Factors Associated with Food Insecurity among Female Savings Group Participants in Burkina Faso

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Abstract

Food security remains a challenge in Burkina Faso due to climate-related hazards that have led to decreasing food availability in areas already plagued with low food consumption and malnutrition. The purpose of this study is to describe the prevalence of food insecurity among women in savings groups in northern and central west Burkina Faso and to identify associated factors. Interviews were conducted with 429 women**.** Logistic regression models were constructed to describe potential associations between key variables of interest and food security. Various factors influenced food insecurity status including income resilience, women's influences on finances and agricultural activities, the use of multiple agricultural techniques, and dietary diversity. In Burkina Faso, women's roles are evolving to take on greater responsibility over food security. Knowledge of evolving cultural roles combined with study findings may aid national officials and non-government organizations in the development of programs that aim to improve food security and associated health outcomes.

Key words: Food security; Burkina Faso; gender; savings groups; agriculture

Introduction

Food insecurity is defined by the Food and Agriculture Organization (FAO) as the lack of consistent access to enough nutritious and safe food to maintain an active lifestyle among all people (FAO, 1996). Improving food security has been established as a global priority as one of the Sustainable Development Goals is to "end hunger, achieve food security and improved nutrition, and promote sustainable agriculture (UN, 2016)." In 2013, the World Health Organization (WHO) and World Food Programme (WFP) reported significant decreases in food insecurity and undernourishment in the previous decade, with the goal of reducing food insecurity to under 11.6% by 2015 in reach (McGuire, 2013). However, since 2015, the prevalence of food insecurity has risen as a result of war and conflict, rising food prices, and unpredictable weather patterns generated by El Nino (WFP, 2017). As of 2016, 108 million people are classified as food insecure (WFP, 2017). To combat the issue of food insecurity, governments are encouraged to continue to prioritize national nutrition standards, programs, and

policies that support food availability and affordability (EIU, 2016). Low-income countries often lack the infrastructure needed to improve food security and therefore remain vulnerable to weather, climate change, population growth, and global market forces. Without investments in capacity building, agricultural sectors, and food systems, the gap between food secure and food insecure countries will continue to widen (EIU, 2016).

Food insecurity negatively affects society as a whole and women and children are particularly at risk (de Souza Bittencourt *et al*. 2013; Kirkpatrick & Tarasuk, 2008; Nanama & Frongillo, 2012; Chilton, Chyatte, & Breaux, 2007). Negative effects of food insecurity may be manifest through hindered child development, poor performance in school, altered household cohesion, and other social and psychological consequences. Concern, worry, and anxiety experienced because of food insecurity can ultimately lead to weight and sleep loss, household disruption and disputes, as well as feelings involving alienation, shame, deprivation, and guilt (Nanama & Frongillo, 2012). These manifestations often result in interrelated, cyclical pathways between poverty and food insecurity which are difficult to escape.

