

Research Application Summary

Gulu University Student-Centered Outreach Model enhanced uptake of research innovations in complementary feeding among rural households in Amuru and Nwoya districts in northern Uganda

Nassanga, P., Ipolito Okello-Uma & Ongeng, D.

Department of Food Science and Post-Harvest Technology, Faculty of Agriculture and Environment, Gulu University, P. O. Box 166, Gulu, Uganda

Corresponding author: pnassanga@gmail.com

Abstract

Universities are mandated to conduct research on community development challenges, including nutrition challenges, and provide results for uptake. Research in universities is largely conducted as part of student training and the results obtained are usually published in scientific journals or simply shelved after student graduation, thus hardly reaching the intended beneficiaries. The Faculty of Agriculture and Environment at Gulu University developed a Student-Centered Outreach Model or S-C-O as a strategy to enhance the contribution of Gulu University to community development for example through improved complementary feeding. Within the framework of the S-C-O model data were collected in 2015 and 2016 to examine complementary feeding challenges among rural communities of Amuru and Nwoya districts in Northern Uganda. The study (i) assessed the knowledge, attitude and practices of caregivers of 6-23 months old children in Acholi Sub-region of Uganda and (ii) feasibility of producing locally adapted formulae using finger millet, sesame and soy, food resources locally available in the area was conducted between 2015 and 2016. For assessment of knowledge, attitude and practices of caregivers of 6-23 months old children, a cross sectional survey that made use of quantitative methods to collect data was applied. Quantitative data collected through in-depth interviews using standardized questionnaires. A multi-stage sampling technique was employed to select the districts, sub-counties, parishes and villages for data collection. With respect to development and acceptability evaluation of the composite formulae, participatory community research approach was used and led to development of complementary food formulae based on finger millet, sesame and soy. Various combinations of finger millet, sesame and soy were compounded to produce complementary food formulae corresponding to energy content of 200, 300 and 550 Kcal meant for breast fed children in the age category 6-8, 9-11, and 12-23 months, respectively and processed into flour under rural conditions. The flour formulae were reconstituted into porridge and evaluated for sensory attributes and acceptability among mothers and caregivers of children 6-23 months old to enable them select the most preferred formula for each energy category. The formulae were well accepted by the panel of caregivers in the study. However information on the products and their use was found to be inadequate among the wider community of end users. Therefore to extend this to the wider community, dissemination of the research findings from the study was undertaken between April-August 2018. The outcome of the dissemination activity revealed community appreciation of the S-C-O model for enhancing uptake of innovations in complementary feeding in rural settings.

