

A Brief Nutritional Intervention to Improve Dietary Knowledge and Behaviors in US Emergency Food Assistance Recipients

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Abstract--The purpose of this study was to evaluate whether a brief nutritional intervention providing easy, fast, nutritious plant-based recipes, tastings and education would improve nutritional knowledge and encourage preparation of more meatless meals in 100 mobile food pantry clients in America. A controlled pilot study was used to assess changes in nutritional knowledge (healthfulness of plant-based meals) and behaviors (preparing more plant-based meals at home) after a brief educational intervention. Significant differences in knowledge and behavior were seen within the treatment group and between the control and treatment groups over time. A targeted, brief educational intervention using quick, easy meatless recipes and food pantry ingredients to promote more plant-based meals cooked at home can positively affect dietary knowledge and behaviors in mobile food pantry clients.

Index Terms--food security; food pantries; food banks; low-income; plant-based meals

I. INTRODUCTION

Millions of people lived in food-insecure households, with limited or uncertain access to nutritious food [1]. The demand for emergency food aid has increased to unprecedented levels in the United States (US) straining private emergency agencies such as food banks and the food pantries, soup kitchens and shelters they supply. Emergency food assistance agencies (typically resource-poor and volunteer-run) struggle with moving large amounts of food, especially perishable food items [2]. Much of food bank food is donated and is of poor nutritional quality [2]-[4], making it challenging to consume healthy nutrition with the limited food provided. Food banks strive to promote healthful eating, and many provide mobile food pantries to expand access to food, bypass transportation barriers, and fill geographic and service gaps [2]. Mobile food pantries serve a unique clientele with less frequent exposure to emergency food services compared to those that visit stationary food pantries [5].

Poor dietary quality and chronic diseases such as obesity, diabetes and hypertension are prevalent among food pantry users [6]. Healthy food is often more

expensive and unobtainable for low-income households [4]. Most pantry clients (particularly women) are overweight or obese, suggesting that food insecure individuals eat too much of the wrong type of foods (energy-dense) rather than getting insufficient calories [4]-[6]. Many low-income households consume low-cost, energy-dense, nutrient-poor foods to maximize their food budgets and stave off hunger [7], [8]. Low-income families also consume more meat (typically cheaper cuts and lower quality) than higher-income households, spending up to 50% of their food budget on meat [9]. Frequent meat consumption (even lean cuts) is linked to serious chronic illnesses including heart disease, type 2 diabetes, some cancers and increased mortality [10], [11]. Another impediment to a healthy diet is a lack of nutrition knowledge [9].

Lower income individuals are also less likely to cook, suggesting greater reliance on processed, packaged foods eaten at home [9]-[13]. A major barrier for cooking healthy meals is limited time [12]-[15]. About 1/3 US low-income women report no cooking at all, and an additional 37% report cooking < 60 minutes per day [15]. Lack of cooking knowledge, confidence, and skills are additional obstacles for low-income adults to prepare food at home. Many nutrition interventions do not address these significant barriers, and easy, quick recipes that utilize nutritious food pantry items are scarce.

A large void exists in addressing nutrition education and dietary behaviors among food pantry clients. Emergency food programs are not a long-term solution for hunger, and their use does not prevent food insecurity [6]. Strategies that decrease food expenditures while improving nutritional quality and address limited cooking time are essential to build self-sufficiency and long-term food security. Ideally programs to improve nutrition and food security should encourage preparation of healthy foods at home, promote knowledge, confidence and basic cooking skills, and use recipes that are easy, quick, nutritious and inexpensive. Strategies must also boost food pantry clients' ability to prepare healthy food at home in a short amount of time [12]. Nutrition education that teaches food budgeting skills and meal preparation strategies involving less meat can enable low-income families to make the best use of their food budget from a health standpoint [9] This has been demonstrated by

Raising the Bar on Nutrition (a 6-week stationary food pantry program for stationary food pantry clients that offers cooking classes and nutritional education to promote plant-based meals), which emphasizes that daily meat/poultry/seafood are not necessary for health and using more plant-based recipes lowers grocery costs [11]. Although several community programs have been developed for stationary food pantries, none exist for mobile food pantry clients.

