

Farm2Fork: Use of the Health Belief Model to Increase Fresh Fruit and Vegetable Intake Among Food Pantry Participants

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ABSTRACT

Farm2Fork was designed using the Health Belief Model (HBM) to increase fruit and vegetable consumption by food pantry participants. The program included weekly produce distribution in conjunction with nutrition education. Surveys were conducted at program start and after 4 months. Seventy-seven participants completed pre- and post-surveys. All HBM constructs significantly improved: food security level ($p = .0005$), produce access ($p = .0005$), health value ($p = .0005$), and self-efficacy ($p = .0005$). Fruit intake increased 0.09 servings ($p = .0005$) and vegetable intake increased 0.75 servings ($p = .0005$). This study shows the effectiveness of a program guided by the HBM for increasing fruit and vegetable intake in food pantry participants.

KEYWORDS

Food insecurity, Health Belief Model, fresh produce, health behavior, food pantries

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Obesity has become a public health crisis in the United States. Over the past three decades, the prevalence of adult obesity doubled from 15.1% to 30.9%.¹ Minority and low-socioeconomic-status groups are disproportionately affected by obesity.¹ Obesity causes a wide range of serious medical complications including hypertension, respiratory disease, diabetes mellitus, elevated levels of serum lipids, asthma, and poor health status.²

The rate of food insecurity has also increased over the past decades. In 2011, following the Great Recession, domestic food insecurity reached its highest level since measurement began in 1995 and continues to remain above 14%.³ Food insecurity is defined as having inconsistent access to safe, adequate, and nutritious food for an active and healthy life.⁴ Since adequate nutrition is critical to health, food insecurity is an important issue to address, as a lack of adequate and healthy food can lead to both short- and long-term health consequences.

Among the food insecure, there is a higher prevalence of obesity than in the food secure population. In a 12-state study of 66,553 adults, those who were food insecure had 32% greater odds of being obese compared with those who were food secure.⁵ In addition to an increased prevalence of obesity in the food insecure, so too is a markedly higher rate of obesity-related diseases. The 2014 Hunger in America study conducted by Feeding America found that 58% of

food pantry recipients had high blood pressure and 33% were diabetic.⁶ The concurrent prevalence of food insecurity and obesity among the food insecure is known as the hunger–obesity paradox.⁷ There are many factors that may contribute to the paradox, including inexpensive, high-calorie foods, and limited access to healthy foods, such as fruits and vegetables.

Studies have suggested that eating fruits and vegetables promotes health and prevents the development of chronic disease.^{8–10} Furthermore, several studies have shown that fruit and vegetable intake is inversely related to risk of obesity.^{11,12} As such, increasing fruit and vegetable consumption is an important preventative measure for health. Yet research has shown that 76% of Americans do not meet the government recommendation for fruit and vegetable intake.¹³ Under-consumption of fruits and vegetables has been shown to be more common among low-income households due to factors, such as cost and availability.¹⁴

The Health Belief Model (HBM) theorizes that a person’s beliefs and perceptions of a health behavior can directly influence their likelihood of adopting it.¹⁵ The model suggests that individuals conduct an internal assessment of the benefits of changing their behavior, and decide whether or not to act. The model identifies four aspects of this assessment: (1) perceived susceptibility to ill-health (risk perception), (2) perceived severity of ill-health, (3) perceived benefits of behavior change, and (4) perceived barriers to taking action.¹⁵ The concept of self-efficacy was later recognized as an additional aspect of health behavior.¹⁵ The combination of these factors causes a response that can lead to action, provided it is accompanied by cues to action that support the behavior change.

It is clear that obesity rates are increasing, are disproportionately higher in the food insecure, and that fruit and vegetable consumption is related to obesity. Interventions to prevent obesity should have multiple strategies to address barriers to fruit and vegetable intake and be tailored to the target audience. Many food assistance programs have sought to increase the availability of fresh produce but few programs have included multilevels of interventions as seen with the HBM. Further, few studies have looked at the effectiveness of produce availability programs. The purpose of this paper is to describe the impact of Farm2Fork, a produce program guided by the HBM, on fruit and vegetable intake among food pantry participants.