Key words: Dissemination, millet, research findings, sesame, soy

Résumé

Les universités sont mandatées pour la recherche sur les défis de développement communautaire, y compris ceux de la nutrition, et fournir des résultats utilisables. La recherche dans les universités est en grande partie menée dans le cadre de la formation des étudiants et les résultats obtenus sont généralement publiés dans des revues scientifiques ou simplement mis de côté après l'obtention du diplôme des étudiants, atteignant ainsi difficilement les bénéficiaires visés. La Faculté d'agriculture et d'environnement de l'Université de Gulu a développé un modèle de sensibilisation, centré sur l'étudiant comme stratégie pour renforcer la contribution de l'Université de Gulu au développement communautaire, par exemple grâce à une alimentation complémentaire améliorée. Dans le cadre de ce modèle, des données ont été collectées en 2015 et 2016 pour examiner les problèmes d'alimentation complémentaire dans les communautés rurales des districts d'Amuru et Nwoya dans le nord de l'Ouganda. L'étude a évalué (i) les connaissances, l'attitude et les pratiques des aide-soignants des enfants âgés de 6 à 23 mois dans la sous-région d'Acholi en Ouganda et (ii) la possibilité de produire des formules adaptées localement en utilisant le mil, le sésame et le soja. Pour évaluer les connaissances, l'attitude et les pratiques des aide-soignants, une enquête transversale utilisant des méthodes quantitatives a été appliquée. Les données quantitatives ont été collectées au moyen d'entrevues approfondies sur base de questionnaires standardisés. Une technique d'échantillonnage à plusieurs degrés a été utilisée pour sélectionner les districts, sous-comtés, quartiers et villages. En ce qui concerne le développement et l'évaluation de l'acceptabilité des formules composites, une approche de recherche communautaire participative a été utilisée et a conduit au développement de formules alimentaires complémentaires à base de millet, de sésame et de soja. Diverses combinaisons de millet, de sésame et de soja ont été préparées pour produire des formules alimentaires complémentaires correspondant à un contenu énergétique de 200, 300 et 550 Kcal destinées aux enfants allaités dans la catégorie d'âge 6-8, 9-11 et 12-23 mois, respectivement et transformés en farine dans des conditions rurales. Les formules de farine ont été reconstituées en bouillie et évaluées pour les attributs sensoriels et l'acceptabilité chez les mères et aide-soignants pour leur permettre de sélectionner la formule la plus préférée pour chaque catégorie d'énergie. Les formules ont été bien acceptées par le panel des aide-soignants de l'étude. Cependant, les informations sur les produits et leur utilisation ont été jugées inadéquates parmi la communauté des utilisateurs finaux. Par conséquent, pour étendre cela à la communauté au sens large, la diffusion des résultats de la recherche de l'étude a été entreprise entre avril et août 2018. Les résultats de l'activité de diffusion ont révélé l'appréciation par la communauté du modèle pour améliorer l'adoption des innovations en matière d'alimentation complémentaire en milieu rural.

Mots clés: diffusion, mil, résultats de recherche, sésame, soja

Introduction

Undernutrition among young children in developing countries remains a major challenge (Semahegn *et al.*, 2014). In Uganda, the prevalence of undernutrition is 25.7% (FAO, IFAD, and WFP, 2014). This is partly attributed to inappropriate complementary feeding (Shi and Zhang, 2011; Khanal *et al.*, 2013). The WHO (2008) recommends the use of locally available indigenous food resources to prepare complementary foods as a sustainable intervention to the challenges of complementary feeding. The political, economic and socio-cultural environment greatly influence the control,

management and distribution of resources which directly or indirectly affect accessibility, availability and utilization of food by populations (Gross *et al.*, 2000). In developing countries, especially in regions affected by war a number of organizations provide support towards addressing challenges of undernutrition during complementary feeding. These include non-government organizations, donor agencies like World Food Program (WFP) especially in Internally Displaced Persons (IDP) camps and refugee settlements, amongst others. They provide food and nutrition training to the people during emergencies and in the aftermath of the war (CSOPNU, 2007). When these organizations leave usually at the end of their project timeline, the communities are left to manage on their own. This has led to the falling apart of what the organizations had built, mainly due to lack of sustainability by the community. Another challenge is that when children in the communities are malnourished they are referred to hospitals where they are provided with already developed nutritious products like F75 or F100 on admission (MoH, 2010) and ready to use therapeutic foods upon discharge back to their homes (Yebyo *et al.*, 2013). The problem with this is that when these developed products given to children upon discharge are finished, the children revert to malnutrition again, even after they had recovered. Challenges appear to be largely anchored on lack of the sense of ownership by the poor communities in addition to lack of knowledge on nutritional characteristics of locally available food resources (Saaka, 2014) and how to maximize their nutritive values (Kikafunda *et al.*, 2009). In Northern Uganda for example, Acheng (2014) attested to this where she found out that poor households had low dietary diversity of complementary foods administered to children aged 6 and 24 months despite them being large producers of cereals and legumes in the country (UBOS, 2010).