Food Security in Burkina Faso

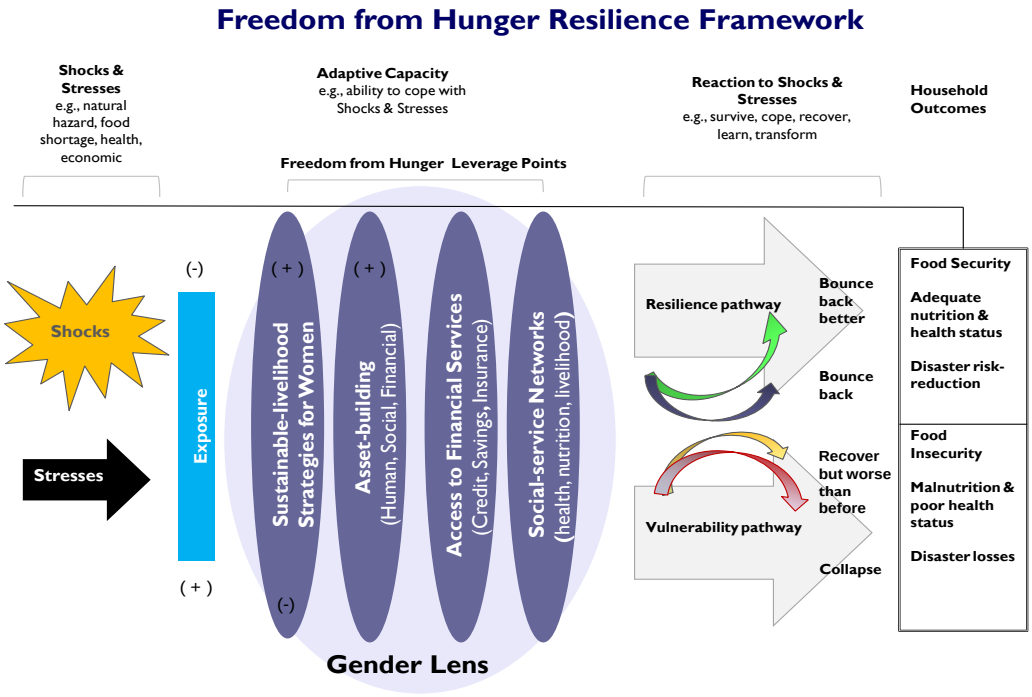
Burkina Faso is ranked 106th out of 113 countries by the Global Food Security Index study of food security which ranked countries according to the affordability, availability, and quality and safety of food (EIU, 2016). Prevalence of national food insecurity, characterized by living in a state without ready access to sufficient and nutritious food necessary for daily life, was reported as 55 percent during the lean season, August through September, and 36 percent during the postharvest season, February through March (EIU, 2016; Mathys & Gardner, 2009). Generally, food insecurity is more prevalent in rural areas than urban areas (Alpha & Gebreselassié, 2015); Maisonneuve *et al*. (2014) found food insecurity in rural western Burkina Faso affected 67 percent of households during the pre-harvest period. Despite more than a 6 percent economic growth in the past decade, the number of hungry people in Burkina Faso continues to increase (Alpha & Gebreselassié, 2015).

The health ramifications of food insecurity can be seen in Burkina Faso's undernutrition rate among children under five. Wasting, when a child is classified as having a low weight-for-height, is the most serious health concern related to food insecurity as affected children are at immediate risk of death. As of 2012 an estimated 11 percent of children in Burkina Faso were found to be wasted, a problem that was categorized by the WHO as 'serious' (UNICEF, 2014). Stunting prevalence is also a concern that the WHO classifies as 'very high,' with 33 percent of children being affected (UNICEF, 2014). Stunting has long-term effects on a child's ability to learn, their cognitive development, and their health throughout life (Black *et al*. 2008). Overall, malnutrition contributes to over 35 percent of deaths of children under 5 in Burkina Faso (UNICEF, 2012). The prevalence of stunting and wasting in Burkina Faso is closely tied to the socioeconomic status, a factor that has a long-term effect on the food security of a household

(Margai, 2007).

National efforts to improve food security in Burkina Faso have included the implementation of economic reforms, promotion of agricultural strategies, and implementation of national policies (Alpha & Gebreselassié, 2015, Burkina Faso government, 2014). A National Strategy on Food Security was put into place in 2003 with a strong emphasis on increasing food production. In October 2014, the country's first policy on food and nutrition security was adopted with the goal of achieving sustainable food and nutrition security (FNS) by 2025 by focusing on five key areas; increased food availability, capacity building to prevent and respond to shocks, improve physical and financial access to food, improve the nutritional status of people, and reinforce governance for food and nutrition security (Alpha & Gebreselassié, 2015).

Figure 1: Freedom from Hunger Resilience Framework



TANGO 2012. Adapted from DFID Disaster Resilience Framework (2011) , TANGO Livelihoods Framework (2007), DFID Sustainable Livelihoods Framework (1999) and CARE Household Livelihood Security Framework (2002)

In addition to government ministries, there are several development groups working to address various FNS issues in Burkina Faso. Freedom From Hunger (FFH) is one such group. FFH aims to reduce poverty and chronic hunger in Burkina Faso through a program called Building Resilience of Vulnerable Communities in Burkina Faso (BRB) in partnership with the Office de Développement des Eglises Evangéliques (ODE). There are three types of resilience capacities to consider: absorptive, adaptive, and transformative (von Grebner et al. 2013). The Freedom from Hunger Resilience Framework (Figure 1), adapted from TANGO International (TANGO, 2012), centers on adaptive capacity, or "the ability to learn from experience and adjust responses to changing external conditions, yet continue operating" (von Grebner et al. 2013).