Method

Intervention and conceptual framework

The Farm2Fork program was a produce distribution model enhanced with nutrition education. Participants received weekly distributions of fresh produce at the food pantry for a total of 4 months. Participants received an initial nutrition education class that focused on eating healthy on a budget and included a cooking demonstration using produce the participants were receiving in the distribution. The education class was supplemented with weekly nutrition messages included with the produce distribution. The nutrition messages contained nutritional benefits,

photo recipes, and storage tips on the produce being provided. Clients were not monitored for number of messages received.

The Farm2Fork program was designed using the HBM which is based on the principle that perceived values and expectations guide behavior.¹⁶ [Figure 1](#) depicts how the HBM guided the Farm2Fork intervention aimed to (1) increase participants' access to fresh fruits and vegetable, (2) increase participants' understanding of the health benefits and perceived value of consuming fruits and vegetables, and (3) provide participants with the skills and self-efficacy to prepare and consume fresh fruits and vegetables. Overall, the program was designed to decrease barriers to fruit and vegetable intake. The primary barrier to fruit and vegetable intake this program addressed was access to produce which the program addressed by distributing produce to food pantries weekly. A second barrier to fruit and vegetable intake is lack of perceived value of produce for health, addressed by educating clients on the health benefits of fruits and vegetables. A third barrier to fruit and vegetable intake is lack of confidence about how to use fresh produce, addressed through client education and recipe ideas provided with the produce delivered.

Figure 1. Conceptual framework for Farm2Fork program.

Sampling and recruitment

A pretest/posttest, descriptive study was conducted at a Feeding America program in Central Florida. A convenience sampling was utilized. All clients attending the first produce deliveries at the 25 participating food pantries were screened for inclusion. Clients were eligible if they were 18 years of age and older, received at least six produce deliveries during the program, were able to provide informed consent, and able to answer survey questions. A member of the research team screened for inclusion criteria and asked food pantry clients at the first produce delivery to participate. Written consent was obtained from those who agreed to complete the surveys. The pretest survey was administered by members of the research team who were trained in survey methods. The survey took approximately 10 min to complete. After 4 months of produce deliveries, clients were asked the same survey questions in the posttest. Approval for the study was obtained from the University Institutional Review Board.

Measures

The survey contained a total of 10 questions that addressed:

- Food security. The USDA Six-Item Food Security Scale (FSS) was used to measure food security. This scale has been shown to identify food insecure households and households with very low food security with reasonably high specificity and sensitivity and minimal bias (17). A score of 0–1 indicates food security, 2–4 indicates low food security, and 5–6 indicates very low food security.
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Access. Participants were asked about access they had to fresh fruits and vegetables, how confident they were using and consuming fresh fruits and vegetables, importance of fresh fruits and vegetables for health using a 5-point scale from very easy, easy, somewhat easy, a little difficult, or very difficult.

Value. Participants were asked to rate the value attributed to fresh fruits and vegetables for health on a 5-point scale from very important, important, somewhat important, not very important, or not important at all.

Confidence. Participants were asked to rate their confidence about using fresh fruits and vegetables on a 5-point scale from very confident, confident, somewhat confident, not very confident, or not confident at all.

Consumption. Participants were asked how many servings of fruit they consumed each day and how many servings of vegetables they consumed each day. Food models were used to assist with estimating portion sizes.