A feasible and practical solution to these challenges is to teach rural communities the dangers of not adhering to the recommended complementary feeding practices as well as to train them on how to use locally available foods resources and technologies to produce nutritious complementary foods for their children. When the local communities are trained to produce their own nutritious foods, the innovations become sustainable because the resources and technologies used are readily available and therefore easily replicated by every household. Nutrition education together with provision of a practical training on food preparation has been shown elsewhere to improve complementary feeding practices (Ickes *et al.*, 2017). This study therefore explored the option of teaching local communities the dangers associated with non adherence to the recommended complementary feeding practices and training them on how local food resources such as finger millet, sesame and soy beans can be blended to produce nutritious foods for their children using the locally available technologies.

Materials and methods

Participatory community action research approach was applied. The Student Centered Outreach Model as described by Kalule *et al.* (2016) was used. In this model, the students are centrally positioned between the faculty and the community. The approach involves unique features in which the students: i) interact with the community on knowledge, skills and experiences exchange; ii) identify community problems and respond appropriately with technical backstopping from academic staff; and iii) collect agricultural enterprise specific problems requiring advanced research attention and transmit them to the faculty. Products of researched problems are then packaged as technologies or improved practices and are disseminated for uptake and adoption by the community. Using this model, a community challenge was identified while at Gulu Regional Referral Hospital for community attachment in 2015. Through discussions with the community members and the researcher, a decision was reached to develop a complementary food using locally available food resources particularly finger millet, sesame and soy. From that discussion a study that: (i) assessed the knowledge, attitude and practices

of caregivers of 6-23 months old children in Acholi Sub-region of Uganda and (ii) experimented the feasibility of the option of producing locally adapted formulae using finger millet, sesame and soy, food resources locally available in the area was conducted between 2015 and 2016. For assessment of knowledge, attitude and practices of caregivers of 6-23 months old children, a cross sectional survey that made use of quantitative methods to collect data was applied. Quantitative data were collected through in-depth interviews using standardized questionnaires. A multi-stage sampling technique was employed to select the districts, sub-counties, parishes and villages. With respect to development and acceptability evaluation of the composite formulae, participatory community research approach was used and led to development of complementary food formulae based on finger millet, sesame and soy which are locally available. Various combinations of finger millet, sesame and soy were compounded to produce complementary food formulae corresponding to energy content of 200, 300 and 550 Kcal meant for breast-fed children in the age category 6-8, 9-11, and 12-23 months, respectively, and processed into flour under rural conditions. The flour formulae were reconstituted into porridge and evaluated for sensory attributes and acceptability among mothers and caregivers of children 6-23 months old to enable them select the most preferred formula for each energy category. The porridge samples were evaluated for sensory attributes of taste, aroma, colour, texture, mouth feel, and overall acceptability. One way Analysis of Variance (ANOVA) was used to test whether difference existed in aggregate scores for each sensory attribute and overall acceptability between composite flour formulae within each energy category. The means were separated using the Turkey's method at 5% level of significance. The flours for the community's preferred formula were taken to the laboratory for nutrient composition analysis. Proximate and mineral contents of community-preferred composite flour formulae were analyzed in the laboratory. Analyses were performed for gross energy, crude protein, ash, fat, crude fibre, total carbohydrates, moisture, phosphorus, calcium, iron, zinc and magnesium. Crude protein was determined using the micro Kjeldahl method as described by Magomya *et al.* (2014). Moisture, crude fat, crude fibre, ash and carbohydrate contents were determined according to AOAC (1990). Energy was determined using a bomb calorimetric method according to FAO (2011). Calcium was determined using the flame photometric method as described by Harworth and Cleaver (1961) while phosphorus, iron, magnesium and zinc were determined using the atomic absorption spectrophotometric method according to AOAC (1990). With regards to the level of knowledge, attitude and practices (KAP) of caregivers related to complementary feeding, the scores on knowledge, attitude and practice for each respondent were calculated by summing up the scores attained on each question and the overall score ranked as good or poor. Knowledge, attitude and practice scores were ranked as poor, average and good if the overall score fell below 55%, 57.1% and 62.5%, respectively, according to Ul Haq *et al.* (2012). SPSS was used for statistical analysis.