Table 1 outlines the characteristics of the BRB program delivery mechanism, project inputs, expected intermediate outcomes and longer-term impacts. Pathways include savings groups, gender dialogues, agricultural training services, and nutrition education. Relating BRB program inputs (Table 1) to the framework in Figure 1, the savings groups address both asset building and access to financial services; the agricultural training addresses sustainable livelihood strategies for women; the nutrition education contributes to building the social service networks; and the gender dialogues contribute to building assets (social), enhancing women's ability to engage in livelihood strategies and accessing financial services. Building adaptive capacity of households through these leverage points could help lead a household down a path of resilience instead of one of vulnerability. Ultimately, a resilient path can lead to better food security, adequate nutrition and improved health status and disaster risk-reduction for a household.

While the effectiveness of savings groups has been demonstrated in reducing food insecurity (Lowicki-Zucca et al. 2014), and previous efforts have demonstrated the effectiveness of FFH savings groups in reducing food insecurity in Mali (Beaman, Karlan, & Thuysbaert, 2014), there is currently limited research in what specific predictors are associated with food security among women in savings groups. The purpose of this study is to describe the prevalence of food insecurity among women in savings groups in northern and central west Burkina Faso and to identify what factors within the BRB Framework are associated with the long-term outcome of food security. This study analyzes variables in the context of the BRB program pathways of finances, gender, agriculture, and nutrition.

Table 1. Building Resilience in Burkina Faso Program Pathways

Program Inputs	Intermediate Outcomes	Longer term impacts
Savings groups	Improved household income and resilience	Improved resilience of vulnerable communities
	Increased savings	Improved food security
Gender dialogue	Improved household dialogue and joint decision-making on financial services, nutrition, and agricultural activities	Improved gender equity in household use of financial services, nutrition and agricultural activities
	Improved self-confidence overall	Improved food security
Agricultural Training services	Increased capacity to engage in agricultural livelihoods	Inclusion of women in private and public agricultural-related skills training
	Increased knowledge of and access to agricultural financing	Improved food security

Nutrition Education	Increased nutrition knowledge and skills More strategic planning for household nutrition year round Increased dietary diversity	Improved food security

Methodology

This study uses data from a baseline assessment of the BRB program. This baseline assessment is part of a quasi-experimental study that compared women in savings groups who received new additional services to women in groups without access to those services. A pilot area was the basis for 20 treatment villages selected to test new program components. Twenty control villages were also selected.

Sampling and Data Collection

Data was collected in March 2016 among 429 female savings group members; 218 from treatment villages and 211 from control villages. To select participants, ODE provided a list of all groups in each of the 40 villages, with the number of women per group (individual names of women were not available). A randomly generated list of 11 numbers (representing women) per village dictated which groups to select and which women to ask to participate. Each village designated three alternates as well. Locally recruited enumerators collected the data during face-to-face interviews using pre-tested paper-based questionnaires. Interviews were conducted in Mooré and Gourounsi, the local languages in these regions. Indicators included livelihood practices, access to use of financial services, asset ownership, social networks and support, gender equity and empowerment, knowledge and practices related to agricultural and nutrition services, and poverty-level status, as well as food security levels. Institutional review board approval for the project was granted by Brigham Young University.

Household food security

Household food security was assessed by asking respondents which of the following scenarios best described the food they consumed in the last year: “enough and the types of nutritious food I wanted to eat,” “enough but not always nutritious food,” “sometimes not enough food to eat, was sometimes hungry,” and “often not enough to eat, was often hungry.” Food secure households were defined as “enough and the types of nutritious food I wanted to eat” while food insecure households were comprised of the other three response options. This one-question evaluation of food security has been previously used and found to be correlated with poverty and factors of well-being in Burkina Faso and is used when resource constraints prohibit the use of a longer food security scale (Gray, 2015).

