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Nutrition education competencies of agricultural extension workers in Uganda

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ABSTRACT

Purpose: To determine the nutrition competency level and training needs of agricultural extension workers (AEWs) in Uganda.

Design/Methodology/Approach: A cross-sectional survey was conducted in four districts with 61 private and 163 public AEWs. Data were collected using self-administered structured questionnaires and analysed using means, Chi-square and Mean Weighted Discrepancy Score.

Findings: AEWs require 9 core competence domains: Basic nutrition; Nutrition needs of household members; Hygiene and sanitation; Post-harvest handling; Planning and resource allocation among others. AEWs were above average competence in most (8) competency domains. Private AEWs perceived themselves to be more competent ($\bar{X} = 4.26$) than the public AEWs ($\bar{X} = 3.77$), $\chi^2(224) = 20.1182$, $p < 0.01$). Prioritized needs by public and private AEWs were; Understanding nutrition needs of different household members, Farming systems that promote nutrition and Postharvest handling and food safety.

Practical Implications: Pre-service and in-service training of AEWs should focus on the identified core competence domains and the priority training needs respectively, depending on the organization contexts.

Theoretical Implications: This study demonstrates that the competency profile of AEWs should include community based nutrition education. Situations where private AEWs have higher capacity than their public sector counterparts, present an opportunity for cross-learning.

Originality/Value: Community based nutrition education has been traditionally the mandate of health sector ministries, and the capacity requirements of AEWs who are not nutrition experts has been contested. This study provides empirical evidence regarding nutrition education competence needs of AEWs to enable them ably complement other sectors in multi-sectoral nutrition policy contexts.

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KEYWORDS

Nutrition; education; competencies; training needs; agricultural extension workers; Uganda

Introduction

The current trends of climate change; globalization; national and regional poverty reduction and food security strategies call for competent agricultural extension

workers (Zwane et al. 2015). Worldwide nutrition related challenges contribute to about 45% of deaths in the under 5 year olds in the entire world (UNICEF 2019). In Uganda, out of the 2.2 million children under five years of age, 29% are stunted, 11% are underweight while 4% are wasted (UBOS and ICF 2017). Holistic strategies such as use of multi-sectoral approaches are increasingly being incorporated in interventions targeting nutrition with any government ministry or department possessing necessary competencies taking lead (FANTA 2017; Fanzo et al. 2015).

Involving the agriculture sector is one of the ways to reinforce efforts for addressing under-nutrition (FANTA 2017). The agriculture sector ensures that diverse foods are available, affordable and safe for feeding the people (Fanzo 2015; FAO 2013). Agriculture extension workers can build farmers' capabilities to attain their full potential in production of crops and livestock for food and income security (Sala, Rossi and David 2016). According to Hughes et al. (2012) effective nutrition education can only be possible when the trainers have the right competencies to undertake such activities. This is because lack of competency affects their performance in terms of the quality of services delivered to clients (Hughes et al. 2012). It is therefore important for agricultural extension workers to update their knowledge levels to suit the prevailing situation and needs of the farmers (Melak and Negatu 2012).

Despite the need for competent agricultural extension workers, little is known about their nutrition education competency levels and training needs (Fanzo 2015). A study of the nutrition competencies of graduating students in Ethiopia with regard to nutrition sensitive agriculture found out that student's competency level was low and this was attributed to deficiencies in the pre-service curriculum (Abebe et al. 2017). Other studies on this subject have looked at actors engaged in nutrition, integration of nutrition into agricultural services and governance of multisectoral processes (Bennett, Douglas, and Kumanan, 2018; Fanzo et al. 2013). Understanding of competencies for actors engaged in nutrition education remains a great need for addressing nutrition matters in Uganda given that areas for competency building remain unclear. This can help to guide interventions to improve the extension services (UBOS 2017) and support the government plan of having competent agricultural extension workers (GoU 2016a).

This study adds to existing body of knowledge on nutrition education competencies and training needs of AEWs by answering the following questions:

- (1) What is the perceived competency level of public and private agricultural extension workers in regard to nutrition education?
- (2) What are the perceived nutrition education training needs of public and private agricultural extension workers?

Literature review and conceptual framework

Understanding of competency of workers is conceptualized as a pathway to informing his/ her training needs. Competence is an individual or organization's capability to undertake a given task and this comprises knowledge, skills and attitudes which can be context specific. These competencies enable an individual to be effective in functioning in a certain profession, organization, position or role (Davis 2015; NFSMI 2004; Mulder 2001). As key to competence development, Sandberg (1994) (as cited in Sandberg

2000) identified three approaches to competency assessment as work-oriented, worker-oriented and multi-method oriented. Our study was informed by the worker oriented approach which aids to identify the skills, knowledge, and abilities needed for effectiveness at work and improvement of organizational performance. For the current study, competency encompassed knowledge, skills and attitudes possessed by an agricultural extension worker to enable him/her provide nutrition education services to the farmers. According to Kajander-unkuri et al. (2014) an individual's competence can be assessed at different levels which was at the heart of this study. The type of organization is likely to influence competence of extension workers due to the differing level of emphasis accorded to nutrition by the public and private sector. Scholars such as Hodge et al. (2015) noted that nutrition is considered as work for health officials. These scholars noted that extension workers especially those in the public sector tend to avoid engagement in nutrition related matters. Consequently, the competency levels of agricultural extension workers across the private and public sector needs to be analyzed separately in order to guide trainings. However, the challenge remains on how to prioritize these competences for training purposes.