Based on the findings of the study, it was recommended that a community wide training on dangers of not adhering to recommended complementary feeding practices and demonstration on how to prepare the complementary feeding product to the wider community be done. The results were disseminated back to the communities in Nwoya and Amuru districts (Koch-goma and Lamogi sub-counties, respectively). The districts were purposively selected because it was where the study was conducted. The sub-counties and the villages were randomly selected. The study started by dissemination of research findings to the different stakeholders. This exercise was done at three levels namely; at the district level to the district officials/ leaders, at the sub-county level to the sub-county leaders, and at the village level. After this the local community at the village level were educated about the dangers of not adhering to recommended complementary feeding practices and trained on how to make nutritious food for children 6-23 months from finger millet, sesame and soy. In the training the tools/equipments used were locally adapted such as cups for measuring different proportions to be included

in the final product, winnower, mortar and pestle for cleaning the ingredients, amongst other things.

Results and discussions

Regarding the level of knowledge, attitude and practices, results from the study showed that a high proportion of caregivers had good knowledge (88%) and attitude (90.1%) towards complementary feeding while only a half (50%) practiced what they knew. With regards to development of complementary foods, Table 1 shows the composition of different formulae that were developed per energy category.

Caregivers' scores on the extent of liking the various finger millet-sesame-soy complementary food formulae, segregated by energy requirements (200Kcal meant for 6-8 months, 300Kcal meant for 9-11 months and 550Kcal meant for 12-23 months old children) are presented in Table 2. Based on the results of overall acceptability evaluation, the community selected 92% finger millet-0.8% sesame-7.2% soy, 75 % finger millet-10% sesame-15% soy, and 12.1% finger millet-10% sesame-77.9% soy composite, as the most preferred formula for children aged 6-8, 9-11 and 12-23 months, respectively. The nutritional composition of the community-preferred composite formulae is presented in Table 3.

Given the fact that nutrition is a multi-sectoral subject (Lamstein *et al.* 2016) which requires efforts from different sectors and stakeholders for its benefits to be well appreciated, the research findings were disseminated to different people at different levels of leadership and from different departments/sectors. At the district and sub-county levels, the dissemination exercise was attended by 21 and 20 leaders from Nwoya and Amuru districts, respectively. They appreciated the dissemination exercise and said that it was a good gesture by the University which should continue. In Koch-Goma sub-county the leaders promised to move a motion in their council meeting that the composite be used in nursery schools for feeding children. From Nwoya district local government the dissemination of research findings was attended by the Regional Nutritionist (01), District Production Officer (01), District Agricultural Officer (01), District Community Development Officer (01), Nutritionist (01), Senior Environment Officer (01), Secretary Production (01), Senior Development Officer (01), Senior Education Officer (01) and the District Engineer (01). In Amuru district the dissemination meeting was attended by the following people: District Nutrition Focal Point Person (01), District Health Officer (01), Health Worker (01), Assistant Engineering Officer Water (01), Deputy Chief Administrative Officer (01), District Production Officer (01), District Education Officer (01), Agricultural Extension Officer (01), Secretaries (02) and a mobilizer (01). At Koch-Goma sub-county the dissemination meeting was attended by Vice Chairperson of Local Council Level 3 L(CIII), Councillors (03), Village Health Team members (06) and Secretary for health and education while in Lamogi subcounty it was attended by Chairperson LCIII (01), Councillors (03) and village health team members (05).

At the community level (Table 4) the training on dangers of not adhering to the recommended complementary feeding practices and dissemination of the study findings was attended by 152 people while the training/demonstration on production of complementary food from finger millet, sesame and soy was attended by 171 people.

