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Determinants of gender differences in household food security perceptions in the Western and Eastern regions of Kenya

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Abstract: In addition to Intra-household resource allocations and internal dynamics of decision-making, gendered perceptions on household food security play a critical role in households' nutritional status, especially in developing countries. However, evidence on the role of gender-based perceptions on households' food security and related implications on the households' nutritional status is limited. This study examines the determinants of gender-disaggregated household food security perceptions among smallholder farming households. We used two panels of data from households in eastern and western Kenya and employ the House hold Food Insecurity Access Scale to measure perceptions of household food insecurity, and the random effects generalized ordered probit model to evaluate the determinants of security perceptions across gender. The results reveal that the factors that influence food security perceptions vary across gender. The education level of household head and the number of relatives were negatively associated with female perceptions of household food insecurity, whereas the household dependency ratio was positively associated with female perceptions of household food insecurity. In contrast, age and gender of household head were positively

ABOUT THE AUTHOR

The research contributes to the existing body of literature on the gender dimension of household food security based on data from the Adoption Pathways (AP). The project covered five countries in Eastern and Southern African countries, including Kenya. The project period was 2013–2015. In Kenya, the project was implemented CYMMYT, Egerton University and KALRO. A key project activity was to identify incentives and constraints to the adoption of sustainable agricultural practice (SAPs) in maize-legume production system. In addition, the project evaluated the impact of SAPs adoption on livelihood outcomes. The first author was a Research Assistant in the project. The second author is a Professor of Agricultural Economics at Egerton University and was the project principal investigator in Kenya. The third author is a senior lecturer of Agricultural Economics at Egerton University. He was a collaborator in the project. The fourth author is a research scientist and coordinator of the project.

PUBLIC INTEREST STATEMENT

Gender mainstreaming in economic and social activities is important in understanding the potential role of gender in addressing economic and social challenges facing the rural poor. The understanding of intra-household dynamics is the first step towards recognizing and supporting gender roles. For instance, understanding gender perceptions of household food security is important in leveraging gender roles in the reduction of food security inequality in rural areas of developing countries. Therefore, this study investigated the determinants of differences in gender perception of household food security. The results indicate that education and sex of household head, dependency ratio, participation in rural institutions, and social capital determined the differences in gender perceptions of household food security. Existing policies need to strengthen women's involvement in rural institutions by not only encouraging their participation but empowering them to take leadership positions.

correlated with male perception of household food insecurity. The findings suggest that gender matters in household food security perceptions and that the determinants of the food security perceptions vary across gender.

Subjects: Gender Studies – Soc Sci; Development Studies; Gender & Development; Population & Development; Rural Development; Economics and Development

Keywords: Gender; household; food security; food security perceptions

1. Introduction

Food insecurity remains one of the most important social and economic challenges in Sub-Saharan Africa (SSA) in the twenty-first century. The number of undernourished people and the prevalence of food insecurity increased between 2015 and 2016 despite the region having achieved significant progress in the alleviation of food insecurity since 2000 (FAO, 2017). About 22.7% of the people in SSA were undernourished between 2015 and 2016 up from about 21% in 2014 (FAO, 2017). Furthermore, the FAO food security report indicates that there was an increase in the proportion of severely food insecure people in the region. The rise in food insecurity and undernourishment is attributed to adverse climate conditions, which severely affects agricultural production. In addition, FAO attributes food security problems in the region to conflicts and a difficult global economic environment.

This paper defines food security as the physical access to sufficient and preferred food at all times by household members. Based on the scores on the Household Food Insecurity Access Scale (HFIAS) households are classified as either food secure, mildly food insecure, moderately food insecure, and severely food insecure (Ville, Po, Sen, Bui, & Melgar-Quiñonez, 2019) . Households that have access to food that meets the adopted definition of household food security are classified as food secure. Households with less uncertainty or severe experience of food insecurity are categorized as mildy food insecure. Moderately food insecure households have reduced food portions, skip meals, and have monotonous diets (Ville et al., 2019). Households that go entire day without food and some members often sleep without food are classified as severely food insecure.

Food and Agricultural Organization (FAO) echoes the importance of improvements in the agricultural sector in accelerating the momentum for food insecurity reduction in SSA. Nevertheless, this would remain elusive if the persistent gender inequality in the region is not addressed. According to the World Bank (2014) and Diiro, Seymour, Kassie, Muricho, and Muriithi (2018), women constitute asignificant proportion of SSA's farmers and contribute most of the agricultural labour. However, the slow progress towards gender equality in the region implies that women face challenges in access to land, productive assets, credit, extension services, and input and output markets, which constrain agricultural productivity (World Bank, 2014; Debela, 2017; Mukasa & Salami, 2016). In addition, women are adversely affected and vulnerable to conflicts and poverty. These challenges prevent women from exploiting the existing and emerging agricultural and non-agricultural opportunities. These affect households and communities by exacerbating poverty, food insecurity, vulnerability, and gender inequality.

In Kenya, women form the largest share of farmers and their engagement in agriculture plays a vital role in rural economies, food security and nutrition (Diiro et al., 2018; Owoo & Boakye-Yiadom, 2015; USAID, 2017). However, gender inequality, culture and less access to employment, land, and education undermine women's contribution to agricultural and non-agricultural activities. For instance, less than 5% of land in Kenya is owned by women farmers, which is attributed to cultural factors that favour men in terms of land inheritance (Young, 2012). Further, Githinji, Konstantinidis, and Barenberg (2014) observe that women in Kenya have fewer land tenure rights and own small plots, forcing them to engage in less valuable farm enterprises. These occur despite empirical evidence suggesting that women empowerment through increased participation in agricultural decision-making and land ownership yields a significant improvement in agricultural

productivity (Diiro et al., 2018). The social and economic factor that undermines women's participation in agriculture results in poverty, which, according to Yushi, Nong, and Xiaojing (2013), is the root cause of food insecurity. These result in gender disparities in food security between female-headed and male-headed households.

Kenya has witnessed unprecedented social changes that are continuously restructuring and shaping gender roles. This indicates that continued women empowerment and reduction in gender inequality would enhance the role of women in ensuring food security. Concurrent with the social changes is the shift in gender roles in ownership of productive resources and involvement in decision-making. In particular, agricultural decision-making is increasingly becoming a joint affair between men and women. Notably, the number of female-headed households is on the rise. This has been caused by the increasing focus of international development policy on the role of female gender in sustainable social and economic development (Hanjra et al., 2013). The continued implementation of policies targeted at improving gender equality is making significant progress in reducing gender disparities in livelihood outcomes.

