AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

African Journal of Rural Development, Vol. 2 (2): April- June 2017: pp.213-223 ISSN 2415-2838

Determinants of household food security in a rangeland area of Uganda

B. MBOLANYI[1], A. EGERU[2] and D. MFITUMUKIZA[3]
[1]Department of Environmental Management, Makerere University, P.O. Box 7062, Kampala, Uganda
[2]Regional Universities Forum for Capacity Building in Agriculture, P.O. Box 16811, Wandegeya, Kampala, Uganda
[3]Department of Geography, Geo-informatics and Climatic Sciences, Makerere University, P.O. Box 7062, Kampala, Uganda
Corresponding Author: bmbolanyi@yahoo.com

ABSTRACT
Pastoralists and agro-pastoralists operating in the rangelands of Uganda remain food insecure. This study determined the status of household food security in Nakaseke district, Uganda. A cross-sectional survey was conducted in February 2016 among 180 randomly selected households. Two measures of food security; a Self-Reported Food Security Status Index (RFSI) and a multi-dimensional index generated through the Principal Component Analysis (PCAI) were used. Ordinary Least Squares (OLS) regressions were performed to identify important determinants. Results showed that 46.8% of the households were food insecure. The perceived peak period for food shortage was between July and August. Most households (95.1%) met their food needs through off-farm sources. Age of household head, educational level of household head, off-farm/ non-farm income, cross-breeding and livestock ownership positively influenced household food security ($p \leq 0.05$). The sex of household head, household size (AE) and absence of credit negatively influenced household food security ($p \leq 0.05$). It is proposed that a suit of actions including income diversification through participation in off-farm activities, increasing access to education, encouraging crop-livestock integration and improving livestock productivity be used to improve household food security in this rangeland area of Uganda.

Key words: Cattle corridor, food stocks, livestock ownership, pastoralism, Principal Component Analysis (PCA), Uganda

RÉSUMÉ
Les éleveurs et les agro-pastoralistes opérant dans les pâturages de l'Ouganda ont toujours des problèmes sécurité alimentaire. Cette étude a déterminé le statut de la sécurité alimentaire des ménages dans le district de Nakaseke en Ouganda. Une enquête transversale a été réalisée en février 2016 auprès de 180 ménages sélectionnés au hasard. Deux mesures de sécurité alimentaire, un indice de statut de sécurité alimentaire et un indice multidimensionnel généré à travers une analyse en composantes principales (ACP) ont été utilisés. Les régressions par la méthode des moindres carrés (MCO) ont été effectuées pour identifier les déterminants importants. Les résultats ont indiqué que 46,8% des ménages étaient dans une insécurité alimentaire. La période de pointe perçue pour la pénurie alimentaire était entre juillet et août. La plupart des ménages (95,1%) surviennent à leurs propres besoins alimentaires par des sources ne provenant pas des fermes. L'âge du chef de ménage, le niveau de scolarité du chef de ménage, le revenu non agricole, l'élevage croisé et la possession du bétail ont influencé positivement la sécurité alimentaire des ménages ($p \leq 0,05$). Le sexe du chef de ménage, la taille du ménage (AE) et l'absence de crédit ont eu une influence négative sur la sécurité alimentaire des ménages ($p \leq 0,05$). Il est proposé que la diversification du revenu grâce à la participation à des activités hors ferme, l'accès à l'éducation, la promotion de l'intégration des cultures au bétail et l'amélioration de la productivité du bétail soient utilisés comme mesures d'amélioration de la sécurité alimentaire des ménages dans la région d'étude.

Mots clés: Corridor de bovin, stock alimentaire, propriété du bétail, pastoralisme, Analyse en composantes principales (ACP), Ouganda

This article is lincenced under a Creative Commons license, Attribution 4.0 International (CC BY 4.0)

Received: 06 April 2016
Accepted: 04 February 2017
Published: 30 June 2017

INTRODUCTION

Food security is a complex multi-dimensional and nuanced phenomenon interpreted differently by diverse researchers (EIU, 2014). Amidst this diversity lies a common appreciation that food security is certainly a global concern with over 925 million people being food insecure; 900 million of whom are from developing countries with some 220 million being in sub-Saharan Africa (FAO, 2010; FAO, 2015). According to the 2015 State of Food Insecurity report, the total number of undernourished people has fallen from 18.6% in 1990-92 to an estimated 10.9% in 2014. Despite this global decrease, the Africa region has continued to register an increase in the total number of undernourished people (FAO, 2015).