Dietary Diversity

A Women's Dietary Diversity Score (WDDS), a validated score created by the Food and Agriculture Organization of the United Nations, was calculated to describe the participants' dietary quality and access to food (Kennedy, Ballard & Dop, 2011). Where food security focuses primarily on access to food, the WDDS focuses on nutritional quality and has been previously validated to be directly correlated with micronutrient adequacy of the diet. Women participated in a dietary recall by answering 13 questions about the types of food they consumed in the previous 24 hours. Responses from the 13 questions were categorized into nine food groups: starchy staples, dark green leafy vegetables, other vitamin A-rich fruits and vegetables, other fruits and vegetables, organ meat, meat and fish, eggs, legumes, nuts, seeds, and milk and milk products. The WDDS score represented the total number of food groups consumed in the previous 24 hours and ranged from zero to nine.

Progress out of Poverty

The Progress out of Poverty Index^{TM} (PPI) for Burkina Faso, a previously validated survey created by the Grameen Foundation, was used to create a PPI score (Schreiner, 2011). The PPI score allows organizations to estimate the likelihood of poverty in areas without directly measuring household income. The PPI score consists of 10 questions that consider factors such as household characteristics and asset ownership to determine likelihood of poverty within a household. Once the PPI score was calculated, it was then converted to a likelihood estimate of living below the National Poverty Line (NPL).

In addition to the WDDS and PPI scores, an income source score was calculated. Survey respondents were asked to name all income sources their household relied on throughout the year and their responses were recorded. A total income source score was then calculated based on the number of responses given. The score ranged from zero to seven. An agricultural technique score was also calculated, with scores ranging from zero to five. Participants were asked about any special agricultural techniques used when growing crops, such as pit construction or fertilizer, and their responses were recorded. A total score for agricultural techniques was then calculated based on the number of responses given.

Data Analysis

Data management and analysis was performed using SAS (version 9.4). After the indices were calculated, frequencies were used to describe the demographics of participants. Unadjusted and adjusted logistic regression models were constructed to describe potential associations between key variables of interest and food security among individuals in savings groups in Burkina Faso. Variables were measured with corresponding survey questions from program pathways (Table 1). Adjusted models controlled for PPI score, literacy, and age.

Results

Household characteristics

Most households were polygamous, with a majority of households having one to three co-wives (62.5 percent), while 27.7 percent were monogamous households (Table 2). The mean number of children was 4.33 with results ranging from zero to 12. The average household size was 13.3 with a range from three to 46. Of all respondents, only 37.8 percent were very confident in their ability to provide clean water and 29.4 percent rely on unimproved water sources, which is classified as using an unprotected well or surface water. Only 15.2 percent of respondents have electricity as their main source of energy for lighting and 55 percent have no toilet arrangement available. Women were an average of 40.3 years old with age ranging from 15 to 72 years. The majority of women had never attended school (84.4 percent) and most were not literate (80.2 percent). Approximately 33.4 percent of women were found to live below the NPL, as measured by the PPI score. The NPL rate is slightly lower among the study population compared to the 2014 national average of 40.1 percent (UNDP, 2015).

Table 2. Characteristics of Participating Households

	Percent (%)	Means (Std Dev)
Household structure, *n=429*		
Monogamous	27.74	
Polygamous	31.00	
2 wives	20.98	
3 or more wives	10.49	
Number of children, *n=429*		4.33 (2.26)
Main source of drinking water, *n=429*		
Public tap/standpipe	3.50	
Tube well or borehole	31.47	
Protected well (dug well)	35.66	
Unprotected well	28.90	
Surface water	0.47	
Main source of energy for lighting		
Flashlight or batteries	82.98	
Electricity or solar energy	15.15	
Other (firewood, candles, kerosene)	1.87	
Toilet arrangements		
No toilet arrangement	55.01	
Non-ventilate pit latrine	44.99	

Septic tank	0.00	
Participating women characteristics		
Age (years), *n=429*		40.28 (11.65)
Ethnic Group		
Gourounsi	51.28	
Mossi	33.80	
Other	14.92	
Level of education, *n=429*		
None	84.38	
Literate	19.81	
Some formal schooling	15.62	
NPL Characteristics		
Living below NPL		33.41 (17.08)

Household Food Insecurity and Related Conditions

Approximately 74 percent of women reported being food insecure (Table 3). This is higher than expected for food insecurity prevalence in March, before the hot season of May (known for low water) and the significant lean season before the October harvest. However, a closer look at responses indicates that food insecurity was more likely due to a lack of nutritious foods rather than an absolute lack of food.

