Peer-reviewed version available at Int. J. Environ. Res. Public Health 2018, 15, 1991; doi:10.3390/ijerph15091991

Article

Title: Faithful Families Cooking and Eating Smart and Moving for Health: Evaluation of a Community Driven Intervention

Caitlin Torrence [1], Sarah Griffin [2,] *, Laura Rolke [3], Kelli Kenison [4], and Alta Mae Marvin [5]

[1] Clemson University; ctorrenc@clemson.edu
[2] Clemson University; sgriffi@clemson.edu
[3] Clemson University, lrolke@g.clemson.edu
[4] University of South Carolina, kenison@mailbox.sc.edu
[5] Clemson University Cooperative Extension, amarvin@clemson.edu
* Correspondence: ctorren@clemson.edu; Tel.: +01-864-387-9187

Abstract: There is a growing need to utilize community interventions to address modifiable behaviors that lead to poor health outcomes like obesity, diabetes, and heart disease. Poor health outcomes can be tied to community-level factors such as food deserts (identified areas with low access to fresh fruit, vegetables, and other healthful whole foods) and individual behaviors like sedentary lifestyles, consuming large portion sizes, and eating high-calorie fast food and processed foods. Through a social ecological approach with family, organization and community, the Faithful Families Cooking and Eating Smart (FFCES) intervention was created to address these concerns in a rural South Carolina community. FFCES used gatekeepers to identify 18 churches and 4 apartment complexes in low-income areas. 176 participants completed both pre- and post- survey measures. Student's t-test measures found statistically significant change in participant perception of food security (0.39, p-value=0.005), self-efficacy with physical activity and healthy eating (0.26, p-value=000), and cooking confidence (0.17, p-value=.01). There was not significant change in cooking behaviors as assessed through the Cooking Behaviors Scale. FFCES shows that a social ecological approach can be effective at increasing and improving individual healthy behaviors and addressing community-level factors in low-income rural communities.

Keywords: Dietary Intervention; Multilevel Intervention; Diet & Exercise, Health Outcomes

1. Introduction

Diet and exercise have been identified as modifiable behaviors that can reduce poor health outcomes including obesity, diabetes, and heart disease [1-6]. However, the prevalence of these diseases, which are sensitive to behavior change, continue to remain high [7]. Obesity and diabetes are increasing around the world and in the United States, one third of adults are obese [7,8]. Growing portion sizes for meals consumed outside the home, limited access to healthy food choices, and the availability of high-calorie fast-food and processed foods are some explanations for the increase in poor health outcomes in the United States [1]. Living in a food desert or a community with low-access to food is also another risk factor for poor health outcomes [9].

The United States Department of Agriculture (USDA) defines food deserts as "parts of country vapid of fresh fruit, vegetables, and other healthful whole foods" [10]. More specifically, at least 500 people or 33% of a census track's population must live more than one mile from a grocery store, supermarket, or farmers market [10]. Communities located within food deserts and low-access areas tend to be poorer and have lower-education levels [9]. In the US, it is also not uncommon for these areas to be rural, meaning areas with lower population density. Rural areas have a greater risk of suffering from this affliction [9]. In South Carolina, where this study takes place, middle-income

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neighborhoods have on average 25% more supermarkets than low-income communities [11]. As a result, fewer fruits and vegetables are consumed in low-income, rural areas [9]. Though rural residents may live near farms or other agricultural endeavors, they often consume fewer fruits and vegetables than their urban peers [12,13]. This is particularly concerning as the importance of fruit and vegetable consumption in preventing heart disease and diabetes is well documented [14-18].

Poor health outcomes have often been consistently associated with a sedentary lifestyle [19-22]. Low-levels of energy expenditure, as characteristic of a sedentary lifestyle, have been linked with obesity, diabetes, high blood pressure, and heart disease [23-25]. Compounding the concern, there is evidence suggesting rural residents are generally less active than urban residents. Often rural residents have few safe options for engaging in exercise and physical activity [26]. While poor health outcomes are not specific to rural communities, living in a rural area is associated with poorer health outcomes [8,27-30]. Rural residents have a greater risk of numerous negative health outcomes including heart disease and type II diabetes [8,27-31].