A. Theoretic Background

The study hypothesis, a simple intervention may increase knowledge, confidence and self-efficacy and change dietary behavior, was driven by Behavioral Theory, mainly Social Cognitive Theory (SCT) which has guided interventions to improve nutrition among low-income people [5]. High levels of self-efficacy (central to SCT) correlate with improved diet quality and nutrition [15]. 3 plant-based recipes were adapted to be easy and quick to promote confidence and self-efficacy, and incorporated informational design principles (using ingredients that clients have at home, accommodating limited literacy skills, containing as few steps and ingredients as possible, requiring as little time as possible, and including a color photograph with the recipe) [5]. The recipes use ingredients commonly found in food pantries, cost < \$1/serving), take 10-15 minutes to prepare, and don't require strong cooking skills. Barriers are minimized including limited time, which is a critical factor [12], [14], [15]. Verbal education emphasizing the benefits of eating more plant-based meals was included with recipe tastings; providing tastings and healthy recipes with ingredients to be used within a short time frame is concrete, and more practical and reinforcing than talking about better nutrition (an abstract achievement) in the future (Construal Level Theory) [13].

Interventions specifically for mobile food pantry clients that address dietary behaviors and provide nutritional education, while using strategies that decrease food costs and improve both dietary quality and food


security have not been attempted. The main goal of this study was to describe the impact of an intervention designed to provide brief, targeted nutritional education involving inexpensive, easy, quick, healthy, delicious recipes, tastings and ingredients, and encouragement of meatless meals 3 times a week among participants from 2 mobile food pantries. A brief educational session emphasized the financial and health benefits of eating less meat and more vegetables, and that canned or frozen vegetables are as healthy as fresh. It was hypothesized that nutritional knowledge (healthfulness of plant-based meals) and behaviors (preparing more plant-based meals at home) would improve in the intervention group (compared to their baseline and also compared to a control group) after this brief intervention.

II. MATERIALS AND METHODS

A. Design and Setting

This study was designed in partnership with River Bend Foodbank (RBFB), using a quasi-experimental study design at 2 separate RBFB mobile food pantry sites. Three plant-based recipes from *Raising the Bar on Nutrition* (a 6-week stationary food pantry program using cooking classes to promote plant-based meals) [11], [16] were adapted (Vegetarian Chili, Vegetable and Bean Soup. Spinach, Beans and Noodles). Print materials were designed using information design principles that support learning theory and behavior change in low-income households [5], [13]. Dr. Susan Evans [5], [13], [17], a study consultant, provided specific suggestions to make the 3 test recipes clearer for food pantry clients, based on her 30 years of experience with food banks. The printed recipes also included health messages that reinforced the nutrition knowledge provided during the education session (Fig. 1). The study was conducted according to the guidelines laid down in the Declaration of Helsinki, and was approved by the University of Massachusetts Amherst Institutional Review Board.

Vegetable and Bean Soup



| Summary | |
|------------------------|------------|
| Total Time: | 20 minutes |
| Servings: | 6 |
| Cost for total recipe: | \$5.92 |
| Cost per serving: | \$0.99 |
| Can be made ahead: | Yes |
| Can be frozen: | Yes |
| Good for leftovers: | Yes |

Ingredients


- 3 large spoons vegetable oil
- 1 can (15 oz) corn, drained
- 1 can (14.5 oz) green beans, drained
- 1 can (15 oz) peas, drained
- 1 can (15 oz) white beans, rinsed and drained
- 1 can (28 oz) diced tomatoes
- 2 cans (14.5 oz) broth (vegetable, chicken or beef); look for low-sodium
- Salt, pepper, or any favorite seasonings
- Noodles or brown rice (optional)

Instructions

1. Heat 2 large spoons of the oil on medium heat in a large soup pot. Add the corn and cook for about 5 minutes.
2. Add 1 large spoon oil, the green beans, peas, and seasonings. Stir and cook for 3-5 minutes.
3. Stir in the can of drained, rinsed white beans and cook for 2 minutes.
4. Add the crushed tomatoes, heat through, and simmer for 5 minutes, stirring often.
5. When the vegetables are cooked, add the broth and heat through. Cooked rice or noodles can be added at the time of eating.

Food for thought...

Beans are a good protein source.



Eating less meat can improve health.