This latest global assessment shows that sub-Saharan Africa remains the most pressed and food insecure region in the world. This situation is projected to continue into the foreseeable future (FAO, 2015). Accordingly, on the basis of food stocks and ability to purchase food, a closer look at Uganda reveals that nearly half of households are currently food insecure with either borderline or poor food consumption score (WFP, 2015). Further, the prices of cereals have more than doubled in Uganda in the recent past, hampering the ability of many people to meet their basic food requirements particularly in areas where food purchases are high (Ssewanyana and Kasirye, 2011). Several parts of the country particularly the semi-arid-rangeland areas of the country-commonly referred to as the 'cattle corridor' remain characterized by persistent food insecurity (Mayanja *et al.,* 2015). These areas are predisposed to extreme climatic events such as drought and floods (Egeru *et al.,* 2015; Egeru, 2016). These events in part affect the people's ability to fully recover and build a sustainable food security status (IPC, 2014).

Studies on food security in Uganda have concentrated on assessing the level of food availability and identifying the main sources of food (Nalule, 2010; Simler, 2010; Ssewanyana and Kasirye, 2011). However, food security inquiry has transcended this level of analysis and is now focusing on understanding the link to livelihoods as well as exploring other models and frameworks of analysis including the Coping Strategies Index-CSI, among others (Maxewell *et al.,* 2008). Further, three shifts in the progression of thinking about food security have been observed; the shift from the global and national to the household and individual level; the shift from a 'food first' perspective to a livelihood perspective; and the shift from objective indicators to subjective perception of food insecurity (Maxwell, 2001). These shifts have been critical in defining the directions through which food security analysis should be approached. Earlier studies identified food security determinants on a regional and national scale including among others; ownership of livestock, farmland size, labour, farm implements, off-farm activities, market access, levels of technology application, access to credit, crop diseases, rainfall and family size. In all these, the fundamental unit of analysis, the household, has often received limited focus.

This current study fills this glaring gap in Uganda with a focus on utilising the Principle Component Analysis (PCA) to capture multiple aspects of food security. The Principal Component Analysis Index (PCAI) is based on the use of selected indicators that are focused on capturing the various factors that influence household food security status. The PCAI allows all the four major dimensions of food security: food access, availability, utilisation and systems stability to be factored into the analysis (Abafita and Kim, 2014). It is hoped that the utilisation of such a multi-faceted approach will provide a more detailed and revealing analysis of the status and determinants of food security at household in a rangeland area-Nakaseke district in Uganda.

METHODOLOGY

Description of the study area. This study was conducted in a rangeland area-Nakaseke district located in central Uganda, between northings 1.13490 and eastings 32.48540. The district receives an average annual rainfall of 1300 mm that is sporadic and poorly distributed. Maximum temperature experienced is between 27.5^0C-30^0C with minimum temperature being in the range of 15^0C-17^0C annually. Minimum temperature in the district has however been rising faster than the maximum temperature thereby increasing the overall average temperature (Nakaseke District Local Government, 2012; Nimusiima *et al.,* 2013). The district has a widespread coverage of savannah grasslands with occasional occurrence and patches of woodlands. Soils in the district are generally red sandy loams that support subsistence farming. The communities in the district rear livestock (cattle, goats and sheep) and for the majority, livestock and livestock product

sales form a major source of household income.

Data collection. Data were collected through a cross-sectional household survey using a semi-structured questionnaire administered to 180 respondents. The sample size was derived based on the approach of Roscoe (1975) that provides a proportionate sample size to that of the overall population in a location. Respondents were randomly selected based on the approach of Roscoe (1975). Semi-structured questionnaires were administered by way of guided interviews. This was deemed necessary because guided interviews provide the opportunity to break-ground; establish trust and iteration of responses when dealing with respondents with low levels of formal education (Phellas *et al.,* 2011; Abafita and Kim, 2014). Participatory food security assessment was also embedded in the cross-sectional survey. A household in this study was defined based on the Uganda National Bureau of Statistics operational definition as a group of people living and eating together (UBOS, 2003).

Determination of household food security status. Food security status is quite a complex phenomenon to determine. Accordingly, this study relied on two latent approaches to decipher status of household food security. Self-report food security indicator/ index (RFSI) that describes whether there was a shortfall in food availability during the course of the year. This index was constructed from a set of responses to questions pertaining to household food availability and consumption.

The second approach is a composite index constructed using the multivariate statistical procedure called the Principal Component Analysis-PCA. This approach has previously been used in food security analysis in Ethiopia by Abafita and Kim (2014). The approach was developed by Vyas and Kumaranayake (2006). The Principal Component Analysis Index (PCAI) is based on the use of selected indicators that are focused on capturing the various aspects of household food security status. PCAI is vital because it provides the opportunity to capture the multiple dimensions of food security thus helping to address its complexity. This study utilises data from indicators providing insights into food access, availability and utilisation but does not focus on systems stability due to the limitation of the study as a cross-sectional survey.
The variables that were used to construct the PCAI were selected following Abafita and Kim (2014) and these included: land area, availability of food stocks, number of crops cultivated, ownership of cattle and access to sanitation and hygiene among others. These capture the three dimensions of household food security. A summary of some of the indicators (component loadings) is found on Table 1. These were land size, availability of food stocks, number of crops cultivated and ownership of domestic animals (cattle, goats and sheep) translated into Total Livestock Unit (TLU) with factor values for cattle (0.7) and goats and sheep (0.1).