Multilevel approaches addressing health problems have been a recommended health promotion practice for more than twenty years [32]. The social ecological framework provides an appropriate lens for addressing behavior change [33]. Individual behavior change is more likely to occur if health promotion programs and activities address the needs of the individual through a multi-layer context that are culturally appropriate. This context must acknowledge and address the individual characteristics as well as the influencing characteristics of the family, organization and community within which behaviors occur [32,34]. This is especially pertinent to rural communities where there is a greater risk of a dynamic interplay between individual behaviors and barriers to access such as living in community with low-access to food or limited physical activity resources, which are factors at the organizational and community levels [9,31]. Churches have been found to play an important role in improving health within rural communities. This has been especially evident in African American rural communities where religiosity and church attendance tend to be high [35].

Core components of many multilevel approaches to improving obesity related health outcomes focus on nutrition and exercise. The promotion of home cooking through nutrition education is a common strategy used to reduce obesity and improve dietary quality [19-22,26]. Cooking dinner at home is associated consumption of a healthier diet [26]. Home cooking tends to result in greater fruit and vegetable consumption and higher self-efficacy for eating a healthy diet [20]. Further, if healthy foods are made available within the home and parents model healthy eating, children are less likely to prefer high fat and sugar foods [22]. Studies have found that programs that encourage home cooking may be particularly needed for low-income families. For example, a lower percentage of fruit and vegetable consumption is found among of families who qualify for the federally funded Supplemental Nutrition Assistance Program (SNAP) compared to families who are ineligible [23]. Another study found that low-income individuals do not consume the recommended daily amount of whole grains, fruit, vegetables, fish, and nuts and seed. However, consumption of processed meats, sweets, bakery desserts and sugar sweetened beverages exceed the recommended daily amount [24].

Studies have found that increased access to fresh fruits and vegetables does not always result in higher levels of fruit and vegetable consumption due to a lack of knowledge regarding food preparation [36-38]. Cooking interventions, however, when combined with nutrition education programs are effective at increasing the consumption of fruits and vegetables while also reducing reliance on heavily processed and other unhealthy foods [25,32]. Home-visit cooking intervention programs have improved attitudes and behaviors toward vegetable consumption by low-income families with young children [32]. Cooling with Kids, a school-based program increased vegetable cooking attitudes and self-efficacy for cooking and eating vegetables among fourth graders [34]. Additionally, community-based cooking skill interventions with vulnerable, low-income groups have had a positive effect on food literacy, particularly in improving confidence in cooking with fruits and vegetables [39]. And, finally, an impact evaluation of the evidenced-based program, Cooking Matters, found significant improvements in dietary choices and patterns among participants [25]. Building on the previous success of nutrition education and cooking programs, by addressing

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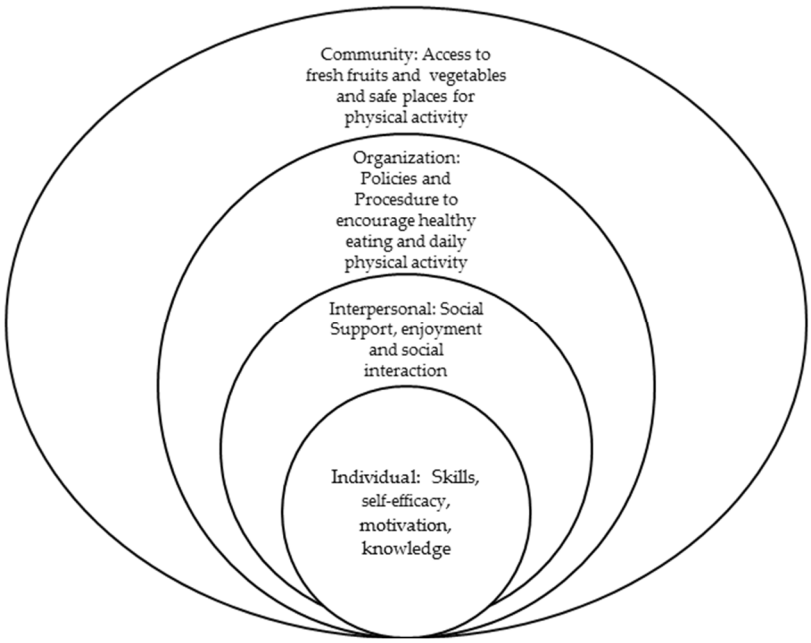
established barriers to accessing healthy food and encouraging physical activity, a holistic approach to health and healthy behaviors may be beneficial for rural communities.

