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Measuring Educational Intervention Impacts on Food Security and Nutrition among Rural Farmers in El Salvador: A Mixed Methods Study

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Abstract

Food insecurity in rural El Salvador has been a long-standing problem. This mixed-methods study explored rural farmers' perceptions of their food security situation, identified critical food security needs, and examined farmers' intentions to adopt measures to enhance their food security after an educational intervention to combat food insecurity in the area. For this community, the results reveal that access and utilization are the food security dimensions in which farmers perceive the most significant challenges. To mitigate these challenges, farmers participated in an educational intervention that addressed food and nutrition security issues, including household food production, food safety, and drinking water treatments. Post-intervention results show an increase in farmers' intentions to adopt new food production, processing, and preparation practices that improve household food and nutrition security. However, the results highlight farmers' need for continuing education to fully address all food problems in the community.

Keywords: El Salvador, farmers, food security, household nutrition, educational intervention

Introduction

According to the Food and Agricultural Organization [FAO], beginning in 2017 the improvements seen in global food security over the last decade began to decline. The number of people living in food insecurity increased from 804 million in 2016, to almost 821 million in 2017 (FAO et al., 2018).

The current trend in global statistics issues a clear warning that if no changes are made, the global goals for eradicating hunger by 2030 will not be achieved (FAO et al., 2018). In El Salvador, despite significant efforts to address food insecurity, there still exist many food deficiencies throughout the country. As recently as 2017, El Salvador reported 42,840 households, representing 214,000 people, living in a state of chronic food insecurity. Farmers and their families are the population most affected by food insecurity (World Food Programme [WFP], 2018).

Educational programs for smallholder farmers about food security and nutrition reduce vulnerability and improve resiliency, especially for the most fragile developing economies (FAO, 2011). FAO recognizes training as an essential catalyst for addressing food insecurity and malnutrition (FAO, 2011; FAO et al., 2005). The education of rural farmers has a positive effect on food production and consumption behaviors. According to Sahyoun et al. (2004), adults can develop or improve their knowledge, skills, and abilities related to food security and nutrition by participating in programs with an appropriate design and facilitation process.

Theoretical Framework

This research study made use of two theoretical frameworks to structure different aspects of the investigation. The first is the FAO Food Security Theoretical Framework, which states that Food security for a household means access by all members at all times to enough food for an active, healthy life. At a minimum, this includes the ready availability of nutritionally adequate and safe foods, and the assured ability to acquire acceptable foods in socially acceptable ways, that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies (Research Triangle Institute [RTI], 2014, p. 1)

In the search to ensure food security in rural communities, the four dimensions of food security—availability, access, utilization, and stability—must be achieved (Simon, 2012). Educational efforts to reduce food insecurity should seek to include all dimensions of food security (FAO, 2012). Research by Olumakaiye and Ajayi (2017) showed that education could reduce levels of malnutrition and food insecurity. Some of the main topics addressed in food and nutrition security interventions include family nutrition, family gardening, and family finances (Simon, 2012).

The second theoretical framework used in this study is the FAO Theoretical Framework for Nutritional Education Programmes. This theoretical framework uses science-based knowledge to promote proper nutrition, as well as to prevent health consequences derived from the lack of nutritious foods (Smith & Smitasiri, 1997). The most compelling aspect of this framework is that it encourages the educator to work in conjunction with participants to identify the best way to use available food and resources. An important component of this framework is that the educator should help participants strategize to prevent food shortages (Barth-Eide et al., 1996; Smith & Smitasiri, 1997).

Purpose and Objectives

The purpose of this mixed methods study was to evaluate the impacts of an educational intervention on food security and nutrition among smallholder farmers in Chalatenango, El Salvador. The following research objectives guided this study:

1. Qualitatively identify the state of food security, food choices, nutritional attitudes, and barriers to access food perceived among smallholder farmers in rural El Salvador
2. Quantitatively measure the impact of an educational program on farmers' knowledge, attitudes, and perceptions on how to improve their food security and nutritional status.