Figure 1. Adapted recipe incorporating informational design & targeted health messages

B. Sample and Recruitment

Mobile food pantry clients at 2 separate sites were informed of the study objectives and invited to participate during the wait time between signing in and receiving food (typically 60-90 minutes). Inclusion criteria included: age ≥ 18 , being the household's primary cook, ability to speak English and having a telephone. 100 food pantry recipients were recruited (50 at each site); as this was a convenience (nonprobability) sampling, participants were not strictly randomized but were given a number assigned to either treatment or control groups. Written informed consent was obtained. All participants completed a pre-survey that captured demographics, food security, dietary habits (behavior variables) and 6 knowledge questions about plant-based foods (knowledge). A modified 6-item short form of the U.S. Household Food Security Module (HFSSM) using a 30-day reference period was used [19]. The treatment participants received a 10-minute interactive educational session (independent variable) describing the health benefits of including several plant-based meals a week, augmented by tastings of 3 recipes for meatless main meals. They completed a brief post-survey (the same knowledge questions), received the 3 recipes and ingredients to make them, and an incentive (large laundry detergent). They were asked to prepare the 3 recipes during the following week, and were then contacted 1 week later (phone survey assessing knowledge and behavior). The control participants were given a 10-minute educational session on an unrelated health topic (stress management) in a separate room, but no recipes or food; they completed the post-survey (knowledge), received an incentive (laundry detergent) and were contacted 1 week later (phone survey for knowledge and behavior). All participants who completed the phone survey received a second incentive (\$20 gift card). All participants also received their normal allotment of food from the food pantry (approximately 60 pounds).

C. Variables

The knowledge variables (on the pre-survey, post-survey and phone survey) were adapted from *Raising the Bar on Nutrition* educational content [11]-[16]. Six nutrition questions were developed from key educational points that were presented during the educational session. Knowledge variables were scored on a 5-point Likert scale (used for questionnaires regarding nutritional knowledge in similar research) [20] (strongly disagree, disagree, unsure, agree, strongly agree):

- Canned and frozen vegetables are as healthy as fresh
- Daily meat/seafood/poultry are necessary for good health
- Vegetables and starches (including beans) contain protein
- Eating a diet with more vegetables increases grocery costs
- Eating more food from plants lowers the risk of many diseases

- Eating meatless meals just a few times a week can improve health

The behavior variables (on the pre-survey and phone survey) included:

- During the past week, how many meals were cooked at home? (0-1,2,3,4, ≥ 5);
- During the past week, how many meals included at least 1 vegetable? (0-1,2,3,4, ≥ 5)
- During the past week, how many meals did **NOT** include meat, poultry or seafood? (0-1,2,3,4, ≥ 5)
- Thinking about a typical week of food shopping, how much do you spend on meat (beef, chicken, seafood)?

Additional questions on the phone survey for the treatment group only regarded the recipes, shopping and preparing meatless meals:

- How much did you spend on meat (beef, chicken, seafood) in the past week?
- Is this more than usual, less than usual, or what you usually spend on meat?
- Did you make any of the recipes? (Y/N)
- How many times?
- Did you like them? (Y/N)
- Will you continue to use them? (Y/N);
- Did you spend less money on packaged food? (Y/N)
- Are you confident that you can cook and prepare meatless meals? (Y/N)

D. Statistical Analysis

IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY, USA: IBM Corp. was used for data analysis. The descriptive statistics conducted consisted of measures of central tendency and variability for the continuous items, with frequency tables constructed for the categorical measures. A series of repeated-measures General Linear Models (GLM) were conducted to analyze repeated-measures data for the effects of time (*Time*) as well as group membership (*Group*Time*). Shapiro-Wilk and Kolmogorov-Smirnov tests were conducted to determine normality of all dependent variables included within the GLM, and indicated no extreme deviations from normality. Measures of skewness and kurtosis revealed no extreme skewness or kurtosis.

III. RESULTS AND DISCUSSION

A. Demographics

50 subjects participated at 2 different sites (100 total; 50 intervention, 50 control). Out of the original 100 participants, 87 completed the phone survey (42 intervention, 45 control). Participants were 77% female, 62% single, 68% White/Caucasian, 18% African American, and 6% Hispanic. 52% had very low food security, 35% had low food security, and 42% participated in the Supplemental Nutrition Assistance Program (SNAP). Only 35% were employed, and 76% reported a monthly household income $< \$1500$. Descriptive statistics confirmed no significant differences

between treatment and control groups for any demographic measures (age, gender, ethnicity, SNAP participation, number of children, household income, food security, employment, and education). In addition, 87% low and very low food security in the study sample matches the RBFB service area statistics (86%) [18], indicating this sample was representative of the Foodbank population and also consistent with existing literature [6].