2. Materials and Methods

Intervention

Faithful Families Cooking and Eating Smart (FFCES) intervention, a family-centered ecological approach to improve nutrition and physical habits, was created to address poor health outcomes of a rural South Carolina community, see Figure 1. Over half of the county where this community is located has been designated as a low food access area and with high rates of obesity and diabetes [10]. At the time of the study, this county had an adult obesity rate of 40%; eight percent higher than the state of South Carolina [40]. FFCES intervention was created to address poor health outcomes for this community. FFCES is a community-based health education and promotion program modeled after two evidenced based and practice-proven programs, Cooking Matters and Faithful Families Eating Smart and Moving More. Recognizing the importance of promoting physical activity in addition to healthy eating, physical activity education and support were incorporated as key components of the intervention. To further enhance FFCES, the program expanded earlier nutrition initiatives adopted by the community. In addition to educational components focused on the importance of nutrition and exercise, FFCES included a mobile farmers market. This innovative feature of the program directly addressed community barriers of access to good quality, healthy foods such as fresh fruits and vegetables. This mobile farmer's market functioned in the same manner as a traditional ice-cream truck; however, it was stocked with local produce and equipped to accept multiple forms of payment including cash, credit/debit card, and SNAP. The mobile farmer's market was run by a retired local community member and supported through community programming, school districts, and businesses.

Figure 1: FFCES Ecological Model



Study Design and Sample

A large, rural South Carolina county, which was also designated as an area of low-access to food, was identified for the implementation of FFCES. Working with community gatekeepers in the selected county, 22 sites were selected for delivering the FFCES program. The target communities within the county were churches in low-income areas and low-income apartment complexes. FFCES was delivered at 18 churches and 4 low-income housing developments. Churches were selected based

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on their location within the county with attention paid to their spread around the county and the extent that they were located in rural communities. Organization recruitment focused on churches that had not participated in previous community healthy eating initiatives. The intervention was open to all church participants and residents in the housing sites. Survey participation was a convenience sample from participating churches and housing sites. All adults participating in the program at each site were encouraged to complete surveys however it was not a requirement for participating in the program. Two-hundred and thirty-six individuals participated in FFCES program evaluation. Participants in the evaluation were either a member of a participating church or residing within a specified low-income housing apartment at the time of the study. Of the participants who completed a survey measure, 76% (176) completed both the pre- and post-test survey. While the program was designed for adults, some children were eager to attend the programming and allowed to participate. A pre-test survey was administered prior to the start of the first class within the program series and the post-test survey was administered upon conclusion of the series. The six-week program was delivered to each site over the course of one and a half years. The study was approved by the Clemson University Institutional Review Board, approval number 2014001418.

Measures

Completeness of intervention implementation was assessed through delivery checklist and attendance records. Intervention fidelity was assessed through session observations by the program evaluators. Intervention outcomes were assessed through participant pre/post surveys. FFCES participants completed surveys that included basic demographic questions and assessed a variety of nutrition and physical activity characteristics (Table 1). Cooking Matters' validated assessments were used to assess three diet and behavior constructs including diet patterns, dietary choices, and psychosocial influencers such as cooking barriers and confidence. The Cooking Matters assessment was a total of 49 questions [41].

Table 1: Demographics of matched pre- & post-tests

Completed Pre & Post Tests	**n=176 (76%)**
Gender	
Male	20 (11.6%)
Female	153 (88.4%)
Age	
Under 18	6 (3.5%)
18-29	13 (7.7%)
30-39	10 (5.9%)
40-49	18 (10.6%)
50-59	28 (16.5%)
60 and over	95 (55.9%)
Race	
White	7 (4%)
Black	164 (95%)
Other	2 (1%)
Ethnicity	
Hispanic	1 (.6%)
Education	
Less than high school	14 (8.4%)
High school degree/GED	55 (33.1%)

