agriculture and Food and Ministry of Health/Ghana Health Services to update the individuals on the project. Many of these leaders have participated in public presentations of the project – for example at the recent African Nutritional Epidemiology Conference in August 2006. There is a particular interest from the Women in Agriculture Development and the Ghana Health Services staff to see the ENAM project move forward with a nutrition curriculum

that could be used for continuing education for their field staff. The course that has been approved for University of Ghana is the first step in developing such a curriculum.

The project has plans to produce a twice yearly one-page fact sheet. Although we are behind schedule in this particular activity, we intend to produce the informational sheet for dissemination to governmental and non-governmental institutions and organizations working in related fields. We had planned to have representatives of key institutions serve in the role of an advisory committee. However, two of our Ghanaian researchers have had less than satisfactory experiences with advisory boards recently and the group decision was to consult with experts from a variety of organizations for every major activity that is initiated (which has been done as demonstrated in the paragraph above). Finally, different members of the team have visited US-AID whenever it has been possible to meet with them.

### OUTREACH

The project is focused on working with community-based women's groups in three regions of Ghana: Central, Brong-Ahafo, and Upper East. These represent the three main agro-ecological zones of Ghana. All project activities are participatory. Community residents have been involved from the Planning Grant stage to identify the problems and intervention approaches that should be used. Residents have been full partners in the formation of their groups, the selection of activities in which they participate, and the rules that their group follows. Training opportunities take place in the community and include those for all residents as well as those for the participating women's groups. The government extension staff has been kept informed of the project and collaborations occur as is possible.

As one activity of this project, Dr. Colecraft is developing a nutrition extension course that will be the first of a curriculum for an academic program that would span nutrition and agriculture. There is interest in also developing a certificate/ diploma program that would serve the needs of extension agents who require continuing education opportunities. These would be offered through the

University of Ghana and the certificate/diploma program has been informally requested by the Women in Agriculture Development Office of the Ministry of Food and Agriculture and the Ghana Health Services. Dr. Colecraft has been appointed as a Part-time Lecturer in the Department of Nutrition and Food Science at the University of Ghana for the academic year 2005/06 to facilitate this goal.

### DEVELOPMENTAL IMPACT

**Environmental impact and relevance.** The project activities will contribute to improved use of ASF, due to improved harvesting / husbandry, handling, processing and marketing of ASF in the study communities and beyond. This implies that the water bodies, forest and the grasslands from which the ASF are directly or indirectly produced or obtained will be more efficiently utilized, thereby result in positive environmental impact.

**Agricultural sustainability.** The activities targeted by the project encourage the production, distribution and utilization of the livestock and other agriculture products in a sustainable fashion. The production generates by-products which can be used for composting / manure for soil fertility management. Improving soil management will improve production of all agricultural products.

**Biotechnology.** Ghana has embraced biotechnology in many areas; the wide spread promotion and production of high lysine (local hybrid) corn is one example. Fermentation is a food processing technique that is also common throughout Ghana and offers a mechanism for mothers to provide safe food for their young children. This project examines all processing methods that will promote better nutrition for children.

**Contributions to U.S. agriculture.** This project has no direct effect on US agriculture. However, it has provided international training for undergraduate students to learn about the West African culture, habits, and agricultural practices. Knowledge gained through these experiences with the ENAM project will benefit future professional development that may benefit the US.

This project's objectives focus on the reduction of poverty through household income generation

activities. This is consistent with US government priorities to reduce hunger and poverty in Africa. Furthermore, collaboration between US-based scientists and partners in the sub-Saharan Africa region will broaden the scope of US disciplines and research, encouraging greater responsiveness to international issues and enriching coursework at Iowa State University.

**Contributions to host country.** The primary objective of the ENAM project is to improve the nutritional well-being of vulnerable children in sub-Saharan Africa and to build a healthy and productive population base for future development. Over half of childhood mortality can be attributed to malnutrition. Improved diets of the young population will contribute to the future society.

The development of an integrated curriculum that addresses agriculture, nutrition, economic, social, and community issues is on-going. With increased collaborations across the continent, the curriculum developed at the University of Ghana may be able to influence Makerere University's curricula. This curriculum will facilitate continued problem assessment and identification of promising interventions, thereby adapting university research to the real needs of vulnerable groups. The highly interactive nature of the project fosters continued dialogue and information sharing with communities and organizations. This ultimately will generate recommendations and policy initiatives leading to more integrated regional interventions in health and agriculture. The training of Ghanaian and Ugandan graduate students will have a long-term effect through their influence as young professionals.