In order to identify food secure and insecure households, food items consumed per day during the dry and wet seasons through the year were obtained from respective households. The amount reported by each household was listed and an average determined in kcal/day/AE. The households whose caloric consumption were greater than or equal to 2100 kcal/day/AE were categorized as food secure.

Upon successful identification of indicators as above, a detailed application of the PCA was then performed to re-express the multivariate data from the indicators into fewer forms. In the application of the PCA on the selected indicators, a series of components is generated with the first component explaining the largest variance in the data and subsequent components explaining additional but smaller proportion of variance in the original variables-indicators (Abafita and Kim, 2014). From the factor scores of the first principal components, a

Table 1. Summary of component loadings of selected indicators of food security

Variable	Mean	Loadings
Land size	113.1±158.1	0.33
Amount of available food stocks	0.74±0.41	1.0
Number of crops cultivated	0.2±0.11	0.207
Ownership of domestic animals	132.1±110.6	0.15

dependent variable for each household was constructed with a zero-mean and a variance equal to one. This dependent variable is what is regarded as the household's food security index (Vyas and Kumaranayake, 2006). Consequently, the PCA-based household food security index was generated using the following equation: dependent variable for each household was constructed with a zero-mean and a variance equal to one. This dependent variable is what is regarded as the household's food security index (Vyas and Kumaranayake, 2006). Consequently, the PCA-based household food security index was generated using the following equation:

$$PCAI_j = \Sigma \frac{F_i(X_{ji} - X_i)}{S_i} \quad \text{..... (1)}$$

Where PCAIj is the value of the j^{th} household's food security index obtained using PCA technique. F_i is the weight for the i^{th} variable in the PCA model, X_{ji} is the j^{th} household's value for the ith variable, and X_i and S_i are the mean and standard deviations of the ith variable over all the sampled households.

In order to identify the determinants of household food security, the household food security index generated from the PCA above were used as the dependent variables. In this regard, the following model (founded on the sustainable livelihoods framework) was then used to estimate the determinants of household food security:

$$HFS = f(H, S, P, F, N) \text{ ..... (2)}$$

Where HFS refers to household food security status; H, S, P, F, and N refer to human (labor), social (associations and groups), physical (environmental/ natural factors), financial (access to credit) and natural capital, respectively. Ordinary Least Squares (OLS) was used to estimate equation 2 so as to reveal the food security determinants at household level.

RESULTS

Demographic and socio-economic characteristics of respondents. A majority of the households (89.7%) were male headed with 94.3% being married. Results also revealed that 93.4% of the respondents had not completed primary level of education. On average a household had seven people with an average land size of 98.15±71.1 acres (1 ha =2.2 acres). Respondents owned a mixture of livestock species including cattle, sheep and goats. In addition, respondents received relatively more household income from off-farm engagements than on-farm (Table 2).

Disaggregated demographic and socio-characteristics of respondents between perceived food secure and insecure households showed variation in respondents characteristics. For example, the average age of household heads among food secure households was 49.5±11.3 years compared to 44.3±13.1 years among food insecure households. Similarly, the average household size was higher in food secure households than in food insecure households (Table 3).

Households that perceived themselves as food secure on average earned about US$ 73.34±1.6 on-farm compared to US$ 58.3±2.2 for the food insecure households per month. The variations took a similar pattern for off-farm income at US 10±0.15 compared to US$ 6.7±0.11, respectively. A majority (98.8%) of the respondents did not use inorganic fertilizers as farm input and among these 49.7% were food insecure. Further, 88.9% did not have access to credit facilities and therefore did not get any form of loans, and as such 45.6% of food insecure households did not have access to credit. In terms of livestock, on average cattle had the highest TLUs reared by the households, with an average of 45.7±11.4 and 78.4±4.6 TLU among food insecure and food secure households respectively. The variation between food secure and food insecure households in terms of TLUs for goats and sheep was similar to that of cattle (Table 3).

Perceived food security status. Over all, perceived food security was estimated at 53.2% among households against 46.8% perceived to those considered food insecure. Perceived household food security varied by household characteristics, being married improved a household's status of being food secure and similarly households with an educated head were more food secure than those with illiterate household heads. Households with limited access to farm inputs such as good seeds, fertilizers, among others, had more chances of being food insecure. Other household characteristics also varied depending on the perceived household's food security status (Table 4).