Methods

The importance of assessing and incorporating a community's socio-economic characteristics in the design and implementation of food security programs has been well-documented (Ahmed & Del Ninno, 2002; Pothukuchi, 2004). For this reason, this study used an exploratory sequential mixed methods design. The main feature of this research approach is the collection of qualitative data in the initial stage of the study and using that data to drive the collection of quantitative data in the second stage of the research (Creswell & Plano, 2018). The data are then integrated to provide a broad understanding of the research results.

Qualitative Strand

To explore food security from the perspective of smallholder farmers, face-to-face interviews were conducted with 17 farmers in the fall of 2018. The interviews focused on farmers' food security, food choices, nutritional attitudes, and perceived barriers to accessing food. The interviews lasted an average of 45 minutes, were administered in Spanish, and were audio-recorded with the participants' permission.

Participants were from the hometown of one of the research team members. This researcher went door to door in the community to recruit participants for the study. This process included the initial visit to their houses to introduce the research project and ascertain their willingness to participate in the study. The investigator then set a time and place for the interview based on the participant's preference.

The interview included questions about family structure and demographics, water and sanitation, agricultural production, food security, and food preferences. The interview questions sought to explore farmers' knowledge on food security and nutrition, food choices, and barriers to accessing food. The food preferences questions were designed using the FAO *Dietary Guidelines for Salvadorian Families* (FAO, 2012).

Qualitative Data Collection. The recordings of the interviews with the 17 farmers were transcribed manually and translated to English by a bilingual Salvadorian and reviewed by two additional bilingual Spanish speakers to ensure accuracy. A pseudonym was assigned to each participant to ensure the confidentiality of the information. For the analysis, coding was implemented to identify common patterns and similarities in the participants' experiences; coding allows the researcher to extract meaning from data units and to gather them into groups or categories (Ivankova, 2015). For this research study, descriptive and concept coding methods were used.

Observations of the smallholder farmers in and around their homes, in the community, and on their land also contributed to the qualitative portion of this study. The primary researcher carefully observed food stocks, storage and preparation areas, as well as the agricultural production. In addition, water sources were visited, waste management processes were observed,

and interactions between family members and community members were documented. Photographs were taken of different aspects of the farmers' lives relating to the dimensions of food security.

In qualitative research, trustworthiness refers to the level of confidence that the researcher has set in the results based on the research design, participants, and research context (Ary et al., 2006). Triangulation of the interview data was accomplished using interviews with leaders in the community, observations, photographs taken by the primary researcher, and the literature. As themes emerged in the analysis, they were categorized under the four dimensions of food security – availability, access, utilization, and stability. A thick rich description using quotes of participants was used as well as an in-depth description of the methods in order to aid in the transferability of the findings. The researcher's interpretations were verified using peer-debriefing.

Research Subjectivity Statement. It is common in qualitative research for the researcher to issue a statement to clarify any potential areas of bias in the research. The primary researcher for this study was born and raised in Chalatenango and has known many of the families in the community for most of his life. Another team member is from Honduras and has worked several Central American countries, including El Salvador. Another author has lived and worked in several countries throughout Latin America. All members of the research team have had professional experience in different developing countries.

Quantitative Strand

A non-equivalent control group design was used in the quantitative phase. The non-equivalent research design compares individuals who are not randomly assigned among the control and experiment groups (Frankel, et al., 2015). The control group was built using matching, which is a selection process of the control group participants based on the similarity of the research criteria, drawing comparisons between the groups. While random assignment is still a superior method of subject selection to avoid bias, matching can help build reliable control groups and reduce bias (Rossi et al., 2009; Stuart & Rubin, 2008). In areas like the one in this study, there are no accurate records of community members; thus, there was no systematic way to randomize the assignment of participants to a treatment or control group. Researchers determined that matching would allow the control group to be generated effectively in this context.