Finances

One-third of households reported not being able to meet their financial obligations in the past month. Approximately 83 percent of households relied on petty commerce as a source of income, while 14.7 percent relied on selling cereals and grains. Less than half of women reported income resilience.

Gender

Approximately half of women reported their husband had more influence over finances than they did. Only ten of the 429 women interviewed personally owned land and just 14.7 percent had personally used an agricultural loan.

Agriculture

Of the women surveyed, 41.5 percent reported not being able to produce enough food for home consumption; 48.7 percent could produce enough food for household consumption, and 9.8 percent were able to produce surplus. One-fourth of women kept a home garden. Most women reported they had learned new knowledge from their savings group members regarding agricultural practices (84.4 percent) and 68.8 percent had exchanged ideas about agricultural activities.

Nutrition

The mean WDDS score was 5.13. This provides insight to dietary quality, but not the quantity of food consumed. Women reported their families eat, on average, 2.7 meals per day in a good month, decreasing to two meals in a lean month. Three-fourths of women reported they had learned new nutrition knowledge from savings group members (74.8 percent).

Table 3. Food Insecurity and Related Conditions

	Percent (%)	**Mean (Std dev)**
Food secure	26.11	
Food insecure	73.89	
Savings Groups		
Household's ability to meet financial obligations in the past month		
Able	13.75	
Somewhat able	52.68	
Not able	33.57	
Income sources (% yes)		
Growing and selling "cash crops" (sesame, cowpeas & groundnuts)	56.88	
Petty commerce	83.45	
Selling cereals (sorghum and millet)	14.69	
Gardening and sale of vegetables	35.43	
Income Source Score		3.17 (1.18)
Self-reported income resilience (% yes)	46.62	
Used savings for agricultural input	24.01	
Gender Dialogue		
Financial influence		
Husband has more influence	47.32	
Woman has more influence	27.74	
Equal influence	24.94	
Women's use of an agricultural loan for crops	14.69	
Women's land ownership		
Yes	2.33	
No	97.67	
Agricultural Engagement		
Household's ability to produce food		
Unable to produce own food	0.00	
Able to produce, but not enough for home consumption	41.49	
Able to produce enough for home consumption	48.72	

Able to produce surplus	9.79	
Home garden (% yes)	26.34	
Agricultural techniques used (% yes)		
Fertilizer	54.78	
Pit construction	14.22	
Zai	16.55	
Composting	7.93	
Agricultural Technique Score		2.23 (0.91)
Exchanged ideas about agricultural activities with savings group members	68.76	
Learned new knowledge from members of savings group about productive agricultural practices (% yes)	84.38	
Nutrition Education		
Number of meals per day in a good month		2.73 (0.45)
Number of meals per day in a lean month		2.08 (0.51)
Learned new knowledge from members of savings group about nutrition (% yes)	74.83	
WDDS		5.13 (1.15)

Factors Associated with Food Insecurity in Women

Finances

Financial variables that increased the odds of food insecurity included feeling somewhat capable of meeting financial obligations compared to not being capable of meeting financial obligations in the past month (OR 2.252) and not growing and selling a cash crop (OR 13.583) (Table 4). A lack of household income resilience (OR 4.336) and having to use savings for agricultural input (OR 4.137) also increased the odds of food insecurity. Having a higher income source score (OR 0.781) was protective against food insecurity (Table 4).