Table 3. Nutritional composition of the community-preferred composite formulae

Properties	F13	F21	F31
Carbohydrate (%)	079.85±3.4	063.40±0.28	029.57±0.41
Moisture (%)	006.59±0.11	006.17±0.21	005.24±0.16
Crude fat (%)	002.64±0.02	008.62±0.24	018.52±0.40
Dietary fibre (%)	010.63±0.61	011.00±0.95	017.15±1.55
Ash (%)	003.01±0.13	003.44±0.14	004.92±0.16
Crude protein (%)	010.25±0.18	013.18±0.48	031.27±0.36
Energy (Kcal)/100g	345.23±1.21	462.81±2.53	454.28±1.93
Phosphorus mg/100g	393.20±9.9	419.27±19.1	577.10±9.5
Iron mg/100g	086.63±0.35	100.50±1.71	107.33±4.41
Zinc mg/100g	001.57±0.15	001.67±0.06	004.17±0.15
Magnesium mg/100g	086.27±0.49	091.70±1.61	121.40±1.97
Calcium mg/100g	642.43±20.1	797.90±39.9	990.30±39.6

Data shows means±SD of triplicate determination. F13: 92% finger millet- 0.8% sesame-7.2% soy; F21: 95% finger millet-10 %sesame-15%soy; F31: 12.1% finger millet-10% sesame-77.9% soy



Figure 1. A photo taken after a meeting with Amuru district local government leaders



Figure 2. A demonstration to community members in Pukure village on how to prepare finger millet-sesame-soy composite



Figure 3. Community members in Agonga village participate in taking measurements after the demonstration.

This study catalyzed the formation of an organized group with elected leadership in Agonga Village. This group envisioned starting up a business of making finger millet-sesame-soy complementary food for commercial purposes. Looking at addressing the malnutrition problem from a different direction, agribusiness has taken on a different dimension and it is at the heart of every development agency. This approach can be used and the locally developed formulae can be translated into a business venture. This would encourage the communities to continuously produce these formulae with a motivation that they would earn some money on top of having good nutrition for their children. This would strengthen ownership and sustainability of the innovation.



Figure 4. A demonstration to community members in Pukure village on how to take measurements for making the finger millet-sesame-soy composite

Table 4. Attendance (numbers) of the training on dangers of not adhering to the recommended complementary feeding practices and the demonstration on preparing finger millet, sesame and soy food

Sub-county	Village	Training (n=152)		Demonstration (n=171)	
		Number	Percentage	Number	Percentage
Koch-goma	Kalang	51	33.6	47	27.5
Koch-goma	Agonga A	27	17.8	30	17.5
Koch-goma	Kal A1	23	15.0	22	12.9
Lamogi	Pukure	17	11.2	37	21.6
Lamogi	Lwalakwar	34	22.4	35	20.5

Conclusions

This study demonstrates the feasibility of the University working with local communities and local authorities to promote locally tailored technologies that address some challenges in the community such as undernutrition.

Acknowledgement

The authors are grateful to the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) for funding this study through a Field Attachment Programme Award, grant number: RU 2018 (CFAPA) 199. This paper is a contribution to the Sixth Africa Higher Education Week and RUFORUM 2018 Biennial Conference.