Different models exist in regard to competency and competency assessment in extension (Scheer and Cochran 2011). Those which have been applied in the American context to identify and develop competencies include Texas Agri-Life Extension YES Model, Michigan State University Extension Core Competency Initiative, and the 4-H PRKC model for 4-H. These models have however been criticized for their differences in regards to the number of core competency areas (Harder, Place, and Scheer 2015). In our study we therefore employed the Borich model (1980) to assess the competency level of extension workers and their current nutrition education needs. This model was developed for assessment of training needs of educators or trainers. The model assumes self-assessment as one way to reveal the current needs of an extension worker. This model for example proposes listing of competencies with regards to the program or organization before prioritizing areas of improvement. It also proposes establishing the influencing factors for perceived relevance and attainment. According to Bose, Oliveras, and Edson (2001), self-assessment aids in identifying needs and improving performance of workers. The Borich model shows the gap between the reality and the ideal situation that can guide in-service training (Borich 1990). It measures the behaviors, skills and competencies of educators against 'the goals of the programme.' That is why the Borich model uses the competency and importance rating (Olorunfemi, Olorunfemi, and Oladele 2020). Borich proposed two ways to assessing needs of trainers; first, where the trainer rates himself/herself twice regarding the **perceived relevance** and **perceived level of attainment** (Figure 1); and secondly, where the trainer rates competence attainment per competence item according to **Knowledge Competence** (Ability to accurately recall, paraphrase, or summarize the procedural mechanics of the behavior in a paper and pencil test); **Performance Competence** (Ability to accurately execute the behavior in a real or simulated environment in the presence of an observer) and **Consequence Competence** (Ability to elicit learning from pupils by using the behavior in the classroom) (see Figure 2) (Borich 1980, 40; Wingenbach 2013). 'Each competency for each respondent yields three discrepancy scores indicating program effectiveness of the training program.' That is; - trainee knowledge - Trainee performance - Pupil consequences' (Borich 1980, 40). We however used the

Competency	Perceived Relevance					Perceived Level of Attainment				
	Low				High	Low				High
1.	1	2	3	4	5	1	2	3	4	5
2.	1	2	3	4	5	1	2	3	4	5
3.	1	2	3	4	5	1	2	3	4	5
4.	1	2	3	4	5	1	2	3	4	5

Figure 1. Borich Model (1980).

first method in our study as depicted in [Figure 1](#) below and developed discrepancy scores to reveal training needs of extension workers.

According to the Borich model, mean weighted discrepancy score ratings can show areas that need urgency in designing in-service trainings. The model has been used by scholars (Olorunfemi, Olorunfemi, and Oladele 2020; Alibaygi and Zarafshani 2008; Cannon, Kitchel, and Duncan 2012) to assess competences and training needs of extension workers and teaching professionals. From the model, areas with highest positive mean weighted discrepancy scores (MWDS) are the ones for first attention for training programs. For the purpose of this study, the Borich model was suitable to help in guiding on understanding the current nutrition education competence level of extension workers and computing their training needs using MWDS.

Materials and methods

Study area and research design

The study was conducted in Uganda in the districts of Kanungu, Wakiso, Kamuli and Arua (see [Figure 3](#)). The major tribes in the districts are Bakiga, Baganda, Basoga and Lugbara for Kanungu, Wakiso, Kamuli and Arua respectively (UBOS 2017). The predominant staples for these tribes are sorghum and millet; banana (matooke); sweet potatoes and cassava for Bakiga, Baganda, Basoga and Lugbara respectively (Amone 2014).

The study had two phases with phase one having a preliminary study that aided in the development of a second phase, a cross sectional survey, as seen in [Table 1](#). A preliminary qualitative study involved key informant interviews with farmers, extension workers and nutrition experts to generate perceived nutrition education competencies. Phase two employed self administered interviews with agricultural extension workers from public

Competency	Perceived Importance	Knowledge of Mechanics of Competency	Ability to Perform Competency	Ability to Produce Pupil Learning with Competency
1.	1 2 3 ④ 5	1 2 3 ④ 5	1 2 ③ 4 5	1 ② 3 4 5
2.	1 2 3 4 ⑤	1 2 ⑤ 4 5	1 2 3 4 ⑤	1 2 3 4 ⑤
3.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Knowledge discrepancy = 0
 Performance discrepancy = 1
 Consequence discrepancy = 2

Figure 2. Expanded view of Borich Model (1980).

Table 1. Data Sources, Collection Methods and Analysis per Study Type.