Table 2. Social and demographic characteristics of respondents

Variable	Min	Max	Mean
Age	27	78	46.5±12.2
Family size	2	11	6.5±1.16
Land size (acres)	15	1500	98.15±71.1
On-farm income ($)	45.5	939.3	65.8±1.95
Off-farm income ($)	0.3	30.3	8.4±0.1
Domestic livestock (TLU)			
Cattle	5.6	700	62.05±8
Goats	0	150	15.75±21.3
Sheep	0	11	0.08±0.8
Discrete variables			
Variable	Category	Percentage %	
Sex	Male	89.7	
	Female	10.3	
Marital Status	Not Married	5.7	
	Married	94.3	
Educational status	Literate	92.7	
	Illiterate	7.2	

Table 3. Disaggregated demographic and socio-economic characteristics of respondents

	Food secure (N=84)			Food Insecure (N=96)			
Variable	Min	Max	Mean	Min	Max	Mean	Sig.
Age	27	78	49.5 ±11.3	29	70	44.3±13.1	0.41
Family size	2	11	7.01±1.22	3	10	6.1±1.1	231**
Land size	20	1500	118.1±171.1	15	450	78.2±97.3	0.73
On-farm income ($)	60.6	939.3	73.34±1.6	45.4	333.3	58.3±2.2	-1.24*
Off-farm income ($)	1.5	30.3	10±0.15	0.3	18.2	6.7±1.1	-1.14***
Domestic livestock (TLU)							
Cattle	10.5	700	78.4±4.6	5.6	140	45.7±11.4	0.13
Goats	0	150	18.1±33.8	0	55	13.4±9.1	0.2
Sheep	0	11	0.15±1	0	6	0.02±0.6	131**

*p<0.1, **p<0.05, ***p<0.01

The results further indicated that households spent at least five months in a year without adequate food. Most affected months included; January, February, July, August and September (Figure 1). Food is perceived to be available during April, May, October and November. The perceived food shortage period commences in late November with a peak period between July and August (Figure 1). Further, food is mainly obtained from the off-farm (Figure 2) engagements throughout the year for 95.1% of the households.

Determinants of household food security. Table 5 presents results from the Ordinary Least Squares (OLS) estimation. Model I results shown in the table are based on the Self-Reported Food Security Status Index (RFSI) while model II results are based on the multidimensional household food security index that was constructed through the PCA technique (PCAI). The OLS model showed that age of household head, educational level of household head, off-farm/ non-farm income, crossbreeding and livestock ownership have significant positive influence on household food security. On the other hand, parameter estimates from the PCAI model indicate that livestock ownership, non-farm income, on-farm income, crossbreeding and livestock ownership have significant positive influence on household food security. On the other

hand, parameter estimates from the PCAI model indicate that livestock ownership, non-farm income, on-farm income, secondary level of education and age of household head had a significant positive influence on food security as measured by the PCA-based multidimensional food security index. With the exception of crossbreeding and education of household head which was significant across all levels in the OLS model, comparison of the two regressions indicates that the findings were qualitatively similar for the two models. Sex of household head, household size (AE) and inability to access credit had a significant negative influence on household food security. The rest of the variables (fertilizer use, use of improved seeds, access to market and sex of household head) were not significant. Overall, the two models (OLS and PCAI model) performed fairly well with marked improvements in estimation in the PCAI over the RFSI model.

Table 4. Differences on household characteristics by food security status

Estimated Food security status					
Food Insecure N=84			Food Secure N=96		
Variable	Frequency	%	Frequency	%	Chi-square
Sex					
Male	79	94.1	81	85.3	0.13
Female	6	5.9	14	9.7	
Marital Status					
Not Married	7	4.1	4	1.7	0.04
Married	77	45.5	92	54.4	
Educational status					
Literate (Secondary, Tertiary)	80	47.3	87	51.5	3.22**
Illiterate (None, Primary)	5	2.4	8	4.7	
Farm input					
Yes	0	0	3	1.2	0.01
No	84	49.7	93	55.1	
Credit access					
Yes	7	4.2	13	7.6	0.61
No	78	45.6	82	48.5	