Gender mainstreaming in agriculture and other economic activities has attracted the focus of empirical research. For instance, the study by Kassie, Ndiritu, and Stage (2014) and Sharaunga, Mudhara, and Bogale (2016) focused on the relationship between gender and food (in)security in Kenya and South Africa, respectively. Other studies have also focused on gender mainstreaming in land ownership and agricultural productivity (Owoo & Boakye-Yiadom, 2015), collective action and agriculture (Fischer & Qaim, 2012), poverty (Milazzo & Van de Walle, 2015), agricultural production (Diiro et al., 2018) and asset ownership (Doss, Summerfield, & Tsikata, 2014). Although these studies provide an understanding of gender disparities in terms of multiple outcomes, the results may be misconstrued to mean that female-headed households are worse-off or subordinated. In addition, the studies use household headship in distinguishing the gender-specific and welfare outcomes. However, headship is an inadequate indicator of gender-differentiated impacts and outcomes for it reduces gender to male or female sexes. Lastly, these studies relied on cross-sectional data which provides a snapshot of the outcomes of interest instead of dynamic outcomes.

This paper addresses the abovementioned shortcomings in recent literature. First, gender perceptions of household food security are captured by self-reported responses measured on Household Food Insecurity Access Scale (HFIAS). The paper disentangles the determinants of gender perceptions of household security. Second, this study enriches the existing literature on gender disparities in livelihood outcomes using gender-disaggregated data which allows an analysis of intra-household dynamics as reflected in the relative positions of women and men within rural households.

Gender and food security literature abound. Sraboni, Malapit, Quisumbing, and Ahmed (2014) examined empowerment-food security nexus in Bangladesh and found that women empowerment in agriculture improved household food and nutritional security. In a related study, Diiro et al. (2018) reported that women empowerment in agriculture resulted in increased maize productivity in western Kenya. In another study in western Kenya, Owoo and Boakye-Yiadom (2015) reported that female farmers with land title deeds produced significantly higher maize output than farmers without title deeds. Sraboni et al. (2014), Diiro et al. (2018), and Owoo and Boakye-Yiadom (2015) noted that women empowerment in agricultural production and income expenditure decisions, and ownership and utilization of resources increased agricultural productivity which translated into improved food and nutritional security.

Mason, Ndlovu, Parkins, and Luckert (2015) used household gender-disaggregated household data variables to analyse gendered food security statuses. There were markedly significant gendered differences in food security and livelihoods. The number of poor and vulnerable households headed by women was higher than their male counterparts. The study identified female ownership of livestock as an important pathway for reducing gender disparities in food consumption. The findings by

Mason et al. (2015) were reiterated by Kassie, Stage, Teklewold, and Erenstein (2015) who indicated female-headed Malawian households were disproportionately more food insecure than households headed by men, which they attributed to differences in asset ownership. However, Kassie et al. (2015) observed that food security gap, which was higher among female-headed households, would be reduced if females were equally endowed with productive resources as men.

Tibesigwa and Visser (2016) analysed gender food security disparities among rural and urban South African households and established that female-headed rural households were more likely to be food insecure compared to their urban counterparts. They attributed this finding to high dependency on agriculture. In a related study, Etana and Tolossa (2017) explored the unemployment-food insecurity nexus in Ethiopia and found households headed by unemployed persons were relatively more food insecure. The results reported by Tibesigwa and Visser (2016) and Etana and Tolossa (2017) are further emphasized by Zereyesus, Embaye, Tsiboe, and Amanor-Boadu (2017) study in Northern Ghana. Using feasible generalized least squares (FGLS), Zereyesus et al. (2017) found that participation in non-farm employment improved ex-ante food consumption, which significantly reduced household vulnerability to food insecurity. The findings by Tibesigwa and Visser (2016), Etana and Tolossa (2017), and Zereyesus et al. (2017) appear to suggest that employment and employment type are important determinants of gender disparities in food security.

Gendered differences in household food insecurity have also been viewed in climate change lens, with studies indicating that households headed by females are more vulnerable to climate change compared to male-headed households. This is revealed by Chandra, McNamara, Dargusch, Caspe, and Dalabajan (2017) in a study conducted in the Philippines. Chandra et al. (2017) established that men and women were affected differently by climate change. Exposure to climate change disproportionately disadvantaged women as a result of its effect on agricultural yields. Reduced agricultural yields increased food insecurity, which was more disastrous to female-headed households. Similar results were reported by Agidew and Singh (2018) in a study conducted in Ethiopia. However, in contrast to other studies herein, Agidew and Singh (2018) found that household headship and land redistribution had no significant effect on food security.

Other studies identify sociodemographic characteristics as determinants of food security. Kakota, Nyariki, Mkwambisi, and Kogi-Makau (2015) showed income and household size as significant determinants of Malawian households' food insecurity. In addition, access to climate information reduced household vulnerability to food insecurity. In another study, Omotayo, Ogunniyi, Tchereni, and Nkonki-Mandleni (2018) identified education status, age, marital status and poverty as factors that underlined food security in western Nigeria. Tiwasing, Dawson, and Garrod (2018) found that education reduced vulnerability to poverty among Pakistanis households. An important observation made by Tiwasing et al. (2018) is that selling food crops worsened household food insecurity. Furthermore, Tiwasing et al. (2018) results indicated that agricultural technology, farm size, and livestock ownership improved the probability of household food security. However, dependency ratio and household size reduced the likelihood of food security.

A conclusion can be made that there exist gender disparities in food security. However, with the exception of Mason et al. (2015), the selected studies used household headship variables which give an incomplete picture of the intra-household roles of women and men. The household headships variable does not allow measurement of the social and economic realities that reflect the lives of men and women. Second, the studies classified households as food secure and food insecure. Such classification does not adequately capture the severity of food poverty, thereby limiting the identification of severe cases of food insecurity. Furthermore, the studies relied on cross-sectional data which fails to capture the dynamic nature of food security. Hence, this study used panel gender-disaggregated data in identifying determinants of gender perceptions of household food (in)security. Panel gender-disaggregated data allow measurement of the dynamic

nature of food security and accounts for the intra-household social and economic realities. Lastly, the study used the HFIAS, which disentangles the severity of food insecurity.