Study type	Objective	Data collected	Data source (s)	Organization	Data collection method and tools	Data analysis method
Preliminary study	To find out perception of farmers, extension workers and nutrition experts on competencies needed by agricultural extension workers to carry out nutrition education	<ul style="list-style-type: none"> Knowledge, skills and attitudes agricultural extension workers should have to be effective in carrying out nutrition education. 	Farmers(n = 82) and Extension workers (n = 12).	Nutrition extension organizations working in Kihihi, Nyamirama, Rugyeyo and Kirima sub-counties of Kanungu since 2012	Focus group discussions (FGDs) using focus group guides Eight FGDs with farmers & two for extension workers	.Content analysis to developed themes and identify nine competency areas and 52 competences with regard to nutrition (Houghton et al. 2015)
			Nutrition experts (n = 07).	Three higher institutions of learning having nutrition education programs and Uganda Action for Nutrition	One FGD with nutrition experts.	
			Secondary data	Food and Nutrition Handbook for Extension Workers in Uganda (MAAIF 2015)	Document review	
Cross sectional survey	To assess the competency level of extension workers	<ul style="list-style-type: none"> Competency level and needs of public and private agricultural extension workers on 52 competencies in regard to nutrition education in areas of: Basic nutrition; Nutrition needs of household members; Hygiene and sanitation; Post-harvest handling; Planning and resource allocation; Farming systems that promote nutrition; Boosting household income; and Gender and nutrition; and attitude 	Public AEWs (n = 161) (District Agriculture Officers, District Production Officers, and Agricultural Extension Workers at district and sub-county level)	Public AEWs (Arua, Kamuli, Kanungu and Wakiso district) Private agricultural extension workers (VEDCO, Arua District Farmers Association, Community Empowerment for Rural Development (CERD), Chain Uganda, USAID Community Connector, Africa 2000 Network, Diocese of Kinkizi and Agency for Integrated Rural Development)	Interview using self-administered questionnaire (five point Likert scale rating (1 = very low and 5 = very high competency)).	*Means and standard deviations and Chi-square (Clark and Foster 2014) using SPSS, STATA & Excel. *Mean Weighted Discrepancy Score was used to derive the competency needs
	To determine the training needs of agricultural extension workers		Private AEWs (n = 63)			

Source: Our Field survey data

selected extension workers from one district per region with the highest numbers of extension workers at the time of study. Secondly since the study was also targeting extension workers from private extension organizations implementing nutrition programs, the districts were selected on grounds of having such organizations.

A sampling frame of private organizations implementing nutrition education programs was obtained from the District Production Department of selected districts. All private extension workers in the selected private organizations participated in the study because they were few in number. For Kamuli and Arua all agricultural extension workers were available for interview while for Kanungu and Wakiso some were not available for the interview and thus were excluded from the study.

Pretesting of the questionnaire

The survey questionnaire was pretested with a non-participating community of seven extension workers. Five of these extension workers had worked with the local government and two with the private sector. The pre-test helped us to establish the duration to complete the questionnaire, its validity and clarity of the questions and the rating scale used. During pretesting, the participants gave us feedback on the content of the tool and advice on any changes to improve clarity which was incorporated accordingly.

Data collection procedures

We used the introductory letter from Makerere University to obtain permission from the Directorate of Agricultural Extension Services in the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) to conduct research with extension workers. The latter in turn introduced us to the District Production Offices of participating districts who mobilized the respondents at district level. Data was collected between December 2016 and January 2017. Through the district production officers we mobilized and interviewed extension workers from one central place in their respective districts. Extension workers were briefed by the researchers on the purpose of the study and questionnaires with consent given to them prior to the survey interview. After the interview with AEWs, we checked for completeness of the questions to ensure that the questions were all answered and in the right way.

Data analysis

Mathematical calculations were carried out using discrepancy analysis to generate a mean weighted discrepancy score from comparison between the level of importance rating and competency of the extension agents. The MWDS were computed for each of the competencies by subtracting the competency mean scores from the importance mean scores and then multiplying by the mean importance ratings for each item to produce an average score for each competency item. Items ranked with the largest gaps represent the highest priority training need (Alibaygi and Zarafshani 2008; Borich 1980; Cannon, Kitchel, and Duncan 2012). A scale of 0–5, as used by Limuaco, Bautista, and Cruz (2014) and Melak and Negatu (2012), was used to interpret the mean values of importance and competency items as follows. The means between

0.00-1.49 = not competent or not important (very low); 1.50-2.49 = less than average (low); 2.50-3.49 = average competency or importance (medium); 3.50-4.49 = above average competency or importance (high) and 4.50-5.00 = very competent or important (very high).

Results

Perceived nutrition training competency level of agricultural extension workers

Across the nine competency areas listed in Table 1, with exception of nutrition needs of household members and attitude, both public and private agricultural extension workers perceived that they are above average competency ($\bar{X} = 3.50-4.49$). These included the following; Basic nutrition knowledge, hygiene and sanitation, Post-harvest handling and food safety, Farming systems that promote nutrition, Planning and resource allocation for household food and nutrition security, Boosting family income, and Gender and nutrition. Only public agricultural extension workers rated themselves as having average competency ($\bar{X} = 3.47$) in providing advisory services on nutrition needs of different household members.