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Some college/2-year degree	52 (31.4%)
College degree (4 year)	20 (12.1%)
Graduate degree	25 (15.1%)
Household size	
Live alone	37 (21.4%)
Live with 1 person	60 (34.7%)
Live with 2 persons	31 (17.9%)
Live with 3 persons	21 (12.1%)
Live with 4 or more persons	24 (13.9%)
Minor in household	54 (32%)
Public assistance	67 (41.9%)
Women, Children, and Infant (WIC)	11 (6.3%)
Supplemental Nutrition Assistance Program (SNAP)	41 (23.3%)
Free or reduced-price school breakfast	22 (12.5%)
Free or reduced-price school lunch	25 (14.2%)
Free or reduced-price school supper	3 (1.7%)
Free summer meals	12 (6.8%)
Head Start	5 (2.8%)
Food pantry	12 (6.8%)
Number of different types of public assistance	
One	38 (56.7%)
Two or more	29 (43.3%)

The Cooking Matters scale assessing dietary patterns was adapted from the validated Share Our Strength measure [25]. This 10-item scale assesses participant food preparation and eating habits. The assessment asks questions regarding the participant's frequency of eating fruits and vegetables and includes questions about how often meals are prepared at home. Participant survey choices include 1 (not at all), 2 (once a week or less), 3 (more than once a week), 4 (once a day), and 5 (more than once a day). To assess participant dietary choices, the Cooking Matters evaluation includes six items that assess participant healthy food choices. The 5-pont Likert scale ranges from 1 (never) to 5 (always). Rather than compiling each question into a scale, each item within this category is assessed as individual outcomes as indicated by the Cooking Matters curriculum. Questions within this category include preferences for low-fat dairy and low-sodium food items.

Psychosocial constructs include food resource management, barriers to cooking, food preparation, and cooking confidence. The Healthy Food Preparation Scale, a component of the Cooking Matters program evaluation, was used to assess participant behavior regarding preparing and eating healthy meals. Ten questions were asked about participant confidence and the frequency that they engage in healthy behaviors. A 5-point Likert scale ranging from 1 (never) to 5 (always) was used for each question. Each question was analyzed individually. To assess confidence and self-efficacy, the Cooking Confidence Scale was also administered. This is a validated scale that is used by the Cooking Matters curriculum. It includes four questions that assess participant confidence in

cooking and purchasing habits of health foods. Two additional questions to assess cooking confidence were added. The Cronbach's alpha of the new scale was .87. FFCES also used the Cooking Barriers Scale as supported by the Cooking Matters curriculum. This scale consists of three questions regarding participant's interest and feelings regarding preparing food. This measure was previously validated by Gretchen Swanson Center for Nutrition [25]. The self-efficacy for healthy behaviors scale (Cronbach's alpha .94) was used to further assess confidence with both food selection and engaging in physical activity. Seven individual items were used to assess family support for healthy lifestyle changes.

Validated scales were used to assess physical activity and additional attitudes regarding cooking. To assess physical activity, the validated Rapid Assessment of Physical Activity (RAPA) was incorporated. Participants were provided an example of light, moderate and vigorous activity and then asked to assess the frequency that they engage in the activity. The RAPA also has an additional component that assesses participant strength and flexibility. The RAPA was implemented and used as outlined by the assessment developers [42].

Statistical Analysis

Survey responses were analyzed using STATA version 14. Descriptive statistics were used to assess participant demographics and student's t-tests were used to assess differences in pretest and post-test means. Only participants who completed both pre and post assessments were included in the analysis.

3. Results

3.1 Intervention Delivery

Each FFCES session contained an introduction, two nutrition education units, a cooking unit, and social time for participants to eat what they prepared during the cooking unit. Session instructors used delivery checklists to report the amount of each unit with a session that was completed. These results were high, ranging from 75% for the cooking unit to 92% for the introduction. Independent program delivery observations conducted by evaluators found that delivery adaptations occurred at each site, however these adaptations did not cause the program to deviate from the core lesson objectives and session goals, thus maintaining program fidelity. Modifications made to the lessons were predominately made because of time shortages or space limitations. Attendance was taken at each session indicating that over 410 individuals participated in the FFCES sessions. Each participating organization committed to developing a health plan for their organization and implementing a minimum of two of their planned organizational policy or procedure changes. Nutrition oriented changes mostly focused on limiting soft drinks or soda and encouraging water, encouraging less sugar in iced tea, fewer desserts, and processes for making sure healthy food options are available at all church sponsored or housing site sponsored events. Four churches also facilitated a mobile farmers market serving 51 families for almost two months. Physical activity oriented changes included offering exercise classes, building fitness trails, holding weekly "praise walks", and updating ballfields.