2. Methodology

2.1. Sampling and data collection
The study used the Adoption Pathways (AP) project's panel dataset. Two surveys were conducted in Bungoma, Siaya, Embu, Tharaka, and Meru counties in 2013 and 2015. The first wave covered a total of 535 households while the second wave collected data from 495 households. The study sample size was determined using proportionate to size sampling approach as propounded by Groebner and Shannon (2005). The data were collected by the International Maize and Wheat Improvement Centre, Egerton University, and Kenya Agricultural and Livestock Research Organization. The two waves provided detailed information on household demographic characteristics, consumption expenditure, food security, location, incomes, agricultural output, decision-making, credit and other institutional information.

2.2. Food security categories
This study measured household food insecurity using self-reported food security data that were scored on the HFIAS. The HFIAS consists of two types of questions; the occurrence question and the frequency-of-occurrence question (Coates, Swindale, & Bilinsky, 2007). The occurrence question is split into nine questions that capture the household experience of food insecurity. Each occurrence question has a corresponding frequency-of-occurrence question. The frequency-of-occurrence question captures the frequency of household food (in)security situations. Households were grouped into four food security levels, depending on their HFIAS responses, where 1 represented food-secure households. Turning to food insecurity, households were assigned 1 if they were mildly food insecure. Values 3 and 4 represented moderate and severe food insecurity, respectively.

2.3. Empirical model
The outcome variable is ordinal, implying that there exists relative ordering of food security. In this circumstance, an ordered probit model is appropriate for estimating the determinants of gender perceptions of household food (in)security. The ordered probit model assumes that there exist cut-offs between the ordinal outcomes, but the distance between them is not exact. Hence, following Pfarr, Schmid, and Schneider (2010), consider four observed categories of self-reported food security status with y^* as the underlying latent food security status. Thus, letting y be the ordered categorical outcome, a cross-section ordered probit model is written as:

$$\Pr[y \leq j|x] = F(\kappa_j - x'\beta) \qquad j = 1, \ldots, J \qquad (1)$$

where κ_j and β are unknown threshold parameters and coefficients, respectively, and J is a vector of distinct ordered categories. The function F denotes a cumulative standard normal distribution. The discrete outcomes are explained by a vector of x covariates. Introducing the latent variable y^* into Equation (1) results in:

$$y = j \quad \text{if and only if} \quad \kappa_{j-1} \leq y^* = x'\beta + u < \kappa_j \qquad (2)$$

where u is the unobserved disturbance term that, together with observable factors x influences the latent variable.

The interpretation of the threshold is that it divides the linear slopes into J categories. $u\ x$, The ordered model as specified in Equation (2) assumes a zero mean and a constant variance.

The probability that the respondent's self-reported food security status would be one out of the possible four, which can be written in the form:

$$\Pr[y \leq j|x] = F(\kappa_j - x'\beta) - F(\kappa_{j-1} - x'\beta) \qquad (3)$$

However, according to Pfarr et al. (2010), the standard ordered probit model (specified in Equations (1) through (3)) is anchored on parallel-lines assumption. The assumption is that the parameter estimates are constant between the categories. This implies that the parallel-lines assumption ignores the possibility of heterogeneity of some of the independent variables. Generalized ordered probit is appropriate when the parallel-lines assumption is violated. According to Pfarr et al. (2010), the generalized ordered probit model assumes that the threshold parameters depend on covariates such that:

$$\kappa_j = \tilde{\kappa}_j + x'\gamma_j \tag{4}$$

where γ_j are the coefficients of threshold covariates. Introducing the threshold Equation (4) into (3) leads to a cumulative probability of generalized ordered probit model, hence:

$$\Pr[y \leq j|x] = F(\tilde{\kappa}_j + x'\gamma - x'\beta) = F(\tilde{\kappa}_{j-1} - x'\beta_j) \qquad j = 1,...,J \tag{5}$$

Equation (5) estimates $J-1$ binary probit models which allow further estimation of $x'\beta_j$ for each distinct category j. Thus, the generalized ordered probit model accounts for parameter heterogeneity (Pfarr et al., 2010).

Turning to the nature of the data used in this study, random effects (RE) generalized ordered probit model would be appropriate for fitting the determinants of gendered food security. Let the ordinal variable of household food security take the values j = 1,...., J. The RE generalized ordered probit model is such that:

$$\Pr(Y_{it} = 1|x_{it}, \alpha_i) = F(-x'_{it}\beta_1 - \alpha_i)$$
$$\Pr(Y_{it} = j|x_{it}, \alpha_i) = F(-x'_{it}\beta_1 - \alpha_i) - F(-x'_{it}\beta_{y-1} - \alpha_i) \qquad j = 2,...,J-1 \tag{6}$$
$$\Pr(Y_{it} = J|x_{it}, \alpha_i) = 1 - F(-x'_{it}\beta_{J-1} - \alpha_i)$$

Additionally, compared to the standard cross-section generalized ordered probit model, RE generalized ordered probit model "outcome probabilities are conditional on the individual effects (α)" (Pfarr et al., 2010, p. 5). Furthermore, the model assumes a zero mean and a constant variance. The outcome variable in Equation (6) is gender self-reported perceptions of household food security. The independent variables, denoted by x_{it}, include demographic, institutional, and social networks and capital. The expectation of the study was that demographic variables would either have a positive or negative effect on gender perceptions of food insecurity. Additionally, institutional factors (credit and savings) and social network and capital (relatives and group membership) were expected to be positively associated with gender perceptions of food insecurity.

3. Results and discussion

3.1. Descriptive results

Table 1 provides descriptive statistics of continuous household characteristics. These variables were not gender disaggregated. The average ages of household heads in 2013 and 2015 were 52 and 53 years, respectively. Household heads had averagely 8 years of education across the two panels. This indicates that household heads had at least primary level education. The average household stock of education was 36 years across the 2 years. The overall household size in adult equivalent terms was five members. Additionally, the household dependency ratio remained at 1 across the years. The tropical livestock units reduced from an average of 1.4 in 2013 to 1.34 in 2015. Lastly, households earned approximately KES 84,384 ($ 840) in 2013 and KES 83,559 ($ 835) as off-farm income per annum.