Data analysis

We analyzed the data from those participants who completed both the pretest and posttest measures and the nutrition education class. We excluded the data from 433 participants who only completed the pretest measures. Paired samples *t*-tests were run to examine pre vs. posttest differences ($n = 77$) on the FSS, and on each of the five responses in the participant survey described above. To avoid the perception of capitalizing on chance due to multiple univariate tests, alpha was adjusted using a Bonferroni correction. This resulted in an effective alpha of .008 (.05/6). Effect size for each analysis was estimated by calculating Cohen's *d*. The conventional standard for evaluating Cohen's *d* was used (small = .02, medium = .05, large = .08). Power analysis suggests that a sample size of 53 will uncover a moderate effect using a two-tailed paired samples *t*-test with an alpha of .008 and power of .80.

Preliminary analyzes

Because the attrition rate from pretest to posttest was so high, we performed preliminary analyzes to determine whether the 77 participants who completed the study were representative of the entire pretest sample of 510. Multivariate analysis of variance determined that there was no difference in fruit or vegetable consumption between those who completed the pretest only and those who completed both pretest and posttest (Hotelling's Trace (2435) = .003, $p = .555$). Chi-square analyses indicated that these two groups did not differ on gender ($\chi^2(1) = 2.18$, $p = .14$), or status on the FSS ($\chi^2(2) = 1.41$, $p = .50$). However, chi-square analysis indicated that the pretest plus posttest group showed a nonsignificant trend toward being older ($\chi^2(5) = 10.33$, $p = .066$). Those participants over 50 years of age comprised 58.9% (267 of 435) of the pretest only group, but made up 75.3% (59 of 77) of the pretest plus posttest group. Chi-

square analysis also indicated a nonsignificant trend toward attrition from the study being affected by ethnicity ($\chi^2(7) = 13.95, p = .052$). Further analysis indicated that the bulk of that trend was accounted for by those who scored “very low” on the FSS ($\chi^2(7) = 13.39, p = .033$). There were no differences in ethnicity between the pretest only group and the pretest plus posttest group among those who scores “low” ($\chi^2(5) = 7.20, p = .21$) or “secure” ($\chi^2(5) = 1.37, p = .93$) on the FSS. Within the most food insecure group, the posttest was completed by 24.1% of Non-Hispanic Blacks (19 of 79), 16.7% of Hispanic Whites (6 of 36), and 10.0% of Non-Hispanic Whites (21 of 211) who completed the pretest.

Results

Seventy-seven program participants completed pre- and post-program surveys. Fifty-one (66.2%) were female and 26 (33.8%) were male. Thirty-eight participants (49.4%) were Non-Hispanic Whites, 27 (35.1%) were Non-Hispanic Blacks, 8 (10.4%) were Hispanic Whites, 2 (2.6%) were Asian, and 2 participants (2.6%) were Native American or mixed Native American and White. Most of this sample were 60 years of age or older ($N = 39, 50.6\%$), while 19 participants (24.7%) were 50–59, 5 (6.5%) were 40–49, 8 (10.4%) were 30–39, and 6 (7.8%) were 18–29.

Food security

Using the FSS, we found that food security levels improved over the 4-month program, a result that was statistically significant ($p = .0005$). Before the program, 61% of participants reported very low food security, 31% low food security, and only 8% were food secure. By the end of the program, only 30% of participants reported very low food security, 49% were low food security, and 21% were now food secure. Over the course of the program, only 6 individuals decreased in food security level while 32 individuals stayed the same food security level and 39 individuals improved food security level.

Importance of produce to health

The reported importance of fresh fruits and vegetables improved over the program, from 4.65 pre-program to 4.96 post-program ($p = .0005$). While self-reported views on importance of fresh fruits and vegetables to health and confidence to consume fresh fruits and vegetables increased statistically, a ceiling effect is evident. Mean ratings on both variables were at the top of the rating scale (“very important” and “very confident”, respectively) at both pre and post.

Access to produce

The reported access improved with the program from 2.68 pre-program to 3.68 post-program ($p = .0005$). Self-reported views on access to fresh fruits and vegetables increased statistically and categorically (pre mean was between “A little difficult” and “Somewhat easy”; post mean was between “Somewhat easy” and “Easy”). Of note, over half (55%) found access difficult prior to the program while only 5% reported it being a little difficult after the program.

