

Evaluation of a Theory-Based Farm to School Pilot Intervention

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ABSTRACT

Purpose/Objectives

The purpose of this study was to evaluate behaviors related to fruit and vegetable intake before and after implementation of a theory-based Farm to School pilot intervention in a rural school.

Methods

Students in fifth grade at a rural elementary school were asked to complete pre- and post-test measures based on the Theory of Planned Behavior (TPB). A pilot Farm to School intervention was implemented and activities targeted students' beliefs, social norms, and self-efficacy regarding fruit and vegetables. Cafeteria promotions, taste testing, and class materials were included in the intervention. Wilcoxon signed ranks test was conducted to test for differences over time, and Kendall's tau correlation assessed relationships between reported access to fruits and vegetables at home and reported intakes of fruits and vegetables as well as preferences.

Results

Demographics of the participants were representative of the school (48% female and 69% white) and entire district (50% female and 74% white). A total of 124 students participated, and significant differences were found between pre- and post-test means for students' beliefs scores ($z=-2.183$; $p=0.029$). Significant correlations were found between reported intakes of fruits and vegetables and access to fruits and vegetables at post-test ($\tau=0.253$; $p=0.001$) as well as between social norms and access ($\tau=.194$; $p=0.011$).

Applications to Child Nutrition Professionals

Findings demonstrated potential for effective implementation of a theory-driven, school-based intervention in elementary school students to increase awareness of the importance of fruit and vegetable consumption in fifth graders at one school site.

Keywords: farm to school, school nutrition, nutrition education

INTRODUCTION

The rapid growth of the childhood obesity epidemic is among the most challenging of America's health issues, and the Centers for Disease Control and Prevention (CDC) report the prevalence of youth obesity as 17% of children and adolescents aged 2-19 years (Ogden, Carroll, Kit, & Flegal, 2014). Because of the negative effects that childhood overweight and obesity may have on future health and chronic disease, considering how best to influence positive health behaviors early in children's lives is important. The U.S. Department of Agriculture (USDA) recommends between 2-5 cups of fruits and vegetables daily, depending on age and gender (USDA & U.S. Department of Health & Human Services, 2010). Despite these recommendations, a recent report

indicated that 60% of children did not eat enough fruit to meet daily recommendations in 2007-2010, and 93% of children did not eat enough vegetables (Kim et al., 2014).

Children who have been exposed to increased fruit and vegetable variety early in life tend to have higher intakes of fruits and vegetables (Glasson et al., 2013), and school-based nutrition interventions have been a relatively effective means for increasing fruit and vegetable consumption (Blanchette & Brug, 2005; Bontrager et al., 2014; Silveira, Taddei, Guerra, & Nobre, 2001). However, not all school-based nutrition interventions are the same and those that are theory-based have considerably larger effect sizes for fruit and vegetable consumption than interventions without a theoretical framework (Diep, Chen, Davies, Baranowski, & Baranowski, 2014). The Theory of Planned Behavior (TPB) is useful for understanding health behaviors because an individual's behavior results from intentions (Ajzen, 1991). Enhancing positive attitudes, social norms, and self-efficacy leads to intentions to perform specified behaviors.

In an effort to increase the number of fruits and vegetables that children participating in the National School Lunch Program (NSLP) consume, the USDA enacted new meal standards mandated in the Healthy, Hunger-Free Kids Act of 2010. These new meal standards changed the ways that school nutrition professionals plan, prepare, and serve foods. An increasingly popular initiative that, in part, aims to improve children's dietary behaviors, especially in terms of fruit and vegetable intakes, is Farm to School (F2S). Participation in F2S has resulted in positive outcomes such as improved nutrition and agriculture knowledge and awareness, increased fruit and vegetable intakes, strengthened willingness to try new foods, and enhanced access to fruits and vegetables (National Farm to School Network, 2014). Most commonly, F2S is conducted as part of NSLP; however, many different areas of the school can be involved (i.e. science, math, physical activity). Ideally, F2S should increase the awareness of the importance of nutritional, agricultural, and environmental sustainability as well as promote health (National Farm to School Network, 2014).

Integration of a theory-based nutrition intervention in the school setting with a multi-level framework such as F2S may improve children's dietary behaviors related to fruits and vegetables. Utilizing the school nutrition program staff at schools will provide consistent messaging and role-modeling to students. The purpose of this study was to evaluate behaviors related to fruit and vegetable intake before and after implementation of a theory-based Farm to School pilot intervention in a rural school. The University of Southern Mississippi's Institutional Review Board approved the methods used for this study.