Farmers who participated in the qualitative phase were invited to participate in the quantitative phase, which included an educational intervention on food security. For the recruitment of the participants, ACOPIDECHA de R.L., a farmers' organization, assisted the researcher. House-to-house invitations, phone calls, flyers, and a formal invitation letter were used to invite the participants. Farmers were asked to meet on the grounds of the ACOPIDECHA de R.L. facility on a particular day and time to participate in the educational intervention.

Prior to the implementation of the intervention, the participants were informed that their participation in the study was voluntary and that they would not receive any compensation for their participation. A folder with an informative manual, a pen, and a notebook were provided for the participants. Participants received an identification code in their notebook to use when completing the research instruments. These procedures were followed to assure anonymity. The participants were not asked for any identifying information except for the identification code on the research instrument.

An instrument comprised of four sections was used in the study, including demographic information, the FAO *Food Insecurity Experience Scale*, a knowledge section, and an attitudinal section. The research instrument was administered before and after the educational intervention as a pre-test and post-test to measure the impacts of the educational intervention on food security and nutrition. The pre-test instrument was administered to the participants at least three days before the intervention. The post-test was distributed to the treatment group after the educational intervention and for the control group at a date and time set by the participants. The control group received the educational intervention after they completed the post-test instrument as compensation for their participation in the research project.

Knowledge test. The knowledge instrument was based on food security and nutrition information and corresponded to the educational intervention curriculum; it tested participants only on the information they were provided during the educational intervention. The 25-item instrument was divided into three sections: food security and nutrition at home, drinking water treatments, and food production. Cronbach's alpha reliability coefficient was acceptable ($>.7$) for each research instrument section (George & Mallery, 2013).

Attitudinal test. The attitudinal instrument was developed based on findings from the qualitative section of the research study. The 47-item instrument used a five-point Likert type scale and was divided into six research constructs in the pre-test and post-test with one construct exclusively for the post-test. The constructs included in the instrument were: community, education, food choices, food safety, water treatments, and agricultural production. Cronbach's alpha reliability coefficient was *acceptable* ($>.7$) for each research instrument section (George & Mallery, 2013).

Quantitative Data Collection. Quantitative data were collected using a paper-based research instrument and entered in an Excel spreadsheet. The Statistical Package for Social Science (SPSS®) was used for the statistical analyses. The negative stated questions were recoded. Descriptive statistics were performed to describe the research population and the state of food security in the community. For the educational intervention evaluation, the participants' scores in attitudinal and knowledge tests were compared. Independent t-tests comparing the control and treatment group were used. The alpha level was set at $\alpha = 0.05$ level of significance, *a priori*. The final instrument reliability was measured using a post-hoc analysis. According to Foster et al. (2018), a post-hoc analysis is carried out after data collection, and not only allows identification of significant differences between groups' means, but also to determines the origin of this difference.

Results

Objective 1

The first objective of this research study was to qualitatively identify the state of food security, food choices, nutritional attitudes, and barriers to access food perceived among smallholder farmers in rural El Salvador. Seventeen farmers participated in the interview process. Among the farmers, nine (52%) were male and eight were female (48%). For the data analysis, the emerging themes were divided using the FAO Four Dimensions of Food Security theoretical framework: food availability, food access, food utilization, and stability (Napoli, 2011).

Food availability. Food availability is the longest-standing food security dimension and focuses on the balance between population and food. Agricultural production and trade (Burchi

& De Muro, 2016) primarily influence this dimension. The theme of agricultural production emerged in this dimension of food security.

Agricultural production refers to the annual production rates and the elements that affect agricultural production. Farmers' food security depends not only on the amount of food available, but also on the diversity and quality of these foods. For example, Jose stated that the food preferences at home influenced the family's agricultural production decisions. Jose said: "...I always produce the same crops. Implementing crop rotation is complicated. What we need to produce is the corn for tortillas..."

The poor agricultural production rates in El Salvador are also affected by the lack of arable land. In El Salvador, farmers compete against rapid urbanization and environmental degradation for the available land (Vargas, 2003). The availability of agricultural land especially affects smallholder farmers. Carlos mentioned: "...I only have a small space to produce. I have to look for someone to lease me land in order to produce the amount [of grain] needed in my home..."