*p<0.1, **p<0.05, ***p<0.01

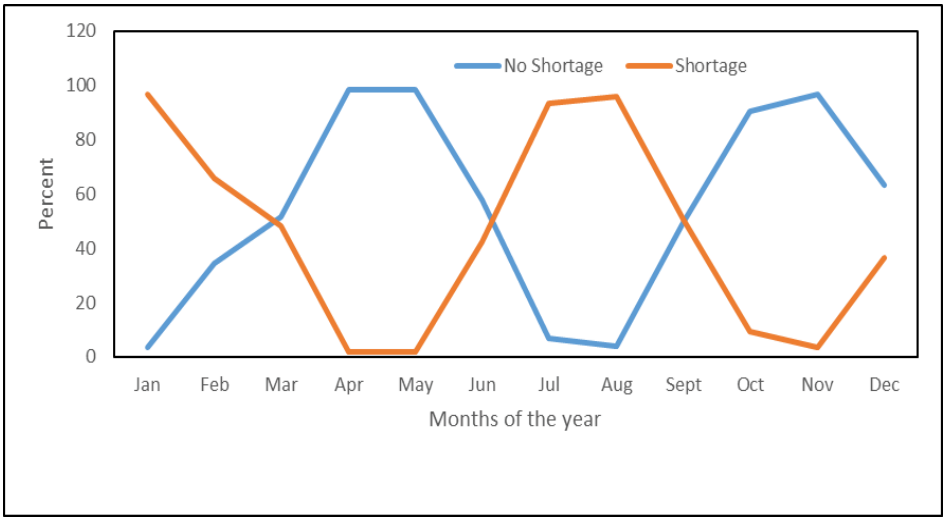

Figure 1: Perceived trend in food status throughout the year

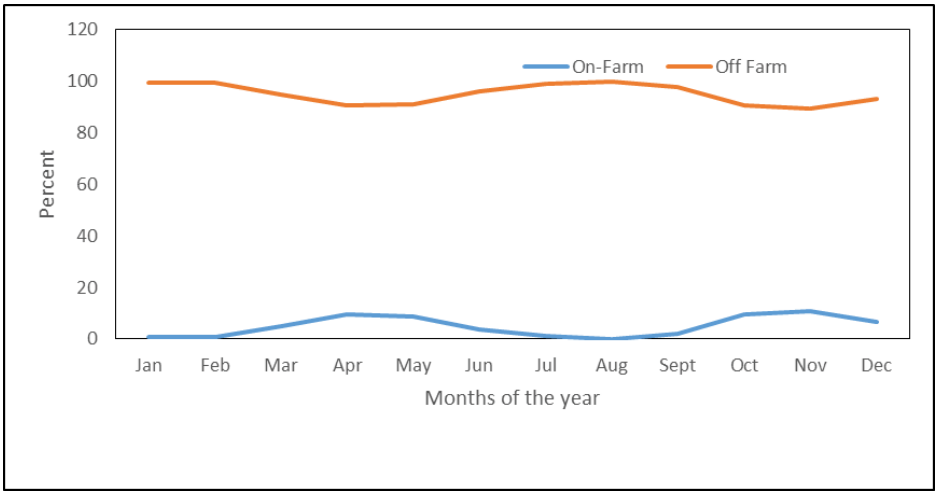

Figure 2: Perceived food sources throughout the year

Table 5. Determinants of household food security in Nakaseke, Uganda

	OLS Model (RFSI)		PCAI model	
Factor	p-values	t	p-values	t
AGEHHH	0.031*	1.144	0.015**	4.135
SEXHHH	-0.179	-2.113	-0.046**	-0.287
EDUHHH				
NONE	0.015**	4.331	-0.005	-4.703
PRIMARY	0.092**	3.001	0.074	0.416
SECONDARY	0.036**	1.623	0.002	1.523
TERTIARY	0.018	7.354	-0.012***	-11.503
AE	-0.041**	-5.313	-0.021	-5.728
NONFRINC	0.037***	8.931	0.009	1.226
ONFRINC	0.003	2.016	0.000***	1.211
FERTUSE	1.780**	0.361	0.056	1.824
IMPRSEED	0.517	1.037	0.011	1.981
CROBREED	0.016	9.281	0.068	2.107
LIVSTOWEN				
Cattle	0.021**	3.141	0.004	2.320
Goats	0.044**	7.112	0.065	0.432
Sheep	0.814	3.002	0.102	1.411
ACCEMART	0.448	0.012	0.092	0.226
RECIEVCRED	-0.028	-0.131	-0.013	-0.119
Region	Yes		Yes	
dummies_cons	-0.517	-4.882	-0.118***	-5.934
Number of observations	180		180	
Adjusted R^2	0.32		0.71	

*p<0.1, **p<0.05, ***p<0.01, Household Head (HHH), Household Size (AE), None-Farm Income (NONFRINC), On-Farm Income (ONFRINC), Fertilizer use (FERTUSE), Improved Seed (IMPSEED), Cross Breeding (CROBREED), Live stock ownership (LIVSTOWEN), Access to Markets (ACCEMART), Received Credit (RECIEVDRED)