3.2 Sample Characteristics

Of the 232 survey participants, 76% (176) completed a pre- and post-test survey (Table 2). Nearly all participants identified as female (88.4%) and over half indicated that they were 60 years of age or older (55.9%). While ages of participants ranged from under 18 to over 60, the majority (83%, 141) identified as 40 years of age or older. Ninety-five percent of participants reported that they were African American. Four percent identified as white and one percent classified as "other" race. Many of the participants reported having a high school diploma or GED (55, 33.1%) or some college (52, 31.4%). However, nearly thirty percent (52, 27.2%) report having a college or graduate degree. Conversely, 84% (14) individuals reported having less than a high school diploma, indicating that while racially homogeneous, educational attainment was quite diverse among our sample. The

household size of participants ranged from living alone to living with four or more individuals. Nearly half of participants lived with at least two additional people (76, 43.9%). Most participants reported living with one additional person (60, 34.7%). While the sample was mostly comprised of middle-age and older adults, over 32% (54) reported that a minor resided within their household. Participants were asked about their household's use of food-based public assistance including the Women, Infants, and Children (WIC) program, SNAP, free or reduced-price school breakfasts, lunches, and dinners, free summer meals, Head Start, or if they frequent a food pantry. Forty-one percent of the sample reported that they received or used at least one of the nutrition programs. Of those receiving a form of food-based public assistance, the majority (56.7%) were receiving only one type; however, 16.5% (29) reported supplementing meals with two or more public assistance food programs.

3.3 Participant Healthy Eating & Physical Activity Outcomes

3.3.1 Participant Dietary Patterns & Dietary Choices

Participants who engaged and completed the six-week program on average increased the frequency that low-fat dairy options were consumed (Table 2). The score increased by 0.3 (p-value =.002). Thirty-six percent of participants at baseline reported "often" or "always" eating low-fat options, while forty percent reported "often" or "always" at completion of the program. The frequency that participants reported selecting low-sodium options also significantly increased. The mean score increase was .2 (p-value<.05). The frequency the participants purchased low-fat meat products also resulted in a significant increase. At baseline, participants reported that they never or rarely purchase low-fat meats 11% of the time. Upon program completion, only 7% reported never or rarely making these types of purchases. The average change in score means was .3 (p-value=.008). When eating out, participants reported that they made more frequent attempts to order healthy foods including fruits, vegetables, whole grains, lean meats, low-fat dairy products, and water. The mean change in score was .2 (p-value<.05).

Table 2: Mean Change

Survey Items or Scales	**Mean (SD)**	
	Baseline	6-week (post)
Dietary Patterns Scale (scale items below)	2.7 (.5)	2.7 (.4)
How often do you typically eat fruit like apples, bananas, melon, or other fruit?	3.3 (1.1)	3.4 (1.0)
How often do you typically eat green salad?	2.6 (.90)	2.8 (.90)
How often do you typically eat French fries or other fried potatoes, like home fries, hash browns, or tater tots?	2.1 (.77)	2.0 (.76)
How often do you typically eat any other kind of potatoes that aren't fried?	2.1 (.80)	2.0 (.86)
How often do you typically eat refried beans, baked beans, pinto beans, black beans, or other cooked beans?	2.0 (.90)	2.1 (.87)
How often do you typically eat other non-fried vegetables like carrots, broccoli, green beans, or other vegetables?	2.9 (.94)	3.0 (.91)
How many times a week do you typically eat a meal from a fast-food or sit-down restaurant? (consider breakfast, lunch and dinner.)	2.3 (.84)	2.1 (.80)
How often do you typically drink 100% fruit juices like orange juice, apple juice or grape juice?	2.8 (1.1)	3.0 (1.1)