METHODOLOGY

Farm to School Intervention

The F2S pilot intervention was developed using the primary researcher's previous experience working with F2S and with the district foodservice director as well as basic tenets from TPB. After discussion with cafeteria staff and the foodservice director, components that were deemed essential included local items on the menu, verbal support from cafeteria staff and teachers for selecting fruits and vegetables in the cafeteria and at point of sale, environmental supports like posters, static clings, taste testing to introduce new items, and role modeling by peers and teachers. Outside of the cafeteria, the primary researcher and foodservice director elected to include a required 60 minute in-service for teachers where continuing education was offered that included information about the NSLP and the importance of proper nutrition for better academic

performance. Another important component outside of the cafeteria was parental involvement which was garnered by sending newsletters, worksheets, and updated menus home with students. After the teacher in-service, the school administrator designated the health teacher to deliver F2S lessons; lesson plans and materials to support activities were provided with the understanding that one 30-minute lesson each week was to be provided to students during F2S Month. F2S lesson plans were adapted from the USDA *Team Nutrition: Dig In!* (<http://www.fns.usda.gov/tn/dig-lessons>) materials to be suitable for local F2S activities and age appropriate. Topic titles were “Choosing MyPlate,” “Making Healthy Choices,” “Farm to Plate,” and “Fun Facts about Local Fruits and Vegetables.”

Working in conjunction with the district child nutrition director, researchers selected locally grown sweet potatoes, field peas, lima beans, collard greens, cucumbers, blueberries, and tomatoes to be included in the F2S Month menu. “From a Farm near You,” static clings were placed on sneeze guards along lunch lines above the local item so that students would be able to distinguish local from non-local items. Bulletin boards included biographies of local farmers with references to food products used as ingredients on the school lunch menu. Bulletin boards also included benefits of locally grown foods, the process of getting food from farm to plate, and what students could do to get involved in local food systems. Healthy eating posters were placed in hallways of commonly traveled areas. The school principal was provided with morning announcements that included a brief statement about local items on the menu. All fifth grade students attended an educational assembly to introduce F2S Month as well as the benefits of eating local foods. During the assembly, students were asked to volunteer to taste-test local fruits and vegetables and participate in F2S activities.

Participants

The intervention was conducted throughout the elementary school (n= 712), but because of the nature of the pilot intervention, financial constraints, and data collection logistics, only fifth grade students (n=124) were chosen for assessment. Informed consent documentation was provided to parents/guardians via F2S Month newsletters.

Instrumentation

The 84-item questionnaire included demographics (age, gender, and ethnicity), fruit- and vegetable-related nutrition knowledge (7 items), preferences (23 items), social norms (16 items), self-efficacy (7 items), intakes (4 items), beliefs (7 items), access (2 items), and intentions (15 items). Nutrition knowledge questions included yes/no responses; constructs related to TPB utilized Likert type scales, and intake was a multiple choice type question where students were asked about the frequency of intake over the past seven days. The questionnaire was developed using selected questions from the Nutrition Education Survey (Network for a Healthy California, 2014), the Golden Eagle/Ginew Healthy “U” survey (Fila & Smith, 2006), and the Gimme 5 fruit and vegetable intervention (Baranowski et al., 2000). Each survey had individually been tested for reliability by the respective authors.

Data Collection

Preceding the F2S assembly and on the first day of the pilot intervention, researchers administered the pre-test survey to students. A total of four weeks elapsed between pre- and post-test. After considering logistical concerns about having students in an auditorium to complete the post-test surveys, school administration advised that post-test surveys should be administered via the homeroom teachers and collected by researchers. Among the 124 eligible fifth grade students, only one child’s parents declined consent in the evaluation survey.

Data Analyses

All data were analyzed with IBM SPSS version 20. Descriptive statistics including frequencies and measures of central tendency were used to describe the sample. Data distributions were used to assess center, shape, and spread while the Shapiro-Wilk test was used to test for normality of data. Wilcoxon signed ranks test was conducted because of non-normality and used to assess changes over time. Kendall's tau correlations were used to assess relationships between reported access to fruits and vegetables at home and reported intakes of fruits and vegetables as well as preferences.