Furthermore results show that the attitudes' category had the highest mean competency rating by both the private and public extension workers. The mean scores were ($\bar{X} = 4.54$; $SD = 0.591$) and ($\bar{X} = 4.22$; $SD = 0.766$) indicating very competent and above average competency for the private and public extension workers respectively. This study has shown that private extension workers perceive themselves to be more competent than public extension workers across the nine competency categories at 95% confidence level (see Table 2). The results therefore imply that training needs for both the private and the public agricultural extension workers may vary. The next sub-section shows the areas of need that were indicated to be of great importance by the extension workers.

Perceived overall nutrition education competency level of extension workers

The overall competency levels ranged from 1(not competent at all) to 5(very competent). For all the 52 competency items, this study found that most (60.3% and 54.0%) of the

Table 2. Nutrition Education Competency Ratings by Private and Public Extension Workers.

Competency Category	Private \bar{X} & SD	Public \bar{X} & SD	χ^2 -Value	p -value
Basic Nutrition Knowledge	4.26 ± 0.66	3.78 ± 0.74	13.3261	0.004***
Nutrition needs of different household members	4.31 ± 0.69	3.47 ± 0.82	40.0955	0.000***
Hygiene and sanitation	4.49 ± 0.60	3.95 ± 0.81	16.4788	0.002***
Post-harvest handling and food safety	4.24 ± 0.65	3.92 ± 0.79	12.7055	0.013**
Farming systems that promote nutrition	4.25 ± 0.57	3.76 ± 0.83	21.2812	0.006***
Planning and resource allocation for household food and nutrition security	4.34 ± 0.63	3.86 ± 0.79	15.2403	0.004***
Boosting family income	4.33 ± 0.68	3.89 ± 0.75	17.4287	0.001***
Gender and nutrition	4.36 ± 0.71	3.71 ± 0.90	30.7280	0.000***
Attitude	4.54 ± 0.59	4.22 ± 0.77	10.6958	0.030**
Overall mean Competency	4.26 ± 0.50	3.77 ± 0.64	20.1185	0.000***

Source: Our Field survey data

private and public extension workers respectively were at above average competency level in regard to their overall competency in nutrition (see Figure 4). While the private extension workers were within the least competent to the very competent level bracket, the public extension workers were distributed amongst all the competence levels including the not competent all.

Results of chi-square showed that there exists a statistically significant association between type of organization (private or public) and overall competency levels ($\chi^2 = 20.1185$, $p < 0.01$) at 95% confidence level. A higher percentage of private extension workers were in the competent and very competent level as opposed to their public sector counterparts. We therefore accept the hypothesis that there is an association between type of extension organization and nutrition education competence level of extension workers.

Extension workers' perceptions of their nutrition-related training needs

Table 3 results show that the top most rated categories for training for the private extension workers were basic nutrition knowledge and post-harvest handling and food safety ($MWDS = 1.66$). The public extension workers however perceived that training is mostly needed in the category of nutrition needs of different household members ($MWDS = 3.83$). Next to this were the categories of farming systems that conserve the environment ($MWDS = 3.59$), post-harvest handling and food safety ($MWDS = 3.34$), and basic nutrition knowledge ($MWDS = 3.19$).

The public extension workers perceived that the greatest specific training needs are 'Understanding how to prepare nutritious foods for babies children and adults' ($MWDS = 4.89$), 'Knowledge on the appropriate quantity of food for babies and children' ($MWDS = 4.63$), 'Principles of meal planning' ($MWDS = 4.33$), 'Symptoms of deficiency of the various nutrients' ($MWDS = 4.27$) and 'Understanding nutrition needs of children of various age groups' ($MWDS = 4.07$). These results show that much as extension workers in the private sector are already carrying out nutrition training among farming communities; hence there is need to prioritize providing them with nutrition education in the areas where they are less competent.

Discussion

What is the perceived nutrition training competency level of agricultural extension workers?

The findings of the study showed that both the private and the public extension workers perceived themselves to be above average competency in regard to their overall nutrition education competencies though private AEWs had higher mean scores. For the major competency areas, public agricultural extension workers were averagely competent in regard to **Nutrition needs of different household members** while both the private and public extension workers were above average competency in most (8) of the major competencies. This clearly indicates that the extension workers are not very competent in regard to most of the major nutrition education competencies and therefore may not be able to deliver well in the areas in which they are lacking. The differences in