DISCUSSION

Demographic and socio-economic characteristics of respondents. This study has shown differences in household characteristics among food secure and food insecure households. For example, the overall high average age among food secure households compared to food insecure households reveals an age-food security dimension. The average difference of about 4.5 years is a high difference between the two categories in as far as life expectancy in Uganda is concerned. This shows that in addition to good health care and education, having adequate food at household level can be a factor in improving life expectancy. According to Bremner (2012) and Asmelash (2014), having adequate access to food improves health and creates an active and a productive life; this in turn contributes to a better life expectancy. This finding further reinforces the socio-demographic belief that older persons tend to have stability in food production arising from experience accumulated over time and resources at their disposal (Arene and Anyaeji, 2010). The high average land size was inflated by some households that owned over 10 square kilometers of land in the rangelands even though most of the households had small pieces of land with some as small as 20 acres which reveals big disparities in land ownership. This is a clear demonstration of parcelisation of land in the pastoral areas that has become a recent development in the most of pastoral East Africa. The difference in household size was rather surprising, while the households perceived to be food insecure had a smaller household average. The recorded data revealed that households with more number of people had more cattle numbers, large land size and their perceived household income was similarly high. The household numbers were mainly increased by labourers who come to work on farm. Further, household numbers in the pastoral studied households arises from hosting relatives who are attracted as either labourers and/or needy persons requiring social safety nets. Additionally, a large household size has traditionally been associated with food insecurity (Bogale and Shimelis, 2009).

Perceived food security status in the rangeland area. Food insecurity in the rangeland area-Nakaseke district is high with 46.8% household perceived as food insecure. This pattern could be linked to the fact that several households meet their household food needs from off-farm sources whose acquisition is dependent on income mainly from livestock and livestock products that are highly susceptible to climate variability in the area. Climate variability affects the availability of livestock products that provide the high percentage of household income; this is a common phenomenon and occurrence in dryland and pastoral areas of East Africa (Kratli *et al.,* 2013). The overall average of food secure households (46.8%) observed in this study compares quite well to the national average of 48% food insecure households (UBOS and WFP, 2013). However, it is slightly higher than the results earlier found by Mayanja *et al.* (2015) that indicated that the district had just 33.6% of the households being food secure; the differences could be arising from methodological differences and differences in time of study.

It is however noted that the 46.8% food insecure households present a real concern. This is because projections show that overall and across Uganda, the population that is food insecure is likely to increase from around 50% to about 80% by the 2024 if the current conditions and agricultural practices continue to prevail (Rosen *et al.,* 2014). This is because factor productivity in Uganda is generally low and as such unable to increase production that can sustainably provide adequate food for the rapidly rising population in the country. Thus, action is urgently required because Nakaseke district lies within the cattle corridor of Uganda; a rangeland area experiencing unreliable rainfall and vagaries of nature that predispose the households to food insecurity (Nimusiima *et al.,* 2013). Further, nearly three quarters of farmers have had their food production decline by 94% and income by 81% following drought events particularly in the dryland areas of northern Uganda (UBOS and WFP, 2013).

This study revealed a five months' time span with limited food availability in the district. The months within which food is limited in the district correspond to the months of below normal rainfall in the district; indicating that food availability in the district has a rainfall variability coupling. Climate variability in the district triggers variations in livestock performance particularly affecting livestock production including; milk availability, livestock body conditions, carcass yield as well as prices paid per animal at live weight during sale; this translates to the inability of households to afford food as the majority of them obtain their food from off-farm sources. According to Nalule (2010) and Elhadi *et al.* (2015) when milk

reduces during the dry periods pastoral households are forced to buy less food as a result of a decrease in household income; this appears to be the pattern in Nakaseke district.

Results further indicate that households mainly obtained their food off-farm. This is clearly attributed to the culture of pastoralists and their attachment to livestock than food crops. They obtain food mainly from the sale of milk and their animals in exchange for food and other household needs. This means that negative changes in livestock will result in alteration of the food security dynamics and status. It should also be noted that the months where 95% of the households obtain their food off farm fall in the dry season. Similar findings were reported by Kratli *et al.* (2013) who also found out that food sources were influenced by seasonal variations and that pastoralist did not grow crops but rather moved from place to place in search of water and pasture.

Determinants of household food security in the rangeland area. It was established that the age of household head and household income positively influenced household food security. Age and income of household heads have traditionally been found to influence household food security for example in Ethiopia (Abafita and Kim, 2014) and generally in East Africa (Silvestri *et al.,* 2015). In the case of Nakaseke district, these factors could have contributed to food security at household level because age for example in the area is associated with better socio-economic wealth status including income and ownership of other production assets such as land; aspects of which improve a household's food wellbeing. The pattern of sociological factors positively influencing household food security status was extended to education; household heads with lack of education, predisposing the household to food insecurity. Earlier studies by Garret and Ruel (1999) and Ssewanyana and Kasirye (2010) showed that education status of household head has an impact on household food security. Although Bigsten *et al.* (2002) found that it is a mother's education level that positively influences household food security; either way, it is a household head's educational status having influence on food security. This is because from time to time women determine food production and consumption patterns at household level in Uganda.