How often do you typically drink a can, bottle or glass of regular soda or pop, sports drink, or energy drink?	2.3 (1.2)	2.3 (1.2)
How often do you typically drink a bottle or glass of water?	4.5 (.89)	4.5 (.84)
Dietary Choices		
When you have milk, how often do you choose low-fat milk (skim or 1%)?	3.0 (1.6)	2.9 (1.5)
When you eat dairy products like yogurt, cheese, cottage cheese, sour cream, etc., how often do you choose low fat or fat-free options?	3.0 (1.4)	3.3 (1.1)**
When you eat grain products like bread, pasta, rice, etc., how often do you choose whole grain products?	3.3 (1.2)	3.5 (1.2)
How often do you choose low-sodium options when you buy easy-to-prepare, pre-packaged foods like canned soups or vegetables, pre-packaged rice, frozen meals, etc.?	3.1 (1.3)	3.3 (1.2)*
When you buy meat or protein foods, how often do you choose lean meat or low-fat proteins like poultry or seafood (not fried), 90% or above lean ground beef, or beans?	3.7 (1.0)	4.0 (1.1)**
When you eat at fast-food or sit-down restaurants, how often do you choose healthy foods? (Healthy foods include fruits, vegetables, whole grains, lean meats, low-fat or fat-free dairy, and water.)	3.3 (1.2)	3.5 (1.2)*
Healthy Food Preparation (questions 2.20-2.29)		
How often do you compare prices before you buy food?	4.0 (1.3)	4.1 (1.1)
How often do you plan meals ahead of time?	3.4 (1.3)	3.2 (1.1)
How often do you use a grocery list when you go grocery shopping?	3.5 (1.4)	3.4 (1.3)
How often do you worry that your food might run out before you get money to buy more?	2.7 (1.6)	2.3 (1.3)**
How often do you use the “nutrition facts” on food labels?	3.0 (1.5)	3.4 (1.2)**
How often do you eat breakfast within two hours of waking up?	3.3 (1.4)	3.4 (1.2)
How often do you eat food items from each food group every day?	3.5 (1.2)	3.7 (1.0)
How often do you make homemade meals “from scratch” using mainly basic who ingredients like vegetables, raw meats, rice, etc.?	3.7 (1.3)	3.5 (1.3)
How often do you adjust melas to include specific ingredients that are more “budget-friendly,” like on sale or in your refrigerator or pantry?	3.5 (1.3)	3.5 (1.2)
How often do you adjust meals to be more healthy, like adding vegetables to a recipe, using whole grain ingredients, or baking instead of frying?	3.6 (1.2)	3.7 (1.1)
Cooking Behaviors Scale (scale items below)	2.1 (.94)	2.0 (.94)
Cooking takes too much time.	2.2 (1.0)	2.1 (1.0)
Cooking is frustrating.	2.0 (.98)	1.9 (.86)
It is too much work to cook.	2.1 (1.0)	2.0 (1.0)
Cooking Confidence Scale (scale items below)	4.2 (.90)	4.4 (.90)**
How confident are you that you can use the same healthy ingredient in more than one meal?	4.1 (1.2)	4.3 (1.1)*
How confident are you that you can choose the best-priced form of fruits and vegetables (fresh, frozen, or canned)?	4.1 (1.1)	4.3 (1.1)

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How confident are you that you can use basic cooking skills, like cutting fruits and vegetables, measuring out ingredients, or following a recipe?	4.3 (1.2)	4.4 (1.1)
How confident are you that you can buy healthy foods for your family on a budget?	4.1 (1.2)	4.4 (1.0)*
How confident are you that you can cook healthy foods for your family on a budget?	4.2 (1.1)	4.3 (1.2)
How confident are you that you can help your family eat more healthy?	4.3 (1.1)	4.5 (.91)**
Self-efficacy for healthy behaviors scale (scale items below)	3.3 (.74)	3.6 (.73)***
How confident are you in preparing fresh vegetables as part of a meal?	3.8 (.90)	4.0 (.80)**
How confident are you in preparing fruits as part of a meal?	3.6 (1.1)	3.9 (.90)**
How confident are you in using herbs and spices as part of a meal?	3.5 (1.0)	3.8 (1.0)*
How confident are you that you can find ways to exercise or be physically active?	3.7 (.92)	3.9 (.84)*
How confident are you that you can reach your exercise or be physically active goals?	3.5 (.95)	3.8 (.87)**
How confident are you that you can overcome things that get in the way of exercise or physical activity?	3.4 (.97)	3.6 (1.0)**
How confident are you that you can get others to exercise with you?	2.9 (1.1)	3.2 (1.1)**
How confident are you that you can find ways to be active with your family?	3.1 (1.1)	3.4 (1.1)**
How confident are you that you can be active with your children?	3.0 (1.3)	3.3 (1.3)**
How confident are you that you can be active with others in your community?	2.9 (1.1)	3.3 (1.1)**
How confident are you that you can be active with others in your church?	3.3 (1.1)	3.5 (1.0)**
Family support		
My family encourages me to make healthy meals.	3.4 (1.1)	3.5 (1.1)
My family helps me make healthy meals.	3.2 (1.1)	3.2 (1.1)
My family and I plan how to make healthy meals.	3.0 (1.2)	3.3 (1.2)*
Our family regularly eats fast food.	2.5 (1.0)	2.6 (.90)
My child (or children) frequently drinks soda or other sweet drinks.	1.5 (1.5)	1.6 (1.4)
My child rarely drinks low-fat milk.	1.7 (1.7)	1.8) (1.7)
Our family does not play games outside, ride bikes, or walk together very often.	2.6 (1.2)	2.4 (1.3)
Rapid Assessment of Physical Activity (RAPA)		
General Assessment	4.8 (1.9)	5.3 (1.7)**
Rapid Assessment of Physical Activity (2): strength & flexibility	1.0 (1.2)	1.8 (1.8)***