RESULTS AND DISCUSSION

The majority (96.5%; n=120) of the intervention school's fifth grade students (N=124) completed both pre- and post-intervention surveys. Incomplete surveys were not included in analysis. More than half of the sample was White (66.7%; n=80) while 30% (n=36) of the participants were Black, 2.5% (n=3) Hispanic or Latino, and 0.8% (n=1) Asian. There were 56 females (46.7%) and the majority (65%; n=78) of students were ten years old. Demographics of the participants are representative of the school (48% female and 69% white) and entire district (50% female and 74% white). Moderate access to fruits and vegetables at home was reported (3.04 and 3.23 out of 6 at pre- and post-test, respectively). Nutrition knowledge score means had no significant improvements from pre-test (3.55 ± 1.04) to post-test (3.62 ± 1.28). Significant differences were found between pre- and post-test means for students' beliefs scores ($z=-2.183$; $p=0.029$; Table 1).

Table 1. Comparison of Elementary Students' Knowledge, Social Norms, Beliefs, Self-Efficacy, and Intake of Fruits and Vegetables Before and After Farm to School Pilot Intervention (N=124)

Outcome Variable	<i>M (SD)</i> <i>Pre-Test</i>	<i>M (SD)</i> <i>Post-Test</i>	<i>p</i>
Knowledge (range 0-7)	3.55 (1.04)	3.62 (1.28)	.434
Social Norms (range 0-20)	11.19 (3.72)	11.58 (3.95)	.166
Beliefs (range 0-14)	10.28 (3.29)	10.74 (3.74)	.029
Self-efficacy (range 0-28)	16.09 (8.02)	15.93 (8.55)	.757
Intentions (range 0-30)	16.09 (6.53)	16.45 (6.76)	.479
Intake of fruits and vegetables (range -5-15)	3.32 (3.32)	3.28 (3.85)	.634
Access to fruits and vegetables (range 0-6)	3.04 (1.09)	3.23 (0.95)	.173

Note: Range indicates possible minimum and maximum score for each calculated construct; Results based on Wilcoxon signed ranks test for scored variables

No significant correlations were found between knowledge and preferences (Table 2); however, a significant correlation was found between reported intakes of fruits and vegetables and access to fruits and vegetables at post-test ($\tau=0.253$; $p=0.001$) as well as between social norms and access ($\tau=.194$; $p=0.011$). Self-efficacy and intentions were significantly positively related to

intake ($\tau=.198$; $p=0.005$, $\tau=.236$; $p=0.001$, respectively). Participants were asked to report if fruits, vegetables, or fast foods were consumed the previous day, and if so, how many times. At pre-test, 21.7% (n=26) reported having consumed no fruit, 37.5% (n=45) no fruit juice, and 29.2% (n=35) no vegetables the previous day, while 44.1% (n=53) reported consuming fast-food or take-out more than once during the previous week. No significant consumption differences were noted between pre- and post- test.

Table 2. Relationships of Elementary Students’ Knowledge, Social Norms, Beliefs, Self-Efficacy, Intentions, Intake of, and Access to Fruits and Vegetables Before and After a Farm to School Pilot Intervention (N=124)

Outcome Variable	1.	2.	3.	4.	5.	6.	7.
1. Knowledge	1	-.017	.419**	.040	-.108	-.061	-.067
2. Social Norms		1	.053	.197**	.171*	.105	.194*
3. Beliefs			1	.252**	.146	.034	.025
4. Self-efficacy				1	.236***	.198**	.078
5. Intentions					1	.056	.035
6. Intake of fruits and vegetables						1	.253***
7. Access to fruits and vegetables							1

Note: * $p<.05$, ** $p<.01$, *** $p=.001$; Results based on Kendall’s Tau Correlation

CONCLUSIONS AND APPLICATION

The purpose of this study was to evaluate behaviors related to fruit and vegetable intake before and after implementation of a theory-based Farm to School pilot intervention in a rural school. There was no change in reported nutrition knowledge. Perhaps because pre-test scores were almost half of the highest possible score, a longer intervention might be needed to increase nutrition knowledge. However, nutrition knowledge may only be one piece of what prompts fruit and vegetable consumption, and thus significant improvements in knowledge may be seen while behaviors do not improve (Powers, Struempfer, Guarino, & Parmer, 2005). For example, in this sample, more than half of students (68.3%; n=82) answered that eating fruits and vegetables would help lower chances of developing heart disease or cancer but nearly a quarter (21.7% and 29.2%, respectively) of students did not report eating a single fruit or vegetable the day prior to pre-test. In the current study, a ‘dose’ (i.e. length and frequency of classroom teaching) of nutrition education was not assessed. In future studies, nutrition related behavior improvement could be evaluated in terms of increasing exposure to nutrition education.