The results in Table 2 show that female and male respondents saved approximately KES 17,513 ($175) and KES 22,112 ($221) per annum on average, respectively. The difference in savings between female and male respondents was significantly different at 5%. The amount of credit for females was KES 11,299 ($112) compared to approximately KES 13,787 ($137) for their male

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Table 1. Descriptive statistics of continuous household characteristics						
	2013 (N = 796)		2015(N = 490)		Overall (N = 490)	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age of household head	52.13	13.85	54.26	13.73	52.94	13.84
Education of household head	8.23	3.64	8.23	3.83	8.23	3.71
Household education stock	35.80	19.74	35.58	18.96	35.71	19.44
Adult equivalent household size	5.05	2.31	4.76	2.11	4.93	2.24
Dependency ratio	1.00	0.95	0.97	0.94	0.99	0.94
Tropical livestock units	1.40	1.46	0.68	1.34	1.12	1.46
Off-farm income (KES)	84385	139853	83559	154751	84071	145650

Table 2. Descriptive statistics of continuous variables disaggregated by gender					
	Female (800)		Male (486)		
Variables	Mean	Std. Dev.	Mean	Std. Dev.	t-value
Savings	17,513	39,621	22,112	41,963	−1.974**
Credit	11,299	35,980	13,787	39,647	−1.156
Participation in rural institutions	0.15	0.12	0.17	0.11	−2.929***
Number of relatives	11.89	17.61	15.18	22.76	−2.902***
Number of non-relatives	15.61	29.82	20.98	46.17	−2.533**
Number of grain traders	8.59	7.82	9.92	7.95	−2.922***

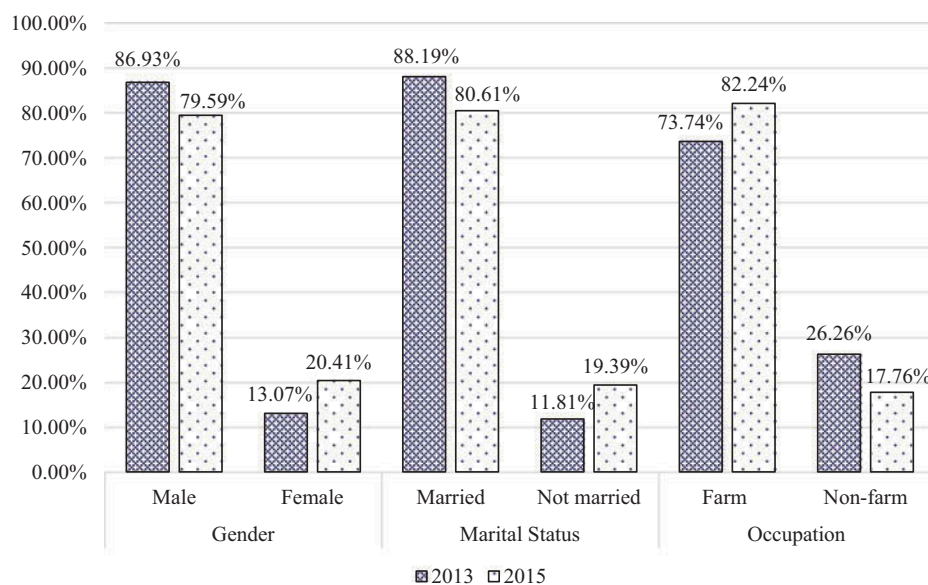**Figure 1. Proportions of the gender of household head, marital status, and occupation by year.**

Table 3. Proportions of female and male perceptions of household food security by year.				
	2013		**2015**	
	Female	**Male**	**Female**	**Male**
Food Secure	22.27	24.78	45.87	41.73
Mildly Food Insecure	12.25	15.85	11.97	13.67
Moderately Food Insecure	35.63	33.14	15.67	20.14
Severely Food Insecure	29.84	26.22	26.5	24.46

counterparts. The difference in access to credit by gender was insignificant. The female level of participation in rural institution (0.15) was significantly lower than males' levels of participation (0.17). The average number of relatives, non-relatives, and grain traders known to the female and male counterparts were significantly different as indicated in Table 2.

Figure 1 provides results of the gender of the household head, marital status, and occupation of the respondents by year of study. Approximately 87% and 13% of the households were male- and female-headed in 2013, respectively. The proportions of households that were male- and female-headed in 2015 were 80% and 20%, respectively. Turning to marital status, about 88% and 81% of the respondents were married in 2013 and 2015, respectively. A majority of the respondents (73% in 2013 and 82% in 2015) had farming as their main occupation. However, about 26% and 18% of the respondents indicated that their main occupations were off-farm activities in 2013 and 2015, respectively.

Table 3 shows gender perceptions of household food security across years. The results show that approximately 22% and 25% of female and male respondents perceived their households as food secure in 2013, respectively. The proportion of households that were food secure increased to 46% and 41% in 2015 as perceived by female and male respondents, respectively. Approximately 12%, 37%, and 30% of the female respondents perceived their households to be mildly, moderately, and severely food insecure in 2013, respectively. The proportions of female respondents who perceived their households as mildly, moderately, and severely food insecure in 2015 dropped to about 12%, 16%, and 27%, respectively. Turning to male perceptions, approximately 16%, 33%, and 26% of the male respondents perceived their households as mildly, moderately, and severely food inse-cure in 2013. Like their female counterparts, the proportions of males who perceived their house-holds as mildly, moderately, and severely food insecure reduced to 14%, 20%, and 24%, respectively.

3.2. Econometric results

First, the standard RE ordered probit model for male equation was estimated. The results show five significant variables (age of household head, household stock of education, dependency ratio, asset value, and location) for the male equation. The standard RE ordered probit model for the female equation results showed nine significant variables (education of household head, household stock of education, adult equivalent household size, dependency ratio, number of relatives, group participa-tion, asset value, credit, and location).

Second, constrained and unconstrained variables were identified for purposes of testing parallel-lines assumption. This was performed by applying the autofit procedure. The null hypotheses of equal coefficients are rejected for the variables adult equivalent household size and log of off-farm income for the male model, and variables adult equivalent household size, participation in rural institutions, and log of asset value for the female model. Specification test for male full model with constraints (global Wald χ^2 = 36.48; p = 0.2683) is insignificant, suggesting that RE generalized ordered probit model does not violate the parallel-lines assumption. The female model's