*p-value <=.05 ** p-value <=.01 ***p-value<=.001

3.3.2 Participant Food Resource Management

While mean changes for most questions regarding purchasing healthy food indicated that participants more frequently checked prices prior to purchasing food, most changes were insignificant. However, participants reported a significant decrease in the frequency that they worry about running out of food before being able to afford to purchase more. At baseline, 18.5% reported "often" or "always" worrying. At program conclusion, 14.8% reported experiencing this worry. The mean change in score was .39 (p-value=.005). In addition to food security, participants reported that

they more frequently used "nutrition facts" and food labels when purchasing food. The mean change was .42 (p-value<.001).

3.3.3 Participant Cooking Behaviors and Confidence

There were not significant changes in the Cooking Behaviors Scale scores; yet, participants were more likely to disagree with the scale items upon program completion. Disagreement with the scale items, indicating more positive cooking behaviors were relatively high (75%) at baseline. Conversely, the Cooking Confidence Scale resulted in an average score increase of .17 (p-value=.01). While cooking confidence was relatively high at baseline (25% reporting "very confident"), participants were more likely to report being very confident (38%) at follow-up. Notably, participants were significantly more confident that they could help their family eat healthier. The mean score change was .2 (p-value=.007). While all items that focused on healthy family initiatives resulted in positive improvements, only one item resulted in significant change. After completing the program, families were more likely to report that they plan how to make healthy meals. On average, this score increased .25 (p-value=.03).

Participant self-efficacy and confidence associated with increased physical activity and healthy eating habits, as assessed by the self-efficacy scale, also indicated significant improvement. The average mean change was .26 (p-value=000). Each individual item within this scale was highly significant indicating that on average participants feel more confident in planning and preparing healthy foods and promoting physical activity within the family.

3.3.4 Participant Physical Activity

Participants reported significant improvements in physical activity and exercise frequency and intensity. At baseline, nearly half of participants assessed with the RAPA were identified as receiving less than the recommended amount and intensity of exercise. For example, 26 percent of participants reported "doing some light physical activity every week", which is classified as regular underactive. Upon program completion, only 37% of participants were classified as not engaging in enough physical activity. Further, just 6% of participants reported only "doing some light physical activity every week". The mean reported change in physical activity frequency and intensity increased .45 (p-value=.004). Further participant strength and flexibility scores also improved. The change in score was .76 (p-value=.000).

4. Discussion

The high rates of obesity where the study took place and in other areas of the world illustrate the need for effective community-based health education and promotion. This evaluation supports the findings of other community-based healthy eating program evaluations [2,19,20,23,25,32,34,36,39]. Building on previous research which indicates that nutrition education is often less effective without a complimentary cooking program that engages participants in food preparation, this program took a novel approach to address a key barrier to healthy meal preparation in many communities located within a food desert. While nutrition and promotion classes can be effective at increasing healthy behaviors; access to healthy food must also be addressed, especially for communities located in food deserts and low-access areas [9,11,36,43]. By incorporating a mobile farmer's market into FFCES, this critical barrier for achieving healthy food-related behaviors was addressed. By building access to healthy food into the program, participants in this FFCES were enabled to apply classroom techniques within their home.