The ability of livestock (cattle and goats) to influence food security in Nakaseke district is not surprising. This is because, this area lies within Uganda's cattle corridor where livestock forms a major source of livelihood and income. This result reinforces the argument that in pastoral and agro-pastoral areas, households with livestock herd often have a better food security status than those without and/or have become pastoral dropouts (Aschalew, 2006; Kratli *et al.,* 2013). Furthermore, the limited effect of sheep in influencing food security in the area arises from the fact that sheep is not a major livestock species in this area. This is further evidenced by the very low TLU value posted on average.

Whereas it is generally expected that a male headed household is food secure due to the providing role that men are naturally predisposed to; the result of this study showed that male headed households in Nakaseke are also prone to be food insecure. Studies in Ethiopia also found a similar sort of result (Abafita and Kim, 2014). However, the extent to which female headed households can have a significant influence on household food security is dependent on their level of access to and control over productive resources. Kassie (2014) found to the contrary that household food security is enhanced by having a male as head.

Unlike in the findings of Bigsten *et al.* (2002) and Abafita and Kim (2014) this study established that a large household size negatively influenced food security in Nakaseke district. Whereas this may not be a unique development, it reveals the holistic burden a household head with a large family size has to bare in meeting the day to day food requirements.

CONCLUSION

This study has revealed that nearly half of the households in Nakaseke district (46.8%) are food insecure with household socio-demographic characteristics varying between perceived food secure and food insecure households. Econometric analysis of results revealed that sex of household head, educational level of household head, off-farm/non-farm income, crossbreeding and livestock ownership positively influence household food security while a lower age and a household head being male negatively influence- household food security. Further, the use of RFSI and PCAI methods in estimating the determinants of household food security based on the use of selected indicators that are focused on capturing the various aspects of

household food security status shows that undertaking transformations in the manner of multivariate PCAI improves the level of confidence with which the results are estimated. It is recommended that a diversification of household livelihood sources be promoted and further enhanced and greater support provided to crop-livestock integrated production with access to production resources as a basis for ensuring a better food security in the district.

ACKNOWLEDGEMENT

The authors acknowledge the Nakaseke District authorities especially the Environment and Natural Resource and Production departments for their support throughout this work. They also share their profound gratitude to the various respondents in Ngoma, Wakyato and Kinoni Sub Counties that were interviewed when the questionnaire was being administered. Without their cooperation, this study would not have been accomplished.

STATEMENT OF NO CONFLICT OF INTEREST

The authors of this paper hereby declare that there are no competing interests in this publication.

REFERENCES

Abafita, J. and Kim, K.R. 2014. Determinants of household food security in rural Ethiopia: An Empirical analysis. *Journal of Rural Development* 37 (2): 129-157.

Arene, C. J. and Anyaeji, J. 2010. Determinants of food security among households in Nsukka metropolis of Enugu State, Nigeria. *Pak. J. Social Sci.* 30 (1): 9-16.

Aschalew, F. A. 2006. Dimensions and determinants of household food insecurity in Dire Dawa, Ethiopia. *Food Sci.Qual. Manage.* 5:19-26.

Asmelash, M. 2014. Rural household food security status and its determinants: The case of Laelamychew Woreda central zone of Tigrai, Ethiopia. *Journal of Agricultural Extension and Rural development* 6(5):162-167.

Bigsten, A, Kebede, B, Shimelis, A. and Taddesse, M. 2002. Growth and Poverty Reduction in Ethiopia: Evidence from household panel surveys. In: *World Development* 31 (1): 87-106.

Bogale, A. and Shimelis, A. 2009. Household level determinants of food insecurity in rural areas of Dire Dawa, Eastern Ethiopia. *Afr. J. Food Agric. Nutr. Dev.* 9 (9):1914-1926.

Bremner, J. 2012. Population and Food Security: Africa's Challenge. Policy Brief, Population Reference Bureau http://www.aghseagles.org/ourpages/users/mkamin/aphg_files/B%20Chapter%202:%20Population/Population%20Articles/Africa/Africa%20Population%20Food%20Security.pdf

Davereux, S. 2001. Livelihood insecurity and social protection: A re-emerging issue in rural development. *Dev. Policy Rev.* 19 (4): 507-519.

Egeru, A. 2016. Climate risk management information, sources and responses in a pastoral region in East Africa. *Climate Risk Management* 11: 1-14. doi:10.1016/j.crm.2015.12.001

Egeru, A.,Wasonga, O., Mburu, J., Yazan,E., Majaliwa, M.G., MacOpiyo, L. and Bamutaze, Y. 2015; Drivers of forage availability: An integration of remote sensing and traditional ecological knowledge in Karamoja sub-region, Uganda. *Pastoralism* 5(1): 1-18.