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Table 4. RE generalized ordered probit estimates of male perceptions of household food security						
	Mildly FI		**Moderately FI**		**Severely FI**	
Variable	**Coef.**	**SE.**	**Coef.**	**SE**	**Coef.**	**SE.**
Age of household head	0.015***	0.006	0.015***	0.006	0.015***	0.006
Education of household head	0.004	0.026	0.004	0.026	0.004	0.026
Household education stock	−0.030***	0.008	−0.030***	0.008	−0.030***	0.008
Adult equivalent household size	0.402***	0.075	0.388***	0.072	0.281***	0.068
Dependency ratio	−0.056	0.074	−0.056	0.074	−0.056	0.074
Gender of HH head (0 = Female, 1 = Male)	0.601*	0.362	0.601*	0.362	0.601*	0.362
Marital status (1 = Married, 0 = Not married)	−0.142	0.243	−0.142	0.243	−0.142	0.243
Primary occupation(1 = Agric. 0 = non-agric.)	−0.002	0.040	−0.002	0.040	−0.002	0.040
Number of relatives	−0.001	0.003	−0.001	0.003	−0.001	0.003
Number of non-relatives	−0.002	0.001	−0.002	0.001	−0.002	0.001
Number of traders	0.004	0.008	0.004	0.008	0.004	0.008
Participation in rural institutions	−0.372	0.569	−0.372	0.569	−0.372	0.569
Log of value of household assets	−0.112**	0.048	−0.112**	0.048	−0.112**	0.048
Tropical livestock unit	−0.049	0.045	−0.049	0.045	−0.049	0.045
Log of savings	−0.016	0.015	−0.016	0.015	−0.016	0.015
Log of credit	0.010	0.013	0.010	0.013	0.010	0.013
Log of off-farm income	0.006	0.016	−0.014	0.016	−0.054***	0.018
Location (0 = Western, 2 = Eastern)	−0.460***	0.149	−0.460***	0.149	−0.460***	0.149

Observations = 486; Wald χ^2 = 80.24, p = 0.000 Note: ***, **, * represent statistical significance at 1%, 5% and 10% levels.

specification test also suggests that the parallel-lines assumption is not violated (global Wald χ^2 = 26.82; p = 0.6330).

The model's statistics, Wald χ^2 = 80.24; p = 0.000 for male and Wald χ^2 111.93; p = 0.000 for female, are significant meaning that the RE generalized ordered probit model fits data well. Tables 4 and 5 present RE generalized ordered probit estimates of male and female perceptions of household food security, respectively. Six and 10 variables were significantly associated with male and female perceptions of household food (in)security, respectively. However, the levels of significance of variables differed across food security categories and gender equations. These results can be construed to imply that different factors influence male and female perceptions of household food security. In addition, as presented in Tables 1 and 2, adult equivalent household size and value of household assets are highly significant for all food security categories. However, the magnitude of their partial effects is different, suggesting differences in determinants influencing gender perception of household food security.

In Table 4, coefficients of the age of household head, household education stock, adult equivalent household size, and region are significant at 1% significance level throughout the three food insecurity categories. Gender of household head is slightly significant throughout male model's

Table 5. RE generalized ordered probit estimates of female perceptions of household food security						
	Mildly FI		**Moderately FI**		**Severely FI**	
Variable	**Coef.**	**SE.**	**Coef.**	**SE**	**Coef.**	**SE.**
Age of household head	0.001	0.004	0.001	0.004	0.001	0.004
Education of household head	−0.053***	0.020	−0.053***	0.020	−0.053***	0.020
Household education stock	−0.016***	0.006	−0.016***	0.006	−0.016***	0.006
Adult equivalent household size	0.220***	0.050	0.214***	0.049	0.145***	0.048
Dependency ratio	0.136**	0.067	0.136**	0.067	0.136**	0.067
Gender of HH head (0 = Female, 1 = Male)	−0.174	0.215	−0.174	0.215	−0.174	0.215
Marital status (1 = Married, 0 = Not married)	0.013	0.242	0.013	0.242	0.013	0.242
Primary occupation(1 = Agric. 0 = non-agric.)	0.042	0.033	0.042	0.033	0.042	0.033
Number of relatives	−0.008*	0.005	−0.008	0.005*	−0.008*	0.005
Number of non-relatives	0.003	0.003	0.003	0.003	0.003	0.003
Number of traders	−0.005	0.006	−0.005	0.006	−0.005	0.006
Participation in rural institutions	2.154***	0.520	1.413***	0.506	0.483	0.563
Log of value of household assets	−0.090**	0.042	−0.183***	0.041	−0.126***	0.042
Tropical livestock unit	−0.035	0.036	−0.035	0.036	−0.035	0.036
Log of savings	−0.009	0.012	−0.009	0.012	−0.009	0.012
Log of credit	0.030***	0.011	0.030***	0.011	0.030***	0.011
Log of off-farm income	−0.020*	0.012	−0.020*	0.012	−0.020*	0.012
Location (0 = Western, 1 = Eastern)	−0.253**	0.117	−0.253**	0.117	−0.253**	0.117

Observations = 800; Wald χ^2= 111.93, p = 0.000.

Note: ***, **, * represent statistical significance at 1%, 5% and 10% levels.

food security categories. The coefficient for the log of the value of household assets is significant at 5% across the three food security categories, while the log of off-farm income is significant at 1% but only for severe food insecurity.

In Table 5, education of household head, household stock of education, adult equivalent household size, and log of credit are significant at 1% level throughout the food insecurity categories. Dependency ratio and region are significant at 5% level while number of relatives and log of off-farm income are slightly significant across all food security categories. Whereas the log of the value of household assets is significant at 5% for mild food insecurity, it is significant at 1% level for moderate and severe food insecurity statuses. Lastly, participation in rural institutions was significant at 1% level but only for mildly and moderately food insecure statuses.

The age of the household head was positively associated with the male respondents' perception of household food insecurity. In particular, an increase in the age of household head increased the possibility of male respondents perceiving households as mildly, moderately, and severely food insecure. This suggests the diminishing contribution of household heads to household food security or welfare as they age. Age possibly reduced the productive potential of household heads in stimulating the capacity of households to overcome food insecurity. An increase in the age above

a given level may have reduced the economic contribution of individuals to welfare improvements. This finding is similar to results reported by Yahaya, Pokharel, Alidu, and Yamoah (2018) and Oluwatayo and Ojo (2019) who found that the age of the household was important in explaining food insecurity in north-western Ghana and Nigeria, respectively.

The direction of the relationship between the education level of household head and female perception of household food security was negative and statistically significant. This finding suggests that education reduces the likelihood of female respondents perceiving households as food insecure. Higher levels of education possibly enhanced knowledge and innovativeness of household heads which gave them the opportunity to access productive resources. In turn, access to productive resources allowed households to, directly and indirectly, improve household food security. This finding is concurrent with Fiaz, Noor, and Aldosri (2018) results that argued that improving food security requires educated farmers who are ready to update their knowledge in agriculture.