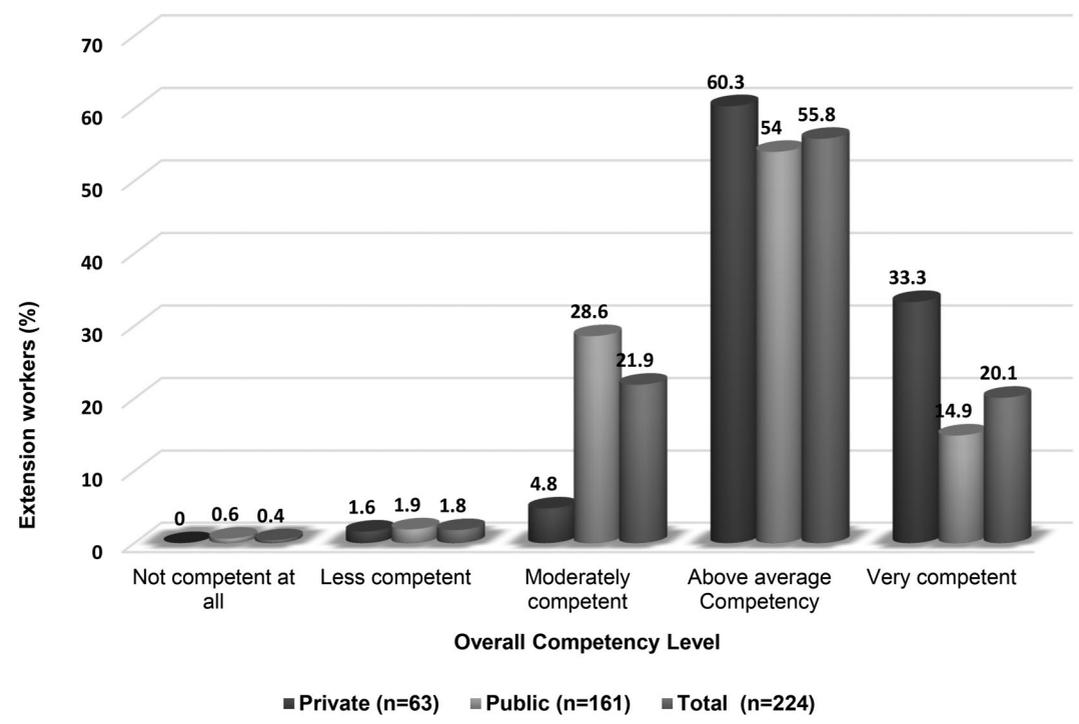


Figure 4. Distribution of overall Nutrition Competency Level of extension workers.

Table 3. Nutrition Education Competency Needs of Private and Public Agricultural Extension Workers.

Category and nutrition education items	Private				Public			
	Mean (SD) importance	Mean (SD) competence	MWDS	Rank	Mean (SD) importance	Mean (SD) competence	MWDS	Rank
Basic Nutrition Knowledge	4.62(0.60)	4.26(0.58)	1.66	1st	4.49(0.78)	3.48(1.07)	3.19	4th
<i>An Agricultural extension work should be knowledgeable about:</i>								
1. Recommended intake of different food crops by different household members	4.59(0.56)	4.16(0.81)	1.97	4th	4.34(0.86)	3.48(1.07)	3.72	3rd
2. Symptoms of deficiency of the various nutrients	4.54(0.59)	3.87(1.02)	3.03	1st	4.53(0.74)	3.58(1.03)	4.27	2nd
3. Food sources of the various nutrients	4.76(0.50)	4.35(0.77)	1.97	4th	4.66(0.66)	3.96(0.97)	3.27	4th
4. Functions of various nutrients in the body	4.65(0.57)	4.33(0.95)	1.48	6th	4.56(0.74)	3.97(0.96)	2.69	9th
5. Importance of good nutrition	4.75(0.47)	4.56(0.56)	0.90	10th	4.66(0.67)	4.12(0.89)	2.49	10th
6. Groups of people most vulnerable to under-nutrition	4.68(0.56)	4.44(0.62)	1.11	7th	4.42(0.93)	3.81(1.07)	2.72	8th
7. Causes of under-nutrition	4.54(0.80)	4.10(1.00)	2.02	3rd	4.20(0.99)	3.63(1.05)	2.40	11th
8. Causes of over-nutrition	4.79(0.45)	4.37(0.68)	2.05	2nd	4.60(0.69)	3.91(0.99)	3.17	5th
9. Balanced diet	4.79(0.45)	4.57(0.56)	1.07	8th	4.77(0.56)	4.12(0.89)	3.08	6th
10. Causes of over-nutrition (obesity and overweight)	4.41(0.84)	4.19(0.88)	0.98	9th	4.39(0.84)	3.73(1.04)	2.86	7th
11. Principles of meal planning	4.35(0.77)	3.90(1.01)	1.93	5th	4.27(0.89)	3.26(1.16)	4.33	1st
Nutrition needs of different household members	4.65(0.63)	4.31(0.69)	1.58	2nd	4.35(0.95)	3.47(0.88)	3.83	1st
<i>An Agricultural extension work should:</i>								
12. Understand the reasons why babies 0–6 months should be fed on only breast milk	4.60(0.58)	4.44(0.84)	0.72	8th	4.48(0.92)	3.90(1.03)	2.60	8th
13. Understand nutrition needs of children of various age groups	4.65(0.65)	4.27(0.92)	1.77	4th	4.49(0.77)	3.58(1.03)	4.07	3rd
14. Be Knowledgeable on the appropriate quantity of food for babies and children	4.63(0.70)	4.17(0.94)	2.11	1st	4.31(0.90)	3.24(1.20)	4.63	2nd
15. Be Knowledgeable meal frequency for babies and children	4.68(0.56)	4.29(0.96)	1.85	3rd	4.32(0.99)	3.42(1.10)	3.90	4th
16. Understand how to prepare nutritious foods for babies, children and adults	4.67(0.54)	4.25(0.92)	1.94	2nd	4.29(1.06)	3.15(1.25)	4.89	1st
17. Able link communities to organizations and actors who can provide technical advice on child spacing and birth control	4.71(0.55)	4.32(0.93)	1.85	3rd	4.30(1.06)	3.48(1.13)	3.53	6th
18. Able link communities to organizations and actors who can provide technical advice on child health	4.70(0.61)	4.43(0.76)	1.28	7th	4.28(1.00)	3.47(1.19)	3.48	7th
19. Able link communities to organizations and actors who can provide technical advice on household nutrition	4.59(0.69)	4.30(0.84)	1.32	6th	4.28(0.93)	3.47(1.11)	3.48	7th
20. Be Knowledgeable on the nutrition needs for pregnant women and breastfeeding mothers	4.60(0.79)	4.29(0.89)	1.45	5th	4.40(0.91)	3.53(1.14)	3.81	5th
Postharvest handling and food safety	4.60(0.58)	4.24(0.66)	1.66	1st	4.64(0.68)	3.92(0.79)	3.34	3rd
<i>An Agricultural extension worker should:</i>								