References

- Acheng, A. 2014. Considerations for improving complementary feeding practices among infants of 6-11 months in Northern Uganda. Master Thesis, Makerere University, Kampala, Uganda.
- AOAC (Association of Analytical Chemists). 1990. Official Methods of Analysis of the Association of Analytical Chemists. Kenneth Helrich (Ed.). 15th ed., Vol. 1. Arlington Virginia: Association of the Analytical Chemists Inc suit 400.
- CSOPNU (Civil Society Organisations for Peace in Northern Uganda). 2007. The impact of armed conflicts on children in Northern and North Eastern Uganda. CSOPNU, Kampala.
- Food and Agriculture Organization (FAO). 2011. Quality assurance for animal feed analysis laboratories. FAO Animal Production and Health Manual No. 14. pp. 115–117. Rome: FAO.
- Food and Agriculture Organization (FAO), IFAD and WFP. 2014. The State of Food Insecurity in the World- Strengthening the enabling environment for food security and nutrition. FAO, Rome, Italy. pp. 1–57.
- Gross, R., Schoeneberger, H., Pfeifer, H. and Preuss, H.J. 2000. The four dimensions of food and nutrition security: definitions and concepts. *SCN News* 20 (20): 1-17.
- Harworth, F. and Cleaver, T.J. 1961. Determination of calcium and magnesium in vegetables. *Journal of Science of Food and Agriculture* 12: 848–852.
- Ickes, S.B., Baguma, C., Brahe, C.A., Myhre, J.A., Adair, L.S., Bentley, M.E. and Ammerman, A.S. 2017. Maternal participation in a nutrition education program in Uganda is associated with improved infant and young child feeding practices and feeding knowledge: A post-program comparison study *BMC Nutrition* 3:32. DOI 10.1186/s40795-017-0140-8
- Kalule, S.W., Odongo, W., Kule, E., Ndyomugenyi, E.K., Omara, P. and Ongeng, D. 2016. Conceptualizing the Student-Centered Outreach Model for experiential learning and community transformation. *African Journal of Rural Development* 1 (3): 219 - 227.
- Khanal, V., Sauer, K. and Zhao, Y. 2013. Determinants of complementary feeding practices among Nepalese children aged 6 – 23 months/ : findings from demographic and health survey 2011. *BMC Pediatrics* 13 (131): 1–13.
- Kikafunda, J.K., Lukwago, F.B. and Turyashemerwa, F. 2009. Anaemia and associated factors among under-fives and their mothers in Bushenyi district, Western Uganda. *Public Health Nutrition* 12 (12): 2302–2308. <http://doi.org/10.1017/S1368980009005333>
- Lamstein, S, Pomeroy-Stevens, A., Webb, P. and Kennedy, E. 2016. Optimizing the multisectoral nutrition policy cycle: A systems perspective. *Food and Nutrition Bulletin* 37 (4S): S107-S114. DOI: 10.1177/0379572116675994
- Magomya, A.M., Kubmarawa, D., Ndahi, J.A. and Yebpella, G.G., 2014. Determination of plant proteins via the Kjeldahl method and amino acid analysis: a comparative study. *International Journal of Scientific and Technology Research* 3 (4): 68-72.
- MoH (Ministry of Health). 2010. Intergrated management of acute malnutrition. MoH, Entebbe, Uganda.
- Saaka, M. 2014. Relationship between mothers' nutritional knowledge in childcare practices and the

- growth of children living in impoverished rural communities. *Journal of Health, Population and Nutrition* 32: 237–248.
- Semahegn, A., Tesfaye, G. and Bogale, A. 2014. Complementary feeding practice of mothers and associated factors in Hiwot Fana Specialized Hospital, Eastern Ethiopia. *Pan African Medical Journal* 18 (143): 1–11.
- Shi, L. and Zhang, J. 2011. Recent evidence of the effectiveness of educational interventions for improving complementary feeding practices in developing countries. *Journal of Tropical Pediatrics* 57 (2): 91–98.
- Uganda Bureau of Statistics (UBOS). 2010. Uganda census of agriculture 2008/2009. Volume IV: Crop Area and Production Report. Retrieved from www.ubos.org
- Ul Haq, N., Hassali, M. A., Shafie, A. A., Saleem, F. and Farooqui, M. 2012. A cross sectional assessment of knowledge, attitude and practice towards Hepatitis B among healthy population of Quetta, Pakistan. *BMC Public Health* 12 (692): 1–8.
- World Health Organization (WHO). 2008. Indicators for assessing infant and young child feeding practices: Part 1; definitions. Conclusions of a consensus meeting held 6–8 November 2007 in Washington, DC, USA. pp. 1–19.
- Yebyo, H.G., Kendall, C., Nigusse, D. and Lemma, W. 2013. Outpatient therapeutic feeding program outcomes and determinants in treatment of severe acute malnutrition in Tigray, northern Ethiopia: a retrospective cohort study. *Plos one* 8 (6): e65840.