Household education stock was negatively associated with the likelihood of male and female respondents perceiving households as severely, moderately, and mildly food insecure. However, the magnitude of the effect of the household stock of educations for the male equations was −0.030 which is almost twice the magnitude of female equations (−0.016). This finding suggests that household stock of education influences gendered perceptions of household food security. A higher level of education reduced the chances of male and female respondents perceiving households as severely, moderately, and mildly food insecure. In other words, respondents were likely to report a higher status of food security with each additional year of the household stock of education. A higher stock of education implies that household members are more knowledgeable and aware of the importance of securing a higher food security status. In addition, households with a higher stock of education are possibly more productive and efficient, which could directly benefit households in terms of improved food security. Mutisya, Ngware, Kabiru, and Kandala (2016) and Zhou et al. (2017) reported similar results in studies conducted in Kenya and Pakistan, respectively.

The adult equivalent household size was positive and significant throughout the food security categories for male and female responses. This implies that large household size increases the likelihood of food insecurity. These results suggest that the larger the household size, the higher the probability of food insecurity. The large food requirement by large-sized households may represent a significant burden of feeding household members. This result agrees with findings reported by Mensah, Aidoo, and Tuffour (2013), Mango, Zamasiya, Makate, Nyikahadzoi, and Siziba (2014) and Tiwasing et al. (2018) in Ghana, Zimbabwe, and Thailand, respectively.

The dependency ratio was positively associated with female respondents' perceptions of household food security. The interpretation of this finding is that a higher dependency is associated with a high probability of female respondents perceiving households as mildly, moderately, or severely food insecure. In other words, the dependency ratio reduces the chances of females perceiving households as food secure or increases the chances of households being in lower levels of food security. Rising dependency ratio possibly negated household labour productivity growth, thereby increasing the burden on economically active household members. These may have made the provision of adequate and quality food difficult as a result of the negative effect of dependency on consumption.

The gender of household head was positive and statistically significant in determining male respondents' perceptions of household food security. Relative to households headed by females, male-headed households were perceived to be more likely to remain in their current food insecurity status or be in a higher category of food insecurity status. This finding suggests that female household heads provide a critical buffer against food consumption shortfalls, allowing households to be food secure. The finding also suggests that households with female heads give more priority

to improving food security. The finding could also be attributed to female-headed households being the de facto type of headship. These could have given women autonomy in decision-making, resulting in positive food security outcomes. This result contradicts findings by Kassie et al. (2014) who established that households headed by females were likely to negatively perceive their households as food secure compared to the male-headed counterparts.

Kinship ties, as proxied by the number of relatives, was negatively and significantly associated with the female perception of household security. The number of relatives reduced the likelihood of female respondents perceiving households as mildly, moderately, or severely food insecure. Put differently, female respondents with a high number of relatives living within and outside the village were at a higher chance of associating the household to be in a lower category food insecurity status. This finding implies that kinship ties offer distinct mutual social relationships that support women by helping them starve the likelihood of severe food insecurity. Supposedly, women received food such as cereals and groceries from relatives, which positively influenced their perception of household food security. This result reemphasizes Cox and Fafchamps (2008) position that extended families offer support to households during hardship times, enabling such households to sustain their consumption.

The log of the value of household assets was negative and significantly associated three the categories food insecurity for male and female equations. The coefficient estimates of the log value of household assets were −0.112 for the male equations and ranged from −0.090 to −0.183 for the female equations. This can be interpreted that assets are more important in determining female perceptions of household food security as compared to male perceptions of household food security. Assets are important resources for smoothing household food consumption by preventing periodic food shortages. The negative direction of the relationship between asset ownership and household food insecurity perceptions could be attributed to the ease of converting assets directly into cash and then exchanging cash for food. The households may have also been able to employ the assets as economic capital over the years, which generated income that was used to acquire food. This result is consist with earlier findings by Guo (2011) and Reincke et al. (2018) who established a positive association between asset ownership and food security. The higher magnitudes of the log of value of household assets for women food security equations affirm earlier conclusion by Kassie et al. (2015) that endowment of women with productive resources would substantially reduce gender food security gaps.

Contrary to expectations, female perceptions of household food security were positively influenced by the amount of credit received. An increase in the amount of credit received over the 2 years increased the likelihood of female respondents perceiving households as food insecure. This could be attributed to the burden of servicing the credit. Credit repayment could have, to a large extent, deviated income from food consumption. The positive relationship could also be explained by investment choices by households that may have resulted in poor returns or credit advances that were insufficient to sustain investments. These could have negatively affected female respondents' perceptions of the role of credit in household food security. Similar results were reported by Ngema, Sibanda, and Musemwa (2018) in a study in a local municipality in South Africa. They explained that households possibly relied on informal credit, which attract exorbitant rates. However, in a study in western Nigeria, Ibrahim, Adeola, and Ibrahim (2016) found that an increase in access to credit reduced the chances of households being moderately food insecure.

The log of off-farm income was negatively associated with female perceptions of households as mildly, moderately, and severely food insecure, but only significantly associated with male perceptions of households as severely food insecure. In other words, off-farm income reduced the likelihood of female respondents perceiving households as mildly, moderately, and severely food insecure. Instead, off-farm income increased the chances of households being in lower categories of food insecurity. This finding is a reflection of the importance of off-farm income in enabling households to procure food directly through purchases. This could also be explained by the

possibility that households with diverse off-farm sources can invest in agricultural production through the acquisition of farming technologies which, in turn, translates into increased food production. The direct role of off-farm income in food acquisition together with its agricultural productivity effect possibly sustained food security for the already food-secure households. In addition, it possibly enabled food insecure households to improve their food security statuses over the years. This finding is in line with the study results reported by Mishra, Mottaleb, and Mohanty (2015) in Bangladesh, Ibrahim et al. (2016) in Nigeria, and Ahmed, Ying, Bashir, Abid, and Zulfiqar (2017) in Pakistan.

Unexpectedly, the effect of women participation in rural institutions was positively associated with female respondents' perceptions of household as mildly and moderately food insecure. The finding appears to imply that the level of women participation in rural groups increases the probability of female respondents perceiving households as mildly and moderately food insecure. This could be attributed to the possibility that group membership may not have adequately resulted in expected benefits. Second, participation in more rural groups could have negatively impacted on women's allocation of time to productive economic activities that may have substantially affected food availability to households. These results are in contradiction to finding by Tibesigwa, Visser, Collinson, and Twine (2016) and Sseguya, Mazur, and Flora (2018) who reported a strong positive association between group membership and food security in rural South Africa and Uganda, respectively.