The lack of evidence for change in behavior could be in part due to the taste preferences children develop. Taste preference has been identified as one of the most important factors in how children select fruits and vegetables (Baxter & Thompson, 2002; Bere & Klepp, 2005). Repeated exposure to fruits and vegetables has improved frequency of consumption of these foods (Birch & Fisher, 1998; Osborne & Forestell, 2012). In this intervention, some featured fruits and vegetables may have been a first time exposure, and since some items were only on the lunch menu once during the intervention, exposure was limited; thus, preferences could not be developed. Children's fruit and vegetable preferences and consumption may be influenced by peers (Birch, 1999); however, changes in social norms were not apparent in this study. Social

norms appeared to be low and are definitely a point of focus for future intervention. Properly addressing the environmental and social aspects of fruit and vegetable consumption could have positive benefits long-term.

As in any study, limitations must be considered in light of the findings. First, data (except gender and race obtained by class rosters) were self-reported which may increase the possibility for socially desirable responses. Items about fruit and vegetable intakes asked participants about intakes on the previous day, and since assessments were conducted on Mondays, the survey accounted for weekend fruit and vegetable intakes. Some studies have reported lower fruit and vegetable intakes on weekends when compared to weekdays (Krolner et al., 2011). No long-term follow up data collection was conducted. Thus, it is reasonable that lack of change was due to insufficient time allowed for changes to occur. Randomized controlled trials (RCT) are necessary to demonstrate the impact and effectiveness of F2S interventions and because this study was not an RCT, results should be interpreted in context. Additionally, interventions lasting longer than one month may be necessary for significant and sustained dietary improvements (Hoffman et al., 2011). Each component of the survey that was scored used valid scoring protocols from other instruments; validity and reliability assessments should be conducted for future research.

Fidelity to intervention measures was collected anecdotally. Researchers visited the school throughout the pilot intervention period and at each time noted cafeteria staff conversing with students, static clings placed in appropriate places, and bulletin boards as well as posters in tact throughout the school. The health teacher indicated completion of the lessons though a formal evaluation was not conducted. Exposure to the pilot intervention was not quantified. In light of the mentioned limitations, several strengths should be noted. The current study had a high response rate with minimal missing data. Pilot intervention components were based on TPB; thus, in future interventions, the quantity and quality of program delivery can be evaluated in the context of TPB.

In terms of applicability to school nutrition professionals, the influence cafeteria staff have on preferences could be integral in achieving positive changes in social norms. In this pilot intervention, beliefs significantly improved over time and statements indicating beliefs were things like “If I eat fruits or vegetables at breakfast, I will be able to think better in class” and “Eating fruits and vegetables will help me grow big and strong”. Speaking positively about fruits and vegetables, role modeling healthy behaviors, and encouraging healthy choices are all inexpensive and time-friendly ways to affect social norms. Furthermore, consistent and deliberate messages are combined with one-time school wide activities have been more effective than daily activities alone (Perry et al., 2004).

Future research is needed to demonstrate effectiveness of the F2S intervention by increasing sample size, conducting more rigorous fidelity measures, and evaluating a longer intervention. Utilization of effective, theory-based and cost-effective nutrition interventions involving school nutrition programs are essential to promoting fruit and vegetable consumption in children.

REFERENCES

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational & Behavioral Human Decision Process*, 50(2),179-211. doi:10.1016/0749-5978(91)90020-T

- Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., Lin, L. S., ... Wang, D. T. (2000). Gimme 5 fruit, juice, and vegetables for fun and health: Outcome evaluation. *Health Education & Behavior, 27*, 96-111. doi:10.1177/109019810002700109
- Baxter, S. D., & Thompson, W. O. (2002). Fourth-grade children's consumption of fruit and vegetable items available as part of school lunches is closely related to preferences. *Journal of Nutrition Education & Behavior, 34*(3), 166. doi:10.1016/S1499-4046(06)60086-9
- Bere, E., & Klepp, K. (2005). Changes in accessibility and preferences predict children's future fruit and vegetable intake. *International Journal of Behavioral Nutrition & Physical Activity, 2*(15). doi:10.1186/1479-5868-2-15
- Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19*, 41-62. doi:10.1146/annurev.nutr.19.1.41
- Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics, 101*(3), 539-549. Retrieved from: <http://pediatrics.aappublications.org>
- Blanchette, L., & Brug, J. (2005). Determinants of fruit and vegetable consumption among 6 - 12-year-old children and effective interventions to increase consumption. *Journal of Human Nutrition & Dietetics, 18*(6), 431-443. doi:10.1111/j.1365-277X.2005.00648.x
- Bontrager-Yoder, A. B., Liebhart, J. L., McCarty, D. J., Meinen, A., Schoeller, D., Vargas, C., ... LaRowe, T. (2014). Farm to elementary school programming increases access to fruits and vegetables and increases their consumption among those with low intake. *Journal of Nutrition Education & Behavior, 46*(5), 341-349. doi:10.1016/j.jneb.2014.04.297
- Diep, C. S., Chen, T., Davies, V. F., Baranowski, J. C., & Baranowski, T. (2014). Influence of behavioral theory on fruit and vegetable intervention effectiveness among children: A meta-analysis. *Journal of Nutrition Education & Behavior, 46*(6):506-546. <http://dx.doi.org/10.1016/j.jneb.2014.05.012>
- Fila, S., & Smith, C. (2006). Applying the Theory of Planned Behavior to healthy eating behaviors in urban Native American youth. *International Journal of Behavioral Nutrition & Physical Activity, 3*, 1-10. doi:10.1186/1479-5868-3-11
- Glasson, C., Chapman, K., Wilson, T., Gander, K., Hughes, C., Hudson, N., ... James, E. (2013). Increased exposure to community-based education and 'below the line' social marketing results in increased fruit and vegetable consumption. *Public Health Nutrition, 16*(1) 1961-1970. doi:10.1017/S1368980013001614
- Hoffman, J., Thompson, D., Franko, D., Power, T., Leff, S., & Stallings, V. (2011). Decaying behavior effects in a randomized, multi-year fruit and vegetable intake intervention. *Preventive Medicine, 52*, 370-375. doi:10.1016/j.ypmed.2011.02.013
- Kim, S. A., Moore, L. V., Galuska, D., Wright, A. P., Harris, D. M., Grumer-Strawn, L., ... Rhodes, D. G. (2014). Vital Signs: Fruit and Vegetable Intake Among Children — United States, 2003–2010. *Morbidity & Mortality Weekly Review, 63*(31), 671-676.

Krolner, R., Rasmussen, M., Brug, J., Klepp, K., Wind, M., & Due, P. (2011). Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part II: Qualitative studies. *International Journal of Behavioral Nutrition & Physical Activity*, 8, 1-38. doi:10.1186/1479-5868-8-112

National Farm to School Network. (2014). About farm to school. Retrieved from <http://www.farmentoschool.org>

Network for a Healthy California. (2014). Nutrition education survey. Research and Evaluation Unit of the Network for a Healthy California website. Retrieved from <http://www.cdph.ca.gov/programs/cpns/Documents/Network-NutritionEducationSurvey.pdf>.

Ogden, C., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *Journal of the American Medical Association*, 311(8), 806-814. doi:10.1001/jama.2014.732

Osborne, C. L., & Forestell, C. A. (2012). Increasing children's consumption of fruit and vegetables: Does the type of exposure matter? *Physiology & Behavior*, 106(3), 362-368. doi:10.1016/j.physbeh.2012.01.006

Perry, C. L., Bishop, D. B., Taylor, G. L., Davis, M., Story, M., Gray C., ...Harnack, L. (2004). A randomized school trial of environmental strategies to encourage fruit and vegetable consumption among children. *Health Education & Behavior*, 31, 65-76. doi:10.1177/1090198103255530

Powers, A. R., Struempfer, B. J., Guarino, A., & Parmner, S. M. (2005). Effects of a nutrition education program on the dietary behavior and nutrition knowledge of second-grade and third-grade students. *Journal of School Health*, 75(4), 129-133.

Silveira, J. A. C., Taddei, J. A. A. C., Guerra, P. H., & Nobre, M. R. C. (2001). Effectiveness of school-based nutrition education interventions to prevent and reduce excessive weight gain in children and adolescents: A systematic review. *Journal of Pediatrics*, 87, 382-392. doi:10.2223/JPED.2123

U. S. Department of Agriculture, & U. S. Department of Health and Human Services. (2010). *Dietary Guidelines for Americans*. 7th ed. Washington, D.C.: United States Government Printing Office.

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