Confidence using produce

Confidence using and consuming produce increased from 4.23 prior to the program to 4.68 after the program ($p = .0005$).

Produce intake

The final measure of program impact was fruit and vegetable consumption. After 4 months in the program, we found fruit and vegetable consumption significantly increased. Fruit intake increased from 1.12 pre-program to 2.03 post-program ($p = .0005$), an increase of almost one serving (0.9). Vegetable intake increased from 1.18 pre-program to 1.93 post-program ($p = .0005$), an increase of 0.75 serving. Of further interest, 23% of participants consumed no fresh fruits or vegetables prior to the program but all participants' diets included some produce at the end of the program. Further, only 10% of participants met the health recommendations for five or more servings of fruits and vegetables prior to the program while 29% met the health recommendations at the end of the program (see [Table 1](#)). **Table 1.** Pre- and post-intervention results. ([Table view](#))

	<i>N</i>	Mean Pre (SD)	Mean Post (SD)	<i>p</i>	Cohen's <i>d</i>	<i>t</i> (df = 76)
Food security survey	77	2.53 (0.6404)	2.09 (0.7105)	.0005	0.67	5.88
Importance to health	77	4.65 (0.66)	4.96 (0.25)	.0005	0.45	3.95
Access	77	2.68 (1.13)	3.68 (0.83)	.0005	1.09	9.56
Confident	77	4.23 (0.87)	4.68 (0.50)	.0005	0.51	4.48
Servings of fruit	77	1.12 (0.99)	2.03 (1.03)	.0005	0.80	7.08
Servings of vegetables	77	1.18 (0.99)	1.93 (1.02)	.0005	0.63	5.53

Discussion

Overall, this study shows the effectiveness of a pilot produce program guided by the HBM for increasing fruit and vegetable intake in food pantry participants. HBM constructs included in the Farm2Fork program were perceived barriers, self-efficacy, benefit, and knowledge. The primary barrier, access to fresh produce, was addressed by weekly distribution of fresh produce at food pantries. Findings demonstrate that the program effectively increased perceived access to fresh fruits and vegetables. It is of interest that only the amount of fresh produce increased in the weekly food baskets during the program, yet participants noted a significant improvement in food security levels overall. The constructs of health benefit, knowledge, and self-efficacy were addressed in the program through education and recipe cards provided to participants. Findings demonstrated an increased health value attributed to fruits and vegetables as well as an increased confidence in using produce. Finally, incorporating HBM constructs resulted in significant change in health behaviors. Participants' fruit and vegetable intake increased by almost two full servings, a finding that is clinically significant for health. The Farm2Fork program successfully combined access to produce with education, thereby removing barriers to fruit and vegetable consumption and promoting health.

Limitations

One limitation of our study was the use of self-reported fruit and vegetable intake which is less accurate than 24-h dietary recalls¹⁷. A second limitation to this study is the lack of a control group. This implies that results from this study are merely suggestive and may not accurately represent the target population. Finally, the extent to which completers in the study were representative of the larger population was brought into question only by nonsignificant trends toward differences. Still, a conservative approach suggests that caution be used in generalizing these findings without taking into account the interaction of factors such as age, ethnicity, and extent of food insecurity.

Implications for practice

Due to the disproportionately higher rates of obesity in the food insecure population and the importance of fruits and vegetables to health, programs to increase access and intake of produce are greatly needed. The use of behavior change models such as HBM can increase the effectiveness of such a community-based intervention. Providing increased access to produce along with education on the importance of fruits and vegetables and skills for preparing the produce is an example of a program incorporating HBM constructs to improving fruit and vegetable intake among food pantry participants. Based on the study findings, programs such as Farm2Fork should be expanded to other food banks and food pantries. Additional research is needed on the application of behavior models to other food assistance interventions and programs.

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