(Continued)

Table 3. Continued.

Category and nutrition education items	Private				Public			
	Mean (SD) importance	Mean (SD) competence	MWDS	Rank	Mean (SD) importance	Mean (SD) competence	MWDS	Rank
21. Understand Control of diseases associated with eating food having Agro chemicals residues (e.g. pesticides etc.)	4.65(0.54)	4.54(0.64)	0.52	7th	4.73(0.60)	4.12(0.88)	2.91	6th
22. Understand Control of diseases associated with eating meat and animal products having veterinary drug residues	4.67(0.51)	4.52(0.56)	0.67	6th	4.60(0.66)	3.94(0.91)	3.06	5th
23. Understand Spread and prevention of zoonotic diseases e.g. brucellosis and tuberculosis from milk and meat	4.63(0.52)	4.38(0.75)	1.18	5th	4.54(0.74)	3.77(1.03)	3.50	3rd
24. Aply demonstrate food preservation techniques using available resources	4.41(0.75)	3.97(1.15)	1.96	4th	4.66(0.72)	3.88(1.14)	3.62	2nd
25. Have Basic post-harvest handling technologies that conserve nutrients	4.59(0.61)	4.11(1.05)	2.18	2nd	4.56(0.71)	3.89(1.08)	3.06	5th
26. Have Basic techniques for prevention of molding of maize and ground nuts to avoid aflatoxin contamination	4.67(0.54)	4.21(0.88)	2.15	3rd	4.67(0.66)	3.96(1.03)	3.34	4th
27. Demonstrate to farmers Value addition to nutritious foods for income	4.57(0.61)	3.98(1.07)	2.68	1st	4.69(0.63)	3.86(1.08)	3.87	1st
Farming systems that promote Nutrition	4.56(0.63)	4.25(0.57)	1.41	3rd	4.55(0.69)	3.76(0.83)	3.59	2nd
<i>An Agricultural extension worker should be knowledgeable about:</i>								
28. Agricultural enterprises with characteristics that offer resilience to adverse conditions and help farmers to cope with food shortages	4.60(0.66)	4.35(0.77)	1.15	2nd	4.58(0.69)	3.78(0.96)	3.68	1st
29. Practices and technologies that help farmers to cope with food shortages	4.51(0.59)	4.14(0.76)	1.66	1st	4.52(0.69)	3.75(0.92)	3.47	2nd
Hygiene and sanitation	4.62(0.73)	4.49(0.60)	0.60	8th	4.35(0.94)	3.95(0.81)	1.74	8th
<i>An Agricultural extension worker should ably:</i>								
30. Demonstrate hand washing techniques to families	4.59(0.69)	4.59(0.64)	0.01	4th	4.34(0.94)	4.04(0.96)	1.31	5th
31. Demonstrate Hygienic food preparation practices	4.62(0.66)	4.51(0.67)	0.52	3rd	4.36(0.87)	3.94(1.00)	1.84	2nd
32. Advise and evaluation of kitchen and house-keeping sanitation practices	4.52(0.80)	4.33(0.84)	0.84	2nd	4.19(1.10)	3.76(1.11)	1.79	3rd
33. Demonstrate appropriate household waste disposal to farmers	4.62(0.77)	4.51(0.78)	0.52	3rd	4.48(0.83)	4.09(1.01)	1.73	4th
34. Guide in Setting up infrastructures for hygiene in homes e.g. pit latrines, rubbish pits etc.	4.75(0.72)	4.49(0.80)	1.23	1st	4.40(0.98)	3.92(1.08)	2.12	1st
Planning and resource allocation for household food and nutrition security	4.57(0.65)	4.34(0.63)	1.05	5th	4.44(0.82)	3.86(0.79)	2.58	5th
<i>An Agricultural extension worker should have:</i>								
35. Ability to estimate household food needs and plan/budget for allocation of family resources based on the context	4.19(0.91)	4.10(0.78)	0.40	6th	4.29(0.90)	3.65(1.02)	2.77	2nd
36. Ability to advise families on what crops and livestock to be produced in different regions of the country to ensure families have a balanced diet	4.56(0.67)	4.40(0.87)	0.72	5th	4.64(0.69)	4.01(0.97)	2.94	1st
37. Ability to advise families on household division of labor where all able bodied men, women, children, youth work together to ensure enough food	4.68(0.56)	4.32(0.82)	1.71	1st	4.49(0.81)	3.98(0.97)	2.29	5th
38. Ability to advise families to plan to enable timely provision of nutritious meals for all household members	4.67(0.60)	4.37(0.77)	1.41	3rd	4.33(0.86)	3.80(0.99)	2.29	5th
39. Ability to advise families to plan the quality and quantity of food they need throughout the year	4.70(0.59)	4.38(0.75)	1.49	2nd	4.43(0.86)	3.84(0.99)	2.64	3rd