Ejigayhu, S.T. 2011. Determinants and dimensions of household food insecurity in Addis Ababa City, Ethiopia.MSc. Thesis, Malawi University, Zomba, Malawi.

Elhadi.Y. A., Nyariki, D. M. and Wasonga, O. V. 2015. Role of camel milk in pastoral livelihoods in Kenya: contribution to household diet and income. *Pastoralism* 5 (1): 1-8.

Garrett, L.J. and Ruel, M. T. 1999. Are determinants of rural and urban food security and nutritional status different? Some insights from Mozambique. *World Development* 27 (11): 1955-1975.

Kassie, B.M. 2014. Food security as a gender issue: why are female-headed households worse off compared to similar male-headed counterparts? CIMMYT Institutional Multimedia Publications Repository. http://repository.cimmyt.org/xmlui/bitstream/handle/10883/3397/98619.pdf

Kratli, S., Huelsebusch, C., Brooks, S. and Kaufmann,B. 2013; Pastoralism: A critical asset for food security under global climate change. *Animal Frontiers* 3 (1): 42-50.

Maxwell, S. 2001. The Evolution of thinking about food security. In: Devereux, S. and Maxwell, S. (Eds.), Food Security in sub-Saharan Africa.ITDG, London. Chapter 1 pp. 13-31.

Maxwell, D., Caldwell, R. and Langworthy, M. 2008. Measuring food insecurity: Can an indicator based on localized coping behaviors be used to compare across contexts? *Food Policy* 33(6): 533–540.

Mayanja, M.N., Rubaire-Akiiki, C., Greiner, T. and Morton, J. F. 2015. Characterizing food

insecurity in pastoral and agro-pastoral communities in Uganda using a consumption coping strategy index. *Pastoralism* 5(1): 1-14.

Nakaseke District Local Government. 2012. The district five year development plan for the period 2012/13 – 2016/17

Nalule, S. A. 2010.Social management of rangelands and settlement in Karamoja. Faculty of Veterinary Medicine, Makerere University, Kampala, Uganda.

Nimusiima, A., Basalirwa, C.P. K., Majaliwa, J.G.M, Otim-Nape, W., Okello-Onen, J., Rubaire-Akiiki, C., Konde-Lule, J. and Ogwal-Byenek, S. 2013. Nature and dynamics of climate variability in the Uganda cattle corridor. *African Journal of Environmental Science and Technology*, 7(8): 770-782.

Phellas, C.N., Bloch, A. and Seale, C. 2011. Structured methods: interviews, questionnaires and observation. Researching society and culture. 3.

Roscoe, J. T. 1975. Fundamental research statistics for the behavioural sciences. New York: Holt, Rinehart and Winston.

Rosen, S., Meade, B., Fuglie, K. and Rada, N. 2014. International Food Security Assessment, 2014-2024, GFA-25, U.S. Department of Agriculture, Economic Research Service, June 2014. http://www.ers.usda.gov/media/1499869/gfa25_final-0708.pdf

Silvestri, S., Sabine, D., Patti, K., Wiebke, F., Maren, R., Ianetta, M., Quiros, F.C., Herrero, M., Ndungu, A., Ndiwa, N., Joash, M., Claessens, L. and Rufino, M. C. 2015. Households and food security: lessons from food secure households in East Africa. *Agriculture and Food Security* 4 (1):1.

Simler, K.R. 2010; "The short-term impact of higher food prices on poverty in Uganda", World Bank Policy Research Working Study No. 5210.

Ssewanyana, S. and Kasirye, I. 2010. Food Insecurity in Uganda: A dilemma to achieving the hunger Millennium Development Goal. Economic Policy Research Centre (EPRC); Research Series No. 70.

The Economist Intelligence Unit-EIU. 2014. Food security in focus: Sub-Saharan Africa. EIU. http://foodsecurityindex.eiu.com/Resources

Uganda Bureau of Statistic (UBOS) and World Food Program (WFP) 2013. Comprehensive food security and vulnerability analysis (CFSVA) Uganda. Government of Uganda. https://www.wfp.org/content/uganda-comprehensive-food-security-and-vulnerability-analysis-cfsva-april-2013

Uganda Bureau of Statistics (UBOS). 2003. "Statistical Abstracts".

United Nations Food and Agricultural Organization (UNFAO). 2015. State of Food Insecurity Report in the world 2015. www.fao.org

Vyas, S. and Kumaranayake, L. 2006. Constructing socio-economic status indices: how to use principle components analysis. *Health policy and Planning* 21(6): 459-468.