The lack of arable land is not the only agricultural problem identified by farmers. Pests and diseases also affect agricultural production. Changes in the biological and chemical interactions between crops, pests, diseases, and their natural enemies have affected tropical countries like El Salvador (Cilas et al., 2016). Fidel said "... there are pests or diseases that we do not know how to treat, and they are stronger [more resistant] every season..."

Food Access. Food access is the second food security and nutrition dimension and refers to the economic, natural, and human resources available to produce and purchase food. This dimension is especially critical for rural communities in lower- and middle-income economies (Cordero-Ahiman et al., 2017). The themes of access to markets and income and purchasing power emerged from the food access dimension of food security.

Access to Markets. The access to market emergent theme refers to the economic, social, and geographic limitations that farmers face to access appropriate markets and agricultural inputs. Farmers associate their limited access to markets with the deficient transport systems available in rural areas of El Salvador. Ramiro mentioned that "...The buses are very old and do not work constantly ..." For farmers in El Salvador, travel to the closest market represents an investment of both time and money. Lidia mentioned "...We go to the market three times or less per year..." Angelica said: "... We do not go to the market very often. Agricultural activities do not allow us to travel constantly..." Farmers recognize that the foods that can be obtained in the market are more diverse compared to those available in the community. Lidia mentioned "...I would like to go [to the market]. There are more things [food] there. But I do not have money to be able to go very often..."

Income and Purchasing Power. This theme explores the economic situation among rural farmers in El Salvador. The farmers' economic conditions are characterized by low purchasing power and low-income rates; the poverty rate of rural farmers is 22% and their principal source of income is agricultural production (FAO et al., 2018). Carlos said: "...We live with what we produce in the field. It's a poor life but we survive..." Farmers in the study used words like *poor*, *scanty*, and *oppressive* to describe their economic conditions.

The farmers' economic situation emerged in almost every interview. Participants described their economic situation as *difficult*, *complicated*, and *getting worse and worse*. When asked about his income, Ramiro said: "... My income is definitely not enough to purchase food for my family..."

Food Utilization. Food utilization is the third food security dimension and refers to both an individual's knowledge of proper food preparation and consumption, as well as the actual sanitary conditions necessary to safely consume and produce food. The following themes emerged in the food utilization dimension: drinking water quality, women's participation, food safety, and family nutrition.

Drinking Water Quality. This theme refers to the water access limitations faced by the farmers, as well as the consequences of the inadequate quality and quantity of drinking water on human health. This theme comprises the limitations of drinking water access and the implementation of water treatments by participants.

The lack of appropriate water sources was a common theme that arose during the analysis of the farmers' interviews. For some families, the principal water source is the well they have at home. While some families have wells and latrines in their homes, many families still lack these basic services, and carry water from a local river. Raquel mentioned "...The water is consumed without any treatment. We store it in containers to keep it fresh and free of trash..." To describe their water, participants used terms like *it has very bad odors*, *it tastes strange* and *it is dirty*.

Women's Participation. This theme explores women's participation and decision power in family agricultural production and family diet of participant households. When the researcher began to ask about the family agricultural production, female participants' answers were principally: "I do not know," "I could not answer," and "my husband knows that." Though they professed a lack of knowledge about the technical, productive, and economic aspects of their own family farming, women actively contribute to household food production. Raquel said "...I help him at work [agricultural production], but he is the one who makes the decisions..." Flor mentioned "... I always work with my husband. Children also help us especially during the evenings..." Lidia said "...He knows how he manages things [agricultural production]. I do not get involved in that..."

Food Safety. This theme explores the food and sanitary conditions and practices implemented by farming households in rural areas of El Salvador. In the participants' homes, there was an evident lack of sanitation that is aggravated by the deficient sanitary infrastructure available. For the most part, participants perform their physiological needs in latrines that use ashes to treat excrement. Some of these latrines are not in good condition; they were built inappropriately, with poor materials, and without considering location with respect to other areas of the house.