Finally, the location characteristic was negatively associated with male and female perceptions of the household food (in)security. The magnitude of regions' influence on food security percep-tions for male equations (−0.460) was almost 1.8 times larger than the females' coefficients (−0.253) in absolute terms. Compared to male and female respondents in Bungoma and Siaya, female and male respondents in eastern counties (Meru, Tharaka Nithi, and Embu) were less likely to perceive the households as mildly, moderately, and severely food insecure. This finding reflects regional differences in food insecurity. This can be attributed to interrelated and complex issues such as social, economic, environmental, and political factors. The variation of these factors over time and space, possibly, directly and indirectly, affected household participation in productive activities which explained differences in perceptions of household food security.

4. Conclusion and recommendations

Household food security perceptions differ across gender and space. The effects of the determi-nants for this difference also vary in both magnitude and significance. Moreover, household food security policy interventions could be made most effective in reaching the targetedmembers of the household through better understanding of the internal dynamics of decision-making within the households, and more importantly the inherent or latent perceptions that inform the decision-making outcomes. Whereas household size positively influenced gender perceptions of food insecurity, household stock of education, household asset value and location were negatively associated with gender perceptions of household food insecurity. Male and female respondents in the eastern region were less food insecure compared to their counterparts in the western region. The education level of household head and dependency ratio were negatively and positively associated with female perceptions of food insecurity, respectively. On the other hand, age and gender of household head were positively correlated with male perception of household food insecurity. These results have implications regarding gender disparity in household food security perceptions and gaps, especially in Kenya First, there is a need to strengthen women social capital by enhancing their active involvement and decision making. Second, there is a need for creating a rural economic environment that would attract and encourage women participation in off-farm income generating activities. Gender-sensitive financial and lending institutions would reduce barriers of access to credit for investments in off-farm economic activities.

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References
Agidew, A. M. A., & Singh, K. N. (2018). Determinants of food insecurity in the rural farm households in South Wollo zone of Ethiopia: The case of the Teleyayen sub-watershed. *Agricultural and Food Economics, 6* (10), 1–23. doi:10.1186/s40100-018-0106-4

Ahmed, U. I., Ying, L., Bashir, M. K., Abid, M., & Zulfiqar, F. (2017). Status and determinants of small farming households' food security and role of market access in enhancing food security in rural Pakistan. *PloS One, 12*(10), 1–15. doi:10.1371/journal.pone.0185466

Chandra, A., McNamara, K. E., Dargusch, P., Caspe, A. M., & Dalabajan, D. (2017). Gendered vulnerabilities of smallholder farmers to climate change in conflict-prone areas: A case study from Mindanao, Philippines. *Journal of Rural Studies, 50*, 45–59. doi:10.1016/j.jrurstud.2016.12.011

Coates, J., Swindale, A., & Bilinsky, P. (2007). *Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide*. Washington, DC: Food and Nutrition Technical Assistance Project.

Cox, D., & Fafchamps, M. (2008). Extended family and kinship networks: Economic insights and evolutionary directions. In T. P. Schultz & J. Strauss (Eds.), *Handbook of development economics* (pp. 3712–3776). Burlington, MA: Elsevier.

Debela, B. L. (2017). Factors affecting differences in livestock asset ownership between male-and female-headed households in Northern Ethiopia. *The European Journal of Development Research, 29*(2), 328–347. doi:10.1057/ejdr.2016.9

Diiro, G. M., Seymour, G., Kassie, M., Muricho, G., & Muriithi, B. W. (2018). Women's empowerment in agriculture and agricultural productivity: Evidence from rural maize farmer households in western Kenya. *PloS One, 13*(5), 1–27. doi:10.1371/journal.pone.0197995

Doss, C., Summerfield, G., & Tsikata, D. (2014). Land, gender, and food security. *The Feminist Economics, 20*(1), 1–23. doi:10.1080/13545701.2014.895021

Etana, D., & Tolossa, D. (2017). Unemployment and food insecurity in urban Ethiopia. *African Development Review, 29*(1), 56–68. doi:10.1111/1467-8268.12238

FAO. (2017). *Africa regional overview of food insecurity and nutrition*. Retrieved from http://www.fao.org/3/a-i7967e.pdf

Fiaz, S., Noor, M. A., & Aldosri, F. O. (2018). Achieving food security in the kingdom of Saudi Arabia through

innovation: Potential role of agricultural extension. *Journal of the Saudi Society of Agricultural Sciences, 17*, 365–375. doi:10.1016/j.jssas.2016.09.001

Fischer, E., & Qaim, M. (2012). Gender, agricultural commercialization, and collective action in Kenya. *Food Security, 4*(3), 441–453. doi:10.1007/s12571-012-0199-7

Githinji, M., Konstantinidis, C., & Barenberg, A. (2014). Small and productive: Kenyan women and crop choice. *Feminist Economics, 20*(1), 101–129. doi:10.1080/13545701.2013.878467

Groebner, D.F., & Shannon, P.W. (2005). Business statistics.*A decision making approach*. Upper Saddle River, NJ: Prentice hall publishers.

Guo, B. (2011). Household assets and food security: Evidence from the survey of program dynamics. *Journal of Family and Economic Issues, 32*(1), 98–110. doi:10.1007/s10834-010-9194-3

Hanjra, M. A., Zafar, M. I., Batool, Z., Nawaz, N., Maann, A. S., Ayawel, Z., & Alemu, B. A. (2013). Gender mainstreaming for food security and poverty reduction programs in Asia and Africa. In M. A. Hanjra (Ed.), *Global food security: Emerging issues and economic implications* (pp. 245–272). Hauppauge, NY: Nova Science Publishers, Inc.