**Linkages and networking.** The project's activities in Ghana, Uganda, and the US integrate disciplines and develop local and regional networks to reduce poverty and promote children's well-being. The resource-poor, sub-Saharan Africa region will benefit through the sharing of resources and expertise in mutually beneficial ways. Uganda has few trained nutritionists and a graduate program that is just starting this year. The country will benefit from the training that the well-established nutrition program at University of Ghana is providing for one of their talented Makerere University students. Ghana is benefiting from the enrichment of their graduate

student population with a talented Ugandan. The Ghana staff are working on furthering the collaborations with district-level government agencies to combine nutrition (and other) education resources in the area.

**Collaboration with international research centers (IARCS) and other CRSPs.** The ENAM project is not presently collaborating with the IARCS. We have had some collaboration with one scientist from the Bean and Cowpea CRSP (Dr. Esther Sakyi-Dawson, University of Ghana) who has completed a small preliminary study to look at the feasibility of drying meat for children's diets. Drs. Marquis, Sakyi-Dawson, and Colecraft meet with Dr. Kwasi Ampofo, who is the Reaching and Engaging Enduser Coordinator for Harvest Plus/CIAT in September in Kampala, Uganda to discuss opportunities for graduate students to visit CIAT and work with projects such as Harvest Plus.

#### OTHER CONTRIBUTIONS

**Support for free markets and broad-based economic growth.** The development of market linkages for animal source food products is based mainly on free-market principles. Members of the local communities are provided with technical assistance and are being empowered to access appropriate services from governmental and private sources.

**Contributions to and compliance with mission objectives.** The overall goals of the mission are to (a) foster a healthier, better educated, and more productive population; and (b) increase the effectiveness of African institutions in promoting a vibrant private sector and democratic governance. To accomplish these goals, the mission has four main strategic objectives; our project contributes directly to the third objective of improving the health status of the population. Through collaborations of the project with staff from the district Ghana Health Services, we are promoting community-based service delivery and linking health to other development activities at district and community level. Although this project is not specifically targeted to people living with HIV/AIDS, it is targeted to the neediest, some of whom will be infected with HIV.

**Concern for individuals.** Freedom of individuals to make informed choices for themselves underlines all project processes. Individuals are invited to participate in group activities; participation is an individual choice, and the participants are informed of their right to disengage from any or all activities at any time. The data collection has been reviewed and approved by the Institutional Review Board at Iowa State University and the University of Ghana, and the project assures confidentiality of the data.

**Support for democracy.** All technical assistance to the project provided to community members through participatory group activities enhances social learning and mutual support. The process of group dynamics among community members encourages active participation in decision-making and may translate to increased empowerment of the community as individuals and as a whole.

**Humanitarian assistance.** Access to adequate, safe food is a human right. This project is focused on increasing the use of nutrient-rich animal source foods in the diets of young children to improve their health, growth, and cognitive development. The activities do not provide a direct transfer of food but will increase households' ability to access a quality diet for their children.

#### LEVERAGED FUNDS AND LINKED PROJECTS

The total value for leveraged funds for the ENAM project during 2006 was \$16,030. The sources of those funds were as follows:

University of Ghana, office space for Department of Animal Science (\$500/mo\*12), \$6,000.

NIH (Research on optimal nutrition for young children), meeting space, transportation, and equipment for Marquis, 09/02/2005-08/07/2006, \$2,553.

Ministry of Food and Agriculture, field personnel, \$2,473; office space (\$300/mo\*12), \$3,600.

VEDCO (Ugandan NGO working with the ISU SRL program-support for ENAM master's student), office space and use of motorcycle, \$156; staff assistance, \$769.

Makerere University (Uganda-support for ENAM visit), car and driver, \$479.

## TRAINING

### *Degree*

Adjei, Gladys. Ghanaian, F, U of Ghana, Nutrition, MS.  
Addo, Adolphina. Ghanaian, F, ISU, Nutrition, MS.  
Aryeetey, Richmond. Ghanaian, M, ISU, Nutrition, PhD.  
Christian, Aaron. Ghanaian, M, U of Ghana, Nutrition, MS.  
Oluka, Samuel. Ugandan, M, U of Ghana, Nutrition, MS.  
Pareja, Rossina. Peruvian, F, ISU, Nutrition, MS.  
Fox, Melissa. American, F, ISU, Nutrition, BS.  
Danowsky, Elizabeth. American, F, ISU, Nutrition, BS.  
Timpo, Olivia. Ghanaian, F, U of Connecticut, Nutrition, MS.