During the interviews, the researcher was able to observe the distribution of spaces in the participants' houses. Some farmers have their latrines located close to drinking water wells. The construction of these houses is driven by the location of water wells so that they are near the places where daily cleaning activities are carried out to facilitate the carrying of water. The close location of the latrines to the cleaning stations is not a healthy practice. The latrines have been built with underground structures for the storage of excrement. These underground structures often connect with the groundwater sources that supply the family well water. This creates a potential source of cross-contamination and represents a health risk.

Family Nutrition. The relevance of studying family nutrition lies in the complexity of nutritional problems and the specifications for each stage of human development. The nutritional requirements for each family member are different and require special care. This theme explores the attitudes and behaviors of participants related to the nutrition of family members.

The participants in this study do not seek to satisfy the dietary preferences of their members. For these families the priority is the amount of food that can be consumed rather than

the quality or satisfaction of individual tastes. Flor said "... I'm looking for food that everyone can afford ... In my house we all eat what is available ..." Armando said: "... My wife knows what she buys for the house ... Foods are always bought cheap ... "Ana mentioned that "... you cannot buy a lot of food, what you buy is for everyone, although not everyone likes it ...".

Food Stability. Food stability is the last food security and nutrition dimension and seeks to ensure the sustainability of the other three dimensions. Food stability requires multidisciplinary approaches that protect, conserve, and promote sustainable food systems. The following themes emerged in the food stability dimension:

Climate Change. This theme explores the farmers' knowledge on climate change and the perceived impact on agricultural production. When asking the participants to define the concept of climate change, the following answers emerged: *I do not know what climate change is, I do not understand that [climate change,] and /or I cannot define it.* A lack of scientific knowledge and training on climate change is evident in the participants. However, by addressing the question in a different way, asking the farmers if they had observed any changes in the climate patterns during the last years, the following answers emerged: Antonio said: "Yes, the weather changes a lot, for example, there are years where it rains a lot and others where the droughts are very long ..." Jose mentioned that "Before, the weather changed year after year ... now, the changes are in the same year, we do not know at times what is going to happen, and we have to be prepared for whatever ..."

Objective 2 Results

The second objective of this research study was to quantitatively measure the impact of an educational program on farmers' knowledge, attitudes, and perceptions on how to improve their food security and nutritional status.

Educational Intervention. A four-hour educational intervention was designed for community members based on the findings from the qualitative data. Three learning modules were developed to present the intervention content to the participants. The educational intervention structure included: introduction, important concepts related to the topic, and practice activities. The practice activities sought to strengthen the farmers' understanding of the topic and increase their engagement. The learning modules were facilitated by the principal researcher. The educational intervention content was compiled in an informative manual designed and developed by the researcher in Spanish. Food security and nutrition experts supervised and revised the informative manual prior to its use. The manual sought to provide an information source for farmers and a reference for use of the information at home. Based on the high level of community illiteracy, the informative manual was designed with diagrams and images facilitating farmers' understanding. For the experimental group, there were more males ($n = 40$) than females ($n = 14$). The control group followed the same tendency, having more males ($n = 29$) than females ($n = 19$). Overall, both groups were composed mainly of males ($n = 69$) rather than females ($n = 33$).

Farmers' Knowledge. After the educational intervention, the experimental and control groups' knowledge scores did not violate homogeneity, as assessed by Levene's Test for Equality of variance ($p = .514$ and $p = .325$, respectively) (Field, 2018). The experimental group's knowledge scores were higher for posttest ($M = 20.78$, $SD = 2.30$) than pretest ($M = 7.93$, $SD = 2.31$), a statistically significant difference $t(106) = -28.97$, $p < .001$. For the control group, there was no statistically significant difference ($p < .05$) between pretest and posttest scores. (Table 1).

Table 1
Group Differences for Treatment and Control Knowledge Pretest and Posttest Scores

Group	Pretest		Posttest		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Experimental	7.93	2.37	20.78	2.30	-28.98	106	<.00*
Control	8.19	2.50	8.40	2.89	-.21	94	.71

Note: ¹Score: 0 – 25; **p* < .01.