Access is a defining feature of food deserts and low-access areas [9]. Especially important to note about access is that it has the great potential to cause a domino effect on resource strain. For instance, as is often the case in rural communities where lack of cost-effective public transportation is common, individuals must drive a distance to access groceries. This requires access to a car and the longer drive requires gas money that is often more costly than public transportation [11,36]. The

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expenditures used to access food among lower-income rural individuals may reduce the amount of money that can be spent on food. In fact, reliable transportation is often cited as a key difference between food secure and food insecure families. The Midlands Family Study found that only 33% of families experiencing child hunger reported access to reliable transportation while over 72% food secure families had reliable access to transportation [11]. The food truck component of this program brought healthy food to local communities, effectively stimulating implementation of program education. It also likely influenced how monetary resources were utilized and assisted with family food budgeting. A significant finding of this study was that participants were far less likely to worry about running out of food before being able to afford more. Having food brought to the community that can be purchased with SNAP benefits is a community level approach that addresses the fundamental barriers to access and reduces the domino effect brought on by limited resources at the individual, intrapersonal, and community level.

By combining complimentary programs that provide information on how to select healthy foods, instruction on cooking, and establishing an opportunity to practice behaviors, participants experienced significant increases in knowledge and confidence with food preparation. This individual level approach results in participants who are more confident in their ability to prepare healthy meals after education programs. While confidence in food preparation did not translate into significant changes in behaviors, the trend was positive. Further, while the evaluation of this program was only six-weeks, the program built on a foundation that the community has sufficiently invested for many years. This program expanded a previous community and state initiative termed Eat Smart Move More, which focused on improving health outcomes such as reductions in rates of diabetes and obesity [11]. FFCES was implemented in a community heavily invested in the ESMM initiative. Behaviors are often more difficult to alter, and short-term programs are less likely to result in significant behavior change [44]. However, the fact that many of the constructs measured were higher than expected at baseline is likely to be the result of previous community endeavors. For instance, over 75% of participants had positive cooking behaviors at baseline, including disagreement with statements such as “Cooking takes too much time” or “It is too much work to cook”. Further, the average baseline score for cooking confidence behaviors ranged from 4.1 to 4.3 indicating that participants were “very” confident with their ability to cook.

Physical activity and exercise, a core component of FFCES, was readily incorporated into each level of the social ecological framework. The benefit of engaging at various levels might best be realized through the physical activity improvements. Focusing on the family as well as the individual for many of the exercise components of the program helped address the influence of social support on motivation. Like many other education programs, self-efficacy for individual factors such as eating better resulted in significant changes; however, this program also resulted in significant changes in confidence of participants to engage their family members and promote healthy behaviors for their loved ones and community. At the organizational level, the program sites developed policies to encourage and support physical activity. Further, it is possible that the previous community endeavors focused on healthy eating primed individuals and the community to accept the physical activity initiative.

While findings provide valuable in-sight, there are several limitations. The sample size is small. It is a convenience sample from with the participating organizations and does not include all who were exposed to the intervention. It could be that those who were willing to participate in both the pre and post program survey were different in terms of their level of intervention participation or outcomes compares to others who did not want to participate in the survey. This project also did not include a control or comparison group. Therefore, we are very careful not to make statements of causation, only statements of difference from pre-intervention to post intervention.

5. Conclusions

A social ecological approach to program planning and implementation can be effective at increasing and improving healthy behaviors. Underpinning programs with an understanding of the interplaying factors at various levels will help tailor programming to the specific needs of the target

individuals and the larger community within which they reside. By addressing access to healthy foods as a key component of a healthy eating program, low income rural participants reported less worry about running out of food before being able to afford more. As it has been acknowledged, communities with poor food literacy often need more than education to improve eating behaviors and access to healthy food is a vital component. Bringing healthy, seasonally appropriate food to low-income rural communities will support education programs. Further, communities that have successfully implemented healthy behavior programs may be well poised to build on these programs to include additional healthy behaviors such as exercise and physical activity. A lengthier follow-up period to this study would help better assess the permanence of the changes. Future studies and programs should explore the unique strengths and weaknesses of the mobile farmer's market using the social ecological model to ground the analysis

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1,

Funding: This research was funded by the United States Department of Agriculture, Office of Rural Health, [1004103].

Acknowledgments:

Conflicts of Interest: The authors declare no conflict of interest.

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