Table 4. Logistic regression, factors associated with food insecurity in women

Variable	Unadjusted OR (CI)a	Adjusted OR (CI)b
Savings Groups		
Ability to meet financial obligation		
Yes vs no	1.439 (0.746-2.777)	1.368 (0.702-2.666)
Somewhat vs no	2.552 (1.584-4.109)**	2.252** (1.382-3.669)
Lack of participation in the following income generating activities:		
Growing and selling “cash crops” (sesame, cowpeas & groundnuts)	14.282 (6.978-29.234)***	13.583(6.606-27.926)***
Petty commerce	0.960 (0.540-1.708)	0.867 (0.481-1.561)
Selling cereals (sorghum and millet)	0.701 (0.365-1.346)	0.615 (0.316-1.195)
Gardening and sale of vegetables	1.616 (1.040-2.512)*	1.543 (0.985-2.417)
Income Source Score	0.762 (0.637-0.910)**	0.781 (0.652-0.935)**

Lack of self-reported income resilience	4.892 (3.026-7.909)***	4.336 (2.667-7.147)***
Used savings for agricultural inputs	4.520 (2.805-7.284)***	4.137 (2.548-6.718)***
Gender Dialogue		
Financial influence		
Husband has more influence vs woman has more influence	11.014 (6.130-19.788)***	12.480 (6.741-23.107)***
Husband has more influence vs equal influence	3.088 (1.636-5.828)***	3.047 (1.589-5.843)***
Women's use of an agricultural loan for crops	1.280 (0.677-2.421)	1.430 (0.744-2.751)
Lack of land ownership	4.429 (1.226-15.997)*	3.831 (1.022-14.361)*
Agricultural Engagement		
Household's ability to produce food		
Not able to produce enough for home consumption vs able to produce surplus	16.729 (7.527- 37.181)***	14.858 (6.609-33.403)***
Able to produce enough for home consumption vs able to produce surplus	4.430 (2.188- 8.968)***	4.114 (2.007-8.432)
Home garden	0.808 (0.501-1.304)	0.937 (0.573-1.531)
Not exchanging ideas about agricultural activities with savings group members	8.863 (5.458-14.393)***	8.792 (5.336-14.406)***
Learned new knowledge from savings group about productive agricultural practices	2.769 (1.612-4.755)***	2.892 (1.659-5.040)***
Total agricultural technique score	0.420 (0.321- 0.548)***	0.434 (0.332-0.568)***
Nutrition Education		
Learned new knowledge from savings group about nutrition	0.925 (0.561-1.528)	1.096 (0.653-1.840)
WDDS	0.561 (0.455-0.629)***	0.581 (0.468-0.721)***

[a] Unadjusted models included a single variable of interest.

[b] Adjusted models included a single variable of interest, controlling for PPI NPL score, literacy, and age.

*p<0.05 **p<0.01 ***p<0.001

Gender

The husband having more financial influence compared to equal (OR 3.047) or less (OR 12.480) influence than the wife increased the odds of food insecurity, as did the women not owning land (OR 3.831).

Agriculture

Variables related to agriculture that significantly increased the odds of food insecurity included learning new knowledge from members of savings group about productive agricultural practices (OR 2.892), and not exchanging ideas and information about agricultural activities with savings groups members (OR 8.792).

Having a higher agricultural technique score, and thus utilizing a greater number of agricultural techniques, decreased the odds of food insecurity (OR 0.434). Being able to produce a surplus of food also decreased the odds of food insecurity, compared to not being able to produce enough food for home consumption (OR 14.858).

Nutrition

Having a higher WDDS score (OR 0.581) and thus greater dietary diversity, significantly decreased the odds of food insecurity.

Discussion

The purpose of this study was to describe the prevalence of food insecurity among women in northern and central west Burkina Faso and to identify factors associated with food insecurity. While food insecurity has generally decreased nationally in Burkina Faso (Alpha & Gebresalassié, 2015), the prevalence of food insecurity in the study area remained high at 73.9 percent. This is slightly higher than the food insecurity prevalence of 67 percent reported by Maisonneuve *et al*. in 2012 among four villages of western Burkina Faso, but lower than the national prevalence of 84 percent reported in 2009 (Maisonneuve *et al*. 2014). A number of factors influenced food insecurity status including income resilience, women's influences, the use of multiple agricultural techniques, and dietary diversity, similar to results from other authors (Payne, Gray & Davis, 2016; West *et al*. 2014; Reardon, Matlon, & Delgado, 1988).