40.	Ability to advise farmers on which nutritious food crops to keep back for the household members when selling	4.63(0.55)	4.48(0.72)	0.74	4th	4.47(0.77)	3.89(0.94)	2.55	4th
	Boosting family income	4.63(0.66)	4.33(0.68)	1.39	4th	4.45(0.77)	3.89(0.75)	2.49	7th
	<i>An Agricultural extension worker should be able to:</i>								
41.	Mobilize and support purposeful saving for men and women	4.54(0.78)	4.33(0.90)	0.95	5th	4.34(0.82)	3.80(0.98)	2.37	2nd
42.	Be able to advise on most profitable investments for men and women	4.70(0.56)	4.25(0.74)	2.12	1st	4.43(0.80)	3.91(0.91)	2.32	5th
43.	Understand gender issues that undermine women's capacity to save and invest	4.71(0.55)	4.41(0.84)	1.40	3rd	4.43(0.83)	3.78(1.04)	2.87	1st
44.	Ably identify organizations and actors within the community who can provide technical advice and services for credit, saving, and financial literacy for the farmers	4.54(0.67)	4.32(0.80)	1.01	4th	4.38(0.75)	3.81(0.99)	2.51	3rd
45.	Understand market oriented enterprise selection	4.67(0.72)	4.35(0.85)	1.50	2nd	4.65(0.67)	4.15(0.93)	2.33	4th
	Gender and nutrition	4.64(0.68)	4.43(0.78)	0.97	6th	4.30(0.88)	3.71(0.76)	2.54	6th
	<i>An Agricultural extension worker should be able to:</i>								
46.	Facilitate household dialogue to promote joint decision making by men and women on matters of food and use of resources	4.63(0.73)	4.37(0.77)	0.59	5th	4.16(0.99)	3.58(1.04)	2.37	3rd
47.	Facilitate community dialogues for sensitization on importance of joint decision making by men and women on matters of food and resource use	4.63(0.77)	4.37(0.94)	0.95	4th	4.18(0.96)	3.58(1.04)	2.32	5th
48.	Improve gender relations to favor agriculture production, food security and nutrition	4.67(0.62)	4.27(0.87)	2.12	1st	4.44(0.73)	3.78(1.01)	2.87	1st
49.	Sensitize communities about gender issues in nutrition	4.65(0.57)	4.43(0.76)	1.40	2nd	4.37(0.90)	3.78(1.06)	2.51	2nd
50.	Sensitize communities to promote sharing of agricultural and household roles to reduce women's workload	4.62(0.73)	4.38(0.91)	1.01	3rd	4.36(0.83)	3.82(1.05)	2.33	4th
	Attitude	4.73(0.63)	4.54(0.59)	0.90	7th	4.55(0.78)	4.22(0.77)	1.50	9th
	<i>An Agricultural extension worker should be:</i>								
51.	Respectful for people's indigenous food and cultural practices	4.70(0.61)	4.44(0.76)	0.33	1st	4.40(0.86)	4.06(0.92)	1.51	1st
52.	Willing to learn from farmers	4.76(0.64)	4.63(0.63)	1.20	2nd	4.69(0.69)	4.39(0.80)	1.43	2nd
	Overall mean competency		4.27(0.50)				3.77(0.64)		

Source: Our Field survey data

perceptions of extension workers could be explained by the fact that private AEWs were from organizations engaged in nutrition related activities in farming communities and a majority (81.0%) of these had had training in nutrition related matters as opposed to only (56.5%) for the public sector. A study on food security knowledge among extension workers in Nigeria (Adeola, Adebayo, and Akintonde 2011) found out that extension workers who had more exposure to the program were more knowledgeable compared to those that had not participated.