B. Nutrition Knowledge and Behavior Variables

GLM examined the interaction effects of groups (treatment and control) and time (between the initial pre-survey, the post-survey and the phone survey). There were significant differences ($P < 0.05$) in responses for 5 of the 6 knowledge questions within the treatment group over time (*Time*), and between the control and treatment groups over time (*Group*Time*), indicating that the educational intervention was effective (Table I). Responses to 5 of the 6 knowledge questions changed significantly with respect to time within the treatment group: increasing agreement that canned and frozen vegetables are as healthy as fresh, vegetables and starches contain protein, and eating meatless meals just a few times a week can improve health; substantial decreases over time for incorrect statements (daily meat/seafood/poultry are necessary for good health; eating a diet with more vegetables increases grocery costs). There were significant differences between the treatment and control groups ($P < 0.05$, *group*time*) for all of the knowledge questions except the statement that eating more food from plants lowers the risk of many

diseases ($P = .062$, approaching statistical significance at the .05 alpha level). No significant changes were seen within the control group over time for any of the knowledge questions.

The behavior questions were compared over 2 time points (pre-survey and phone survey). Significant differences were seen over time for 3 of the 4 behavior variables: increases in meals cooked at home, meals that included at least 1 vegetable, and a decrease in meat expenditures (Table I, *Time*, $P < .001$). The mean number of meals without meat significantly increased in the treatment group as compared with the control group (*Group*Time*; $P = .012$). Mean meat expenditure substantially (but not significantly) decreased after the intervention in the treatment group as compared with the control group (results not shown).

Additional questions only in the treatment group (Table II) indicated that they were very enthusiastic about the intervention: 88% made at least 1 recipe, 97% liked them, all (100%) stated they will continue to use them, and 79% spent less money on packaged food compared to the week before. In addition, confidence in preparing meatless meals significantly increased after the intervention compared to before ($P = .044$). Nutritional knowledge, confidence and self-efficacy are core CBT constructs and critical factors in promoting positive dietary and health changes [20]. Both knowledge and confidence in cooking and preparing meatless meals significantly increased after the intervention in the treatment group.

TABLE I. ANALYSIS OF KNOWLEDGE AND BEHAVIOR VARIABLES USING WITHIN-SUBJECTS VARIABLES (*TIME*) & BETWEEN-SUBJECTS VARIABLE OF INTERVENTION VERSUS CONTROL GROUP (*GROUP*TIME*)

| Multivariate tests | <i>P, time</i> | <i>P, group*time</i> |
|--|----------------|----------------------|
| Knowledge variable: | | |
| Canned and frozen vegetables are as healthy as fresh | .031 | .004 |
| Daily meat/seafood/poultry are necessary for good health | < .001 | < .001 |
| Vegetables and starches (including beans) contain protein | .003 | .046 |
| Eating a diet with more vegetables increases grocery costs | .009 | .030 |
| Eating more foods from plants lowers the risk of many diseases | .072 | .062 |
| Eating meatless meals just a few times a week can improve health | < .001 | .046 |
| Behavior variable: | | |
| <i>During the past week,</i> | | |
| How many main meals were cooked at home? | < .001 | .059 |
| How many meals included at least 1 vegetable? | < .001 | .542 |
| How many main meals did not include meat, poultry or seafood? | .271 | .012 |
| How much did you spend on meat? | < .001 | .615 |
| Behavior variable in treatment group only: | | |
| Are you confident that you can cook and prepare meatless meals? | .044 | |

C. Summary of Results

The results indicate that this intervention promoting healthy plant-based meal preparation at home by using easy, quick recipes to increase cooking self-efficacy and confidence and minimize barriers was beneficial. Significant differences were revealed between the 2 groups with respect to their responses to the knowledge and behavioral questions, as well as significant changes over time. Less effect between group membership and

time was seen with the behavior questions, although a significant increase in meatless meals was seen in the intervention group compared to the control, which was one of the main study objectives. Low-income households buy and eat more meat than households of higher incomes, especially lower-quality meat [9]. This intervention did not purport to turn families into vegetarians or reverse a preference for meat; rather it promoted the health and financial benefits of incorporating several meatless main dishes a week.

Utilizing ingredients commonly found in food pantries to make fast, nutritious, inexpensive meatless meals is a robust and viable approach to help improve the nutritional quality in this vulnerable group. This simple educational intervention improved nutritional knowledge and eating behaviors, decreased food costs, and was very well received.