### *Non-Degree*

Community training in fish smoking, February 20-23, 2005 and June 19-22, 2006 in Winneba and Navrongo, Ghana. Facilitated by Margaret Aguu and Alice Dawson. To expand caregiver household income through alternative income generation activities that will lead to increased access to ASF. Attended by 88 participants (5 male and 83 female).

Community training in poultry production, February 25, 2006 in Winneba, Ghana. Facilitated by Professor Ben Ahunu, Dr. Emmanuel Canacoo, and Mr. Kofi Adjololo. To expand caregiver household's income through alternative income generation activities that will lead to an increased access to ASF. Attended by 66 participants (4 male and 62 female).

## COLLABORATING PERSONNEL

### *Ghana*

Ahunu, Benjamin. University of Ghana, Animal Science/Statistics, PhD, Assoc. Professor

Canacoo, Emmanuel. University of Ghana, Veterinary Science, DVM, Senior Lecturer  
Colecraft, Esi. Iowa State University, International Health/Nutrition, DrPH Prog. Coordinator  
Lartey Anna. University of Ghana, Nutrition, PhD, Assoc. Professor  
Sakyi-Dawson, Owuraku. University of Ghana, Agriculture Extension, PhD, Assoc. Professor

### *Uganda*

Muyanja, Charles. Makerere University, Food Science, PhD, Senior Lecturer

### *United States*

Butler, Lorna. Iowa State University, Sociology/Anthropology, PhD, Professor  
Jensen, Helen. Iowa State University, Economics, PhD Professor  
Lonergan, Elisabeth. Iowa State University, Animal Science, PhD, Assoc. Professor  
Marquis, Grace. Iowa State University, Nutrition, PhD, Assoc. Professor  
Reddy, Manju. Iowa State University, Nutrition, PhD, Assoc. Professor

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It should be noted that Dr. Marquis is now a faculty member of McGill University in Montreal Canada and the School of Dietetics and Human Nutrition unofficial provides support to the ENAM project through Dr. Marquis' salary.

### PUBLICATIONS

Esi Colecraft, Grace S. Marquis, Richmond Aryeetey, Owuraku Sakyi-Dawson, Anna Lartey, Benjamin Ahunu, Emmanuel Canacoo, Lorna M. Butler, Manju B. Reddy, Helen H. Jensen, Elisabeth Huff-Lonergan. Constraints on the use of animal source foods for young children in Ghana: a participatory rapid appraisal approach. *Ecology of Food and Nutrition*, 45: 351–377, 2006

### ABSTRACTS/PRESENTATIONS

Experimental Biology. April, 2006. San Francisco, CA.

E Colecraft, GS Marquis, AA Lartey. Nutritional status and dietary animal source food diversity of 2- to 5-y old Ghanaian children living in rural and peri-urban communities in a coastal district.

African Nutritional Epidemiology Conference. 15th – 18th August 2006. Accra, Ghana.

E Colecraft, GS Marquis, AA Lartey. Nutritional status and dietary animal source food diversity of 2- to 5-y old Ghanaian children living in rural and peri-urban communities in a coastal district.

Abstracts submitted for Experimental Biology 2007 (Washington DC)

E Colecraft, GA Adjei, A Lartey, and GS Marquis. Contribution of animal source foods to total iron intake of children in coastal Ghana

AK Christian, A Lartey, E Colecraft, O Sakyi-Dawson, B Ahunu, and GS Marquis. Caregivers'

Income Generation Activities and Diversity of Animal Source Foods in Children's Diets in Ghana.

EK Colecraft, GS Marquis, A Lartey, O Sakyi-Dawson, B Ahunu, Lorna M Butler, Helen H Jensen, Manju B Reddy, Elisabeth Lonergan. The magnitude and pattern of purchased ready-to-eat foods in the diets of rural Ghanaian children.

Grace S Marquis, Kimberly Harding, Esi K Colecraft, Melissa Fox, Owuraku Sakyi-Dawson. Seasonal patterns of severe food shortages vary by region in Ghana.

### LEAD PRINCIPAL INVESTIGATOR

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