Utilizing a greater number of income sources and reported income resilience were two factors associated with a household being less likely to report food insecurity. Maisonneuve *et al*. (2014) also confirmed the finding that income-generating activities were associated with food security. Lack of livelihood diversity with heavy dependence on rain fed agriculture exposes communities to external shocks such as disasters and climate variability (Doka, Madougou, & Diouf, 2014). We also found that households who had to rely on their savings for agricultural input were more likely to report food insecurity, possibly due to less funds subsequently available for food purchases (Gundersen & Garasky, 2012; Millimet , McDonough & Fomby, 2015).

Supporting income diversification may protect against shocks and allow households to keep money in their savings by using other funds for agricultural input and daily food. However, barriers to income diversification arise from low access to investment financing, which would allow new livelihood options to be developed, and from lack of access to markets, which limits

income generation opportunities (West *et al*. 2014). Many programs tend to focus only on existing livelihood strategies, rather than providing technical support in the development of new skills and livelihood strategies. (West *et al*. 2014). In contrast, participation in FFH savings groups, which foster new and existing strategies, may have increased income generating opportunities and diversity by allowing for greater access to markets, improving access to investment financing, and supporting the development of new skills. This is reflected in the fact that petty commerce was the number one listed income source followed by growing and selling a cash crop. Programs seeking to improve food security should promote the development of new skills and provide connections that enable income diversification to improve resilience and reduce food insecurity.

Gender dialogue is another important issue surrounding food security (Scanlan, 2004; Sharaunga, Mudhara, & Bogale, 2015**).** Only 2.3 percent of women in the study sample owned land, and regression findings suggest that lack of land ownership increases the risk of food insecurity. While examining gender roles and gender equality in rural India, Rao, 2006 also found that women who are landowners generally have improved food security and that their children experience better nutrition compared to women who do not own land (Rao, 2006). Maisonneuve *et al*. (2014) found a similar relationship between land ownership and food security among individuals in Burkina Faso, stating that land ownership is one of the single most influential factors on food security. In Burkina Faso, the processes to obtain landownership are controlled by men while women generally only gain access to land by borrowing or being gifted land from their husband; only eight percent of landowners in all of Burkina Faso are women (Doka, Madougou, & Diouf, 2014). A statement from a men's focus group in Burkina Faso regarding agricultural traditions reads, "The religions practiced... do not forbid land ownership by women. It is only customary practice that discriminates against women" (Doka, Madougou, & Diouf, 2014). While land ownership may not be an actionable opportunity for an intervention, this attitude may reflect an openness to evolving social and gender norms.

Regression analysis also revealed that when a husband had more say over household finances than the woman, the household was more likely to be food insecure. The International Food Policy Research Institute (IFPRI) stated that women having greater relative power to men is associated with better nutritional status of their children (Mathys & Gardner, 2009). Doka, Madougou, and Diouf (2014) echoed this finding by stating that a woman's ability to negotiate and influence decisions in her household enhanced food security. Additional previous research has identified that women's empowerment inversely correlates with food insecurity (Garikipati, 2008; Mathys & Gardner, 2009; Maisonneuve *et al*. 2014; Sharaunga *et al*. 2015; Payne *et al*. 2016). This could be explained by the fact that women are more likely than men to put financial priority on food purchases (Quisumbing *et al*. 1995). Women in Burkina Faso play an important role in the food security status of their household as they are primarily responsible for the care of children, as well as food related tasks such as cooking, fetching water, and obtaining wood for

fuel. (Maisonneuve *et al*. 2014; Mathys & Gardner, 2009).

While they are key in deciding the food security status of their household, women in Burkina Faso face many barriers to obtaining food security including limited access to land, programs and services. For example, the Burkina Faso Ministry of Agriculture provides smallholder agricultural extension services in an effort to improve food security. However, female producers do not systematically benefit from those services, which are concentrated on larger population centers with male producers as their target. Barriers to program access include non-gender-friendly dissemination channels (unsuitable to women's schedules and agenda) and limited access to funding. Other barriers include lack of land rights, lower education levels, lack of credit access, and lack of empowerment (Maisonneuve *et al*. 2014).