Focused, brief interventions are important for low-income groups, who face high levels of stress [8] and often have irregular, fragmented lives with competing time demands due to unemployment, unstable mental health status, lack of transportation, and frequent relocation [20]. A brief and simple intervention is easier to integrate and disperse: the smaller the intervention, the more easily it can be incorporated, facilitating immediate use and making change more feasible [21]. The typical wait of 60-90 minutes between check-in and food collection at mobile food pantries is an ideal opportunity for education and recipe tastings.

The adapted recipes rely heavily on frozen and canned vegetables, which are at least as healthy if not healthier than fresh vegetables (the former have similar vitamins as fresh but some studies show they have higher phytonutrient content because they are kept on the plant longer) [22]. Focusing mainly on fresh produce to improve dietary quality in low-income populations ignores the nutrient benefits of canned and frozen

vegetables. In addition, fresh produce is not always available, shelf life is limited, it is costly, and clients may not know how to cook with it or utilize it as a main meal. Few food pantries offer fresh produce, dairy and meat on a continual basis, and additional freezer and cooler requirements strain already limited resources. Strategies that decrease reliance on meat and incorporate nutritious, inexpensive, widely available ingredients such as canned legumes and vegetables in quick, easy recipes have far-reaching utility. Many pantries focus on increasing meat and perishables, and this project offers a robust alternative.

D. Strengths and Limitations

A major strength of this study is that it addresses both food insecurity and malnutrition in vulnerable food pantry recipients and also addresses barriers such as the high reliance on meat, time constraints and lack of access to fresh produce. Decreasing meat consumption reduces food expenditures, which may promote long-term food security. In addition, consuming more plant-based foods and less meat is associated with many health benefits, including decreased risk for cardiovascular disease, obesity, hypertension, and many cancers [23], and lessening meat production and consumption is also beneficial to the environment.

TABLE II. BEHAVIOR QUESTIONS REGARDING THE RECIPES, SHOPPING & PREPARING MEATLESS MEALS (TREATMENT GROUP ONLY; N=42)

| Questions | Frequency % |
|---|-------------|
| Did you make any of the recipes? | |
| Yes | 88 |
| No | 12 |
| How many times? | |
| 1 | 13 |
| 2 | 41 |
| 3 | 46 |
| Did you like them? | |
| Yes | 97 |
| No | 3 |
| Will you continue to use them? | |
| Yes | 100 |
| No | 0 |
| Did you spend less money on packaged food? | |
| Yes | 79 |
| No | 21 |
| Are you confident that you cook and prepare meatless meals? | |
| Yes | |
| No | 98 |
| Change in confidence over time (multivariate analysis) | 2 |
| | P=.044 |

A main limitation of this study is that it was impossible to control for the allotment of food provided by the foodbank for each client (60 pounds/person), which may obscure typical food expenditures and meal patterns. Analysis revealed less of an effect on behavior; food provision could potentially affect some of the behavior questions regarding meals containing meat and meat

expenditures (although typically food provided by the food pantry does not include meat). In addition, during the phone survey, many respondents indicated that they buy meat in bulk monthly, making it difficult to quantify meat expenditures during the previous week. Another possibility is that knowledge change is easier and that behavior change takes more time. In addition, assessing

changes after 1 week does not reflect the impact on food expenditures over the long-term. A single intervention may not be enough to permanently change behaviors, but the inclusion of health tips in the recipes may reinforce positive health messages over longer periods. Longer studies are clearly needed. Lastly, this study employed a convenience sampling, which may introduce selection bias, systematic error, and limited generalizability (resulting in low external validity). But overall, the results indicate that this pilot project was beneficial, and that a targeted, brief educational intervention can positively affect dietary knowledge and behaviors in mobile food pantry clients, at least in the short-term.

IV. CONCLUSIONS

This study provides novel evidence that a brief targeted nutrition intervention (consisting of education, tastings, recipes, and provision of recipe ingredients) about plant-based foods positively affects dietary knowledge and behaviors and promotes more plant-based meals cooked at home among mobile food pantry clients. It builds on previous research with *Raising the Bar on Nutrition*, demonstrating that easy, quick meatless recipes, canned vegetables and nutritional education decreased food costs and improved dietary quality and food security [11]. This study utilizes a modified approach in a different setting, i.e. providing brief nutritional information and adapted meatless recipes without cooking lessons for mobile food pantry clients. It informs a new strategy to build healthy nutritional knowledge and behaviors that easily be incorporated on a widespread basis, and fills a major gap in the body of knowledge concerning community nutrition programs that target this demographic group. Further research should identify additional strategies to boost food pantry clients' ability to prepare quick, healthy food at home and build self-sufficiency and long-term food security.

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