Farmers' Attitudes and Perceptions. The attitude and perception scores per construct per each level of testing were normally distributed. Distribution was assessed by skewness and kurtosis between -2 and +2, which are considered acceptable in order to prove normal univariate distribution (Field, 2018). This was followed by visual inspection of the distribution shape.

In the experimental group, the *Community* construct, farmers' attitudes and perceptions were higher for posttest ($M = 4.14$, $SD = .68$) than pretest ($M = 3.26$, $SD = .63$), a statistically significant difference $t(106) = -6.9$, $p < .001$. Sample questions addressing the *Community* construct included *I am not interested in feeding my community*, and *I am willing to exchange food products with other members of my community*.

For farmers' scores on the *Food Choices* construct, there was an increase in scores from posttest ($M = 3.64$, $SD = .32$) to pretest ($M = 3.21$, $SD = .59$), a statistically significant difference $t(106) = -4.6$, $p < .001$. Sample questions addressing the *Food Choices* construct included *The foods produced in home gardens are not good quality*, and *To have a healthy diet I have to eat a variety of foods (cereals, vegetables, meat, dairy products ...)*.

In the *Education* construct, there was an increase in scores from posttest ($M = 4.13$, $SD = .71$) to pretest ($M = 3.38$, $SD = .60$), a statistically significant difference $t(106) = -6.2$, $p < .001$. Sample questions addressing the *Education* construct included *I am not trained to produce food in a home garden*, and *I need to learn more about my family's diet*.

The *Food Safety* construct did not meet the Levene's Test for Equality of Variance assumption of homogeneity of variance ($p = .03$). The corrected t-test was used not assuming homogeneity of variance. There was an increase in scores from posttest ($M = 4.01$, $SD = .47$) to pretest ($M = 3.43$, $SD = .62$), a statistically significant difference $t(99.05) = -7.3$, $p < .001$. Sample questions addressing the *Food Safety* construct included *The storage temperature of food is not important in my house*, and *The cleaning of food is not important for the health of my family*.

For the *Water Treatments* construct, there was an increase in scores from posttest ($M = 3.70$, $SD = .43$) to pretest ($M = 3.44$, $SD = .79$), a statistically significant difference $t(106) = -4.6$, $p = .035$. Sample questions addressing the *Water Treatments* construct included *Contaminated water is not a risk to my family*, and *Water cleaning is not important in my house*.

In the *Agricultural Production* construct, there was an increase in scores from posttest ($M = 3.16$, $SD = .36$) to pretest ($M = 3.14$, $SD = .41$), no statistically significant difference $t(106) = .215$, $p = .830$. Sample questions addressing the *Agricultural Production* construct included *I have the right resources to produce food*, and *I am not interested in producing food in my house*. For the control group, there was no statistically significant difference in constructs between pretest and posttest scores (Table 2).

Table 2
Group Differences for Treatment and Control Attitudes Pretest and Posttest Scores

Group	Pretest		Posttest		<i>T</i>	<i>df</i>	<i>p</i>
	<i>M</i> ¹	<i>SD</i>	<i>M</i> ¹	<i>SD</i>			
Community							
Experimental	3.26	.63	4.14	.68	-6.9	106.00	<.001*
Control	3.31	.86	3.18	.87	.99	94.00	.321
Food choices							
Experimental	3.21	.59	3.64	.32	-4.6	106.00	<.001*
Control	3.25	.62	3.37	.68	-.91	94.00	.364
Education							
Experimental	3.38	.60	4.13	.71	-6.2	106.00	<.001*
Control	3.49	.74	3.64	.55	-.34	94.00	.735
Food safety							
Experimental	3.43	.62	4.01	.47	-7.3	99.05	<.001*
Control	3.70	.78	3.63	.69	.95	94.00	.924
Water treatments							
Experimental	3.44	.79	3.70	.43	-4.6	106.00	.035*
Control	3.56	.66	3.51	.71	.60	94.00	.550
Agricultural production							
Experimental	3.14	.41	3.16	.36	.21	106.00	.830
Control	3.12	.38	3.21	.43	.10	94.00	.819

Note: ¹Likert type scale: (1) Strongly Disagree (2) Disagree (3) Neither in disagreement nor in agreement (4) Agree (5) Strongly Agree; **p* < .05.