Since competencies are directly related to the service that the clients receive (Hughes et al. 2012), attention needs to be put to these areas in order to ensure good service delivery to farmers. AEWs are not very competent in post-harvest handling yet according to the most recent National Housing and Population Census in Uganda of 2014, the biggest (49%) source of food to households in rural areas is own farm production (UBOS 2014). Furthermore, the current levels of malnutrition and deaths related to hygiene and sanitation like diarrhoea in the country (UBOS and ICF 2017) could be reduced if agricultural extension workers were more competent to address these aspects. AEWs are not adequately skilled to sensitize and advise on gender relations at household and community levels that favor equitable participation and benefits by men and women in agriculture production, food security and nutrition of targeted smallholder family farms. In Uganda, gender relations affect food production; utilization and access to resources, and these play a key role in nutrition. This is because women who play a key role in household nutrition are disadvantaged in most societies in regard to resource access, utilization and decision making which affects household nutrition (Fanzo 2015; Fanzo et al. 2015).

Both the private and public extension workers rated themselves of highest competence in the domain of attitudes which included willingness of extension workers to learn from farmers and respect for people's indigenous food and cultural practices. This means that extension workers' attitude can enable them to interact with farmers and deliver on nutrition. Qualitative data from the FGDs revealed that farmers preferred that extension workers should be willing to learn from them because there is knowledge and practices that they have that an extension worker may be lacking but can be gained through such avenues. Fanzo et al. (2013) showed that for extension workers to train farmers in nutrition they need to be equipped with both soft and hard skills. This can help extension workers to be effective in their operations. Attitudes consequently affect performance as shown by a study on personal traits of extension workers that found out that attitudes facilitated performance of extension workers and made them successful in their work (Buadi, Anaman, and Kwarteng 2013).

What are the nutrition training needs of extension workers?

According to the Borich model (1980), training priority should be given to areas with high MWDS (Alibaygi and Zarafshani 2008; Cannon, Kitchel, and Duncan 2012). The top most rated major competency categories for training for the private extension workers were 'basic nutrition knowledge' and 'postharvest handling and food safety' (MWDS = 1.66). The public extension workers however perceived that training is mostly needed in the competencies regarding 'nutrition needs of different household members' (MWDS = 3.83). Identified basic nutrition education needed by AEWs

included among others symptoms of deficiency of the various nutrients, causes of over-nutrition, and causes of under-nutrition and principles of meal planning respectively. The needed post-harvest handling and food safety competencies were prioritized as ability to demonstrate to farmers how to add value to nutritious foods for income, possessing basic techniques for prevention of molding of maize and groundnuts to avoid aflatoxin contamination, and basic post-harvest handling technologies that conserve nutrients and ability to demonstrate food preservation techniques using available resources among others. While regarding nutrition needs of different household members, AEWs should be able to advise farmers on the appropriate quantity of food for babies and children, how to prepare nutritious foods for babies, children and adults, meal frequency for babies and children, and how to link communities to organizations and actors who can provide technical advice on child spacing and birth control among others.

The findings of this study serve as empirical evidence showing areas of focus for MAAIF in building competence of Agricultural extension workers to carry out nutrition education. This is especially when Uganda is currently making a lot of policy adjustments and prioritizing nutrition education to reduce malnutrition (FANTA 2017). The prioritized areas for training revealed in this study could guide in-service training of extension workers to aid realization of the desired policy outcomes of improved well-being and livelihoods among people (GoU 2016b; NPA 2020). The use of the Borich model in our study enabled a self assessment for AEWs within a short time, and also allowed easy execution of the analysis. This is one of the cost effective models that could aid in guiding on areas for in-service training especially with the limited finances within both private and public organizations.

Conclusions

The role of extension workers as nutrition education agents in communities has been an issue of debate especially whether their competencies matched up to this task. This study provides empirical evidence regarding nutrition education competence needs of AEWs proposing that extension workers can carry out nutrition education with development of areas of inadequacy. This could support multi-sectoral nutrition efforts and policy frameworks in Uganda. Though both private and public extension workers felt that they were above average competency level, private extension workers were at a higher level, and this can be an opportunity for inter-organizational learning to public extension workers. Secondly, Agricultural Extension Workers expressed that competence development is needed in most of these competences. Identified priority areas for training include *Nutrition needs of different household members, Farming systems that promote nutrition and Postharvest handling and food safety, Basic Nutrition Knowledge, Planning and resource allocation for household food and nutrition security, Gender and nutrition, Boosting family income, Hygiene and sanitation and Attitude.*

The authors make recommendations for training of public and private agricultural extension workers for the prioritized areas with regards to nutrition education. Private and public extension organizations should develop in-service training programs for extension workers while higher education institutions need to incorporate the competencies identified in the study into the curriculum for preparing the next generation of

extension workers. Lastly, research needs to be done on the current nutrition education competence level of tutors and lecturers training extension workers in higher institutions of learning. Since this study was a self-assessment, another study using more objective sources of information (such as supervisors' perceptions and performance tests) to assess extension workers' competencies, can be conducted for purposes of triangulation and more conclusive evidence.

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