Results also suggest that households in Burkina Faso that utilize a greater number of agricultural techniques have improved food security status, consistent with other literature (Douxchamps, Van Wijk, & Silvestri, 2016; West *et al*. 2014). Mossi households in the northern Central Plateau of Burkina Faso have become more food secure by implementing improved agricultural techniques and investing in animals (West *et al*. 2014). However, the majority of women in rural Burkina Faso still use traditional agricultural production methods due to limited knowledge of more modern techniques, which results in low production (Maisonneuve *et al*. 2014). This can be seen in our sample as the average number of agricultural techniques was two and the most frequently used technique was fertilizer.

A unique finding regarding agricultural practices is that women who learned new knowledge about productive agricultural techniques from members of savings groups were more likely to experience food insecurity. This highlights an important distinction between new knowledge about new agricultural practices and simply exchanging ideas, which was found to be protective. It may be that new agricultural techniques being taught by participants in savings groups to others in the group are not appropriate for the types of households that apply them. In various regions in West Africa, researchers concluded that different agricultural teaching techniques should be implemented in different types of households (Douxchamps, Van Wijk, & Silvestri, 2016). If correct techniques are being taught, it may also be that they are not properly applied. Proper techniques, if not properly applied, can result in a lower crop yield (Douxchamps, Van Wijk, & Silvestri, 2016). Programs should encourage the use of various agricultural techniques among households, but care should be taken to ensure that appropriate techniques are being taught and properly applied.

Our finding that women in Burkina Faso who report greater dietary diversity are less likely to report food insecurity is consistent with findings from previous studies (Payne *et. al*. 2016; Maisonneuve *et al*. 2014; Becquey, 2010; Faber, Schwabe & Drimie, 2009; Hoddinott & Yohannes, 2002;). Payne *et. al*. (2016) found that women in self-help groups in India were more

likely to report food insecurity for themselves and their children when they also experienced low dietary diversity. Several other studies have also shown a positive correlation between dietary diversity and food security using the Dietary Diversity Score (DDS) based on a 24-hour dietary recall (Hoddinott & Yohannes, 2002; Ruel, 2003; Lo *et al*. 2012). This applied across all seasons and in both rural and urban households (Hoddinott & Yohannes, 2002). The literature also suggests a link between household income and dietary diversity, with families of higher socioeconomic status achieving a greater DDS due to the greater cost of diverse foods, thus linking income and food security (Lo *et al*. 2012). Nutrition education in programs should focus on strategies for maintaining a healthy diet during the lean season, including the importance of household vegetable gardens, drying and storing greens and vegetables and saving money for better nutrition during the lean season.

Limitations

Food security was only measured by one survey question, making it difficult to compare prevalence across other studies that used various food security scales. However, FFH has found benefits to shortening the 9-18 question food security scale to justify the single question evaluation (Gray, 2015). This single question measure has been used successfully by FFH in India (Payne *et. al*. 2016).

The study design did not control for the bias of self-selection of participants who join savings groups or who engage in community agricultural, nutrition, or gender-dialogue programs. Thus, the results may not be appropriately generalized to women who do not participate in savings programs or community programs. Furthermore, the information captured in the survey was reported by participants without outside verification.

Conclusion

The results from this study suggest that food insecurity is widely experienced among women in northern and central west Burkina Faso. Factors associated with food insecurity are consistent with findings from previous studies, especially agricultural, income, and gender related factors. Programs seeking to improve food security should support income diversification by improving access to investment financing, and improving access to markets to improve income generating opportunities. If implemented correctly, programs that promote the use of various agricultural techniques can also improve a household's ability to produce food, thus reducing the risk of food security.

In Burkina Faso, women's roles are evolving to take on greater responsibility over food security (Doka, 2014). Where the full responsibility of food and living conditions used to fall solely on the male head of the household, responsibilities are shifting towards men and women being

jointly responsible for household conditions. National policies, programs, and cultural practices that support women's in these responsibilities are lacking (Maisonneuve *et al*. 2014). Our findings stress the importance of a continued focus on improving household gender dialogue and promoting joint decision-making on matters of finance, agriculture, and nutrition to improve food security. The findings from this study provide insight into how national and non-government organizations can target programs to address these determinants and improve food security and associated health outcomes among households in Burkina Faso.

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