Discussion

In El Salvador, the highest levels of poverty mainly affect rural populations. Poverty limits the satisfaction of many basic needs of farmers, including food, education, and water and sanitation (Government of El Salvador [GOES], 2017). In 2017, of the total population living in poverty or extreme poverty, 83.7% of households did not have adequate sanitation conditions and 49% did not have access to potable water (GOES, 2017).

The results of this research study indicate that in this particular community in rural El Salvador, food insecurity centers primarily in the access and utilization dimensions of the FAO framework. Though access is challenging to address in an educational intervention, the utilization dimension was addressed in this case. Results of post-intervention assessment indicate a change in farmers' knowledge on food security and nutrition after the educational intervention. According to Brenes (2017) knowledge is an important component of the behavior change process. Farmers' attitude and perception scores increased after the educational intervention and are evidence of the contribution of the training to the possible change on farmers' food security and nutrition. After the educational intervention, farmers expressed their intentions to adopt the concepts of family nutrition, home water treatments, and agricultural production practices. However, these results should be interpreted cautiously because the *agricultural production* attitudes and perceptions did not change significantly after the training.

For future interventions that seek sustainable improvement in the food and nutritional security of a community, it is recommended to include an education and training component for the participants that is derived from community members' own assessments of their needs. The intervention in this study was developed based on the results of qualitative inquiry in the community. Understanding the community members' perceptions helped structure the content and delivery methods used in the intervention. The results of this study indicated that the changes in farmers' knowledge, attitudes, and perceptions, may have been generated by participation in the educational intervention (Berckler & Wiggins, 1989).

Educational interventions in rural communities should be designed, implemented, and evaluated, promoting the active participation of women and youth. Improving food and nutrition security is a task in which all family members should participate. The qualitative analysis in this study showed that although women work in agricultural activities, they are not seen, nor do they see themselves, as playing a decisive role in those activities. However, women decide the family diet and have the leading role in the food decisions at home. Additionally, young people and children work in family agricultural production in the geographical area of this study, but their voices are not often heard on matters of food security. Food choices and preferences during childhood not only influence development and growth, but also affect the adoption of bad eating habits during adulthood, underscoring the importance of including their perspectives in food and nutrition security research (Taylor, et al., 2005).

For future educational programs with farmers, it is recommended to tap into the interests of the farmers to participate in these types of programs. The reasons for the participation of adults in multiple educational modalities are diverse and influence the kind of results the program can achieve (Merriam et al., 2007). Educational interventions should be sensitive to the social, cultural, and economic aspects of the population of interest. In food and nutrition security, many aspects of daily life are influenced by tradition and are strongly rooted in cultural identity (Counihan & Van Esterik, 2012). The participation and possible adoption of knowledge by farmers must be motivated by offering accessible and relevant knowledge and technologies (Adesina & Zinnah, 1993).

Lastly, the impacts of educational interventions on smallholder farmers should be evaluated in the short, medium, and long term (David & Asamoah, 2011). Assessing the level of knowledge retention and techniques that have been implemented over time would assist in designing interventions that are more effective with similar communities. Based on the intervention designed in this study, it is recommended to provide ample time for the execution of the intervention in order to fully address all aspects of the intervention topic. In this study, not all the topics identified in the qualitative stage were addressed in the educational intervention.

Additional research with smallholder farmers in El Salvador is recommended, especially in light of the small sample size that comprised the participants in this study. A longitudinal study with the same community would also provide interesting insight into the longevity of the knowledge gained in the educational intervention. Research into the actual behavior change – if any – of the study participants over time would also yield fruitful and informative data on food security interventions.

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