Ibrahim, H. Y., Adeola, S. S., & Ibrahim, H. I. (2016). Determinants of food insecurity among farming households in Katsina state, North Western Nigeria: An ordinal logit regression approach. *Journal of Agricultural Sciences, 61*(3), 291–301. doi:10.2298/JAS1603291I

Kakota, T., Nyariki, D., Mkwambisi, D., & Kogi-Makau, W. (2015). Determinants of household vulnerability to food insecurity: A case study of semi-arid districts in Malawi. *Journal of International Development, 27*(1), 73–84. doi:10.1002/jid.2958

Kassie, M., Ndiritu, S. W., & Stage, J. (2014). What determines gender inequality in household food security in Kenya? Application of exogenous switching treatment regression. *World Development, 56*, 153–171. doi:10.1016/j.worlddev.2013.10.025

Kassie, M., Stage, J., Teklewold, H., & Erenstein, O. (2015). Gendered food security in rural Malawi: Why is women's food security status lower? *Food Security, 7* (6), 1299–1320. doi:10.1007/s12571-015-0517-y

Mango, N., Zamasiya, B., Makate, C., Nyikahadzoi, K., & Siziba, S. (2014). Factors influencing household food security among smallholder farmers in the Mudzi district of Zimbabwe. *Development Southern Africa, 31*(4), 625–640. doi:10.1080/0376835X.2014.911694

Mason, R., Ndlovu, P., Parkins, J. R., & Luckert, M. K. (2015). Determinants of food security in Tanzania: Gendered dimensions of household headship and control of resources. *Agriculture and Human Values, 32*(3), 539–549. doi:10.1007/s10460-014-9568-5

Mensah, J. O., Aidoo, R., & Tuffour, T. (2013). Determinants of household food security in the Sekyere-Afram plains district of Ghana. *Global Advanced Research Journal of Agricultural Science, 2* (1), 347–353.

Milazzo, A., & Van de Walle, D. (2015). Women left behind? Poverty and headship in Africa. *Demography, 54*, 1119–1145. doi:10.1007/s13524-017-0561-7

Mishra, A. K., Mottaleb, K. A., & Mohanty, S. (2015). Impact of off-farm income on food expenditures in rural Bangladesh: An unconditional quantile regression approach. *Agricultural Economics, 46*(2), 139–148. doi:10.1111/agec.12146

Mukasa, A. N., & Salami, A. O. (2016). Gender equality in agriculture: What are really the benefits for sub-Saharan Africa? *Africa Economic Brief, 7*(3), 1–12.

Mutisya, M., Ngware, M. W., Kabiru, C. W., & Kandala, N. B. (2016). The effect of education on household food security in two informal urban settlements in Kenya: A longitudinal analysis. *Food Security*, 8(4), 743–756. doi:10.1186/s12889-015-2403-0

Ngema, P. Z., Sibanda, M., & Musemwa, L. (2018). Household food security status and its determinants in Maphumulo local municipality, South Africa. *Sustainability*, 10(9), 33–56. doi:10.3390/su10093307

Oluwatayo, I. B., & Ojo, A. O. (2019). Effect of access to ICT on food insecurity among farming households in Nigeria. *The Journal of Developing Areas*, 53(2), 155–168. doi:10.1353/jda.2019.0027

Omotayo, A. O., Ogunniyi, A. I., Tchereni, B. H., & Nkonki-Mandleni, B. (2018). Understanding the link between households' poverty and food security in South-West Nigeria. *The Journal of Developing Areas*, 52(3), 27–38. doi:10.1353/jda.2018.0034

Owoo, N. S., & Boakye-Yiadom, L. (2015). The gender dimension of the effects of land tenure security on agricultural productivity: Some evidence from two districts in Kenya. *Journal of International Development*, 27(7), 917–928. doi:10.1002/jid.3028

Pfarr, C., Schmid, A., & Schneider, U. (2010). *Estimating ordered categorical variables using panel data: A generalized ordered probit model with an autofit procedure* (Discussion Paper 02-10). Universität Bayreuth. doi:10.2139/ssrn.1624954

Reincke, K., Vilvert, E., Fasse, A., Graef, F., Sieber, S., & Lana, M. A. (2018). Key factors influencing food security of smallholder farmers in Tanzania and the role of cassava as a strategic crop. *Food Security*, 1, 1–14.

Sharaunga, S., Mudhara, M., & Bogale, A. (2016). Effects of 'women empowerment' on household food security in rural KwaZulu-Natal province. *Development Policy Review*, 34(2), 223–252. doi:10.1111/dpr.12151

Sraboni, E., Malapit, H. J., Quisumbing, A. R., & Ahmed, A. U. (2014). Women's empowerment in agriculture: What role for food security in Bangladesh? *World Development*, 61, 11–52. doi:10.1016/j.worlddev.2014.03.025

Sseguya, H., Mazur, R. E., & Flora, C. B. (2018). Social capital dimensions in household food security interventions: Implications for rural Uganda. *Agriculture and Human Values*, 35(1), 117–129. doi:10.1007/s10460-017-9805-9

Tibesigwa, B., & Visser, M. (2016). Assessing gender inequality in food security among small-holder farm households in urban and rural South Africa. *World Development*, 88, 33–49. doi:10.1016/j.worlddev.2016.07.008

Tibesigwa, B., Visser, M., Collinson, M., & Twine, W. (2016). Investigating the sensitivity of household food security to agriculture-related shocks and the implication of social and natural capital. *Sustainability Science*, 11(2), 193–214. doi:10.1007/s11625-015-0332-6

Tiwasing, P., Dawson, P., & Garrod, G. (2018). Food security of rice-farming households in Thailand: A logit analysis. *The Journal of Developing Areas*, 52(1), 85–98. doi:10.1353/jda.2018.0006

USAID. (2017). *Gender equality and women's empowerment in Kenya*. Retrieved from https://www.usaid.gov/kenya/gender-equality-and-womens-empowerment-kenya

World Bank. (2014). *Levelling the field: Improving opportunities for women farmers in Africa*. Retrieved from http://documents.worldbank.org/curated/en/579161468007198488/pdf/860390WP0WB0ON0osure0date0March0180.pdf

Yahaya, I., Pokharel, K. P., Alidu, A. F., & Yamoah, F. A. (2018). Sustainable agricultural intensification practices and rural food security: The case of North-western Ghana. *British Food Journal*, 120(2), 468–482. doi:10.1108/BFJ-01-2017-0021

Young, L. (2012). *Challenges at the intersection of gender and ethnic identity in Kenya*. Retrieved from http://responsibilitytoprotect.org/MRG_Rep_KenGend_Nov12_FINAL.pdf

Yushi, M., Nong, Z., & Xiaojing, Y. (2013). *Food security and farm land protection in China*. Singapore: World Scientific.

Zereyesus, Y. A., Embaye, W. T., Tsiboe, F., & Amanor-Boadu, V. (2017). Implications of non-farm work to vulnerability to food poverty-recent evidence from Northern Ghana. *World Development*, 91, 113–124. doi:10.1016/j.worlddev.2016.10.015

Zhou, D., Shah, T., Ali, S., Ahmad, W., Din, I. U., & Ilyas, A. (2017). Factors affecting household food security in rural northern hinterland of Pakistan. *Journal of the Saudi Society of Agricultural Sciences*, 18(2), 201–210. doi:10.1016/j.jssas.2017.05.003

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