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Fresh Produce, Fresh Start was a pilot farm to family study which tested the effectiveness of a local produce delivery program on dietary intake of Head Start participants. Utilizing a pre-test/post-test design, measures collected from Head Start parents included 24-hour recall of dietary intake, height and weight, and a food security questionnaire. Intent-to-treat analysis was conducted using paired t-tests. Significant increases were found in intake of vitamin A, vitamin C, fiber, vegetable, and fruit and vegetable servings combined ($p < .05$) for participants ($N = 51$). In particular, fruit and vegetable intake increased by 1.4 servings per day. Food security status and weight status did not significantly change. Results indicate that a produce delivery program has potential to improve dietary intake of Head Start families and, possibly, other populations, impacting lifelong consumption habits.

Keywords: Head Start, fruit and vegetable intake, farm to family, delivery program, diet

Introduction

Adequate fruit and vegetable (FV) consumption, as part of a balanced diet, reduces the risk for developing several obesity-related chronic diseases, including heart disease, some cancers, stroke, and diabetes (Bazzano et al., 2002; Ford & Mokdad, 2001; Hung et al., 2004; Joshipura et al., 1999). Many American families do not consume the daily recommended amounts of FVs (Centers for Disease Control and Prevention, 2009, 2010). In addition, many Americans are not aware of the daily recommended servings of FVs (Erinosho, Moser, Oh, Nebeling, & Yaroch, 2012; U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010),

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even with existing evidence about the benefits of FV consumption. Research emphasizes that access and affordability of fruits and vegetables (FVs) may influence FV intake (Beaulac, Kristjansson, & Cummins, 2009; Larson, Story, & Nelson, 2009).

Several public health strategies have emerged to improve dietary quality, especially realted to FV consumption (Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008) as a mechanism for obesity prevention, although little research has reported on their effectiveness, particularly for low-income families. Access to and affodability of healthy foods has been described as potentially contributing to higher rates of obesity and overweight in low-income families (Kumanyike & Grier, 2006). For example, there are many areas where access to healthy food is low, such as in rural areas, low-resource communities, and areas with a greater proportion of racial/ethnic minority populations (Beaulac et al., 2009; Dean & Sharkey, 2011; Dubowitz et al., 2008; Story et al., 2008). In order to positively impact obesity rates within families, policy and environmental interventions that make healthy dietary choices easier are likely to have a large impact and achieve a broad reach (Sallis, Story, & Lou, 2009).

Head Start (HS) is an ideal location to partner with low-income families to implement and understand obesity prevention efforts. In 2009 alone, 904,153 children and their families were served by HS (U.S. Department of Health and Human Services, 2011). In addition, one-third of HS children entering the preschool program are overweight or obese (Tarullo, West, Aikens, & Hulsey, 2008), and they are more likely to be more overweight than the general population (Acharya, Feese, Franklin, & Kabagambe, 2011; Feese et al., 2003; Hernandez, Uphold, Graham, & Singer, 1998; Hoerr, Horodynski, Lee, & Henry, 2006; Stolley et al., 2003; Williams, Strobino, Bollella, & Brotanek, 2004). One study with HS children found that they were less likely to consume recommended amounts of protein, thiamin, riboflavin, niacin, calcium, and selenium when compared to other preschool groups (Bucholz, Desai, & Rosenthal, 2011). Additionally, HS mothers with poor dietary quality are more likely to have children with poor dietary quality (Hoerr et al., 2006).

A key strategy to improving nutrition-related health outcomes and decreasing overweight and obesity in the general population includes promoting access to fruits and vegetables (Hung et al., 2004). To do this, farm-to-where-you-are projects with youth are increasing (National Farm to School Network, 2013), but little research has been reported on farm-to-where-you-are efforts targeted toward the preschool age group and their families (Urban & Environmental Policy Institute, 2013). This article describes the pilot study, *Fresh Produce*, *Fresh Start* (FPFS). FPFS examined the effectiveness of a free, FV delivery program (farm-to-where-you-are) on FV intake among HS families.

FPFS demonstrates a collaboration among HS and its families, local food producers, and researchers to decrease barriers to implementing obesity prevention policies and practices at HS

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in order to improve obesity-related public health outcomes. We hypothesized that the delivery program would increase FV intake by increasing the access to produce at home and overcoming affordability barriers.

Methods

Fresh Produce, Fresh Start Program

As each community has its own unique characteristics, ranging from income levels to cultural practices and beliefs, it is important that community-based programs involve community partners throughout all stages of a program, beginning with the planning and identification of needs (Stith et al., 2006). The research team, local farmers, and HS preschools worked together to formulate the concept of FPFS. The consideration of the needs of all partners helped to ensure appropriate adoption and delivery of the program, as well as created possibilities for post-intervention maintenance and sustainability (Bogart & Uyeda, 2009; Green, Lewis, & Bediako, 2005).

Study Design

Produce was procured by researchers from local farmers. The farmers delivered FVs as a part of their normal delivery route once weekly. FVs were packed into bags by the research team, students, and volunteers. FV bags were delivered to the family via their child riding the HS bus. Delivering produce on the HS bus was identified as the most accessible method for families to receive bags, as transportation was a major barrier to food access. Children rode the bus most of the time, and parents infrequently picked up the HS child at the preschool. When parents did pick up the child at the preschool, school staff gave the produce bag directly to the parent.

Each weekly bag contained recipes that assumed limited cooking skills, met SNAP-Ed (Supplemental Nutrition Assistance Program – Education) Connection Recipe review criteria (U.S. Department of Agriculture, 2010), used less than five ingredients, and cost less than five dollars. This criteria was determined by all individuals involved with the construction of FPFS as the most feasible method for increasing the likelihood that participants would prepare and consume FVs. Produce bags contained a worksheet detailing the name of each FV included inside of the bag, a picture of each FV, and the amount needed to consume the equivalent of one cup, in accordance with the Dietary Guidelines for Americans (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010). Each bag provided 21 cups (or equivalent) of produce per week, an average of 8 cups of fruits and 13 cups of vegetables.

A pre-test/post-test design was utilized, with the pre-test administered four weeks prior to the start of the eight-week FPFS program and the post-test implemented four weeks after delivery ceased. All tests were administered to the HS parent (see Instruments for further information).

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Participants and Recruitment

FPFS was a free, eight-week pilot FV delivery program (with an additional four weeks pre-test and four weeks post-test included for measurement, totalling 16 weeks) implemented in two HS preschools (HS1 and HS2). One HS parent per family was the unit of analysis. Given the pilot nature of the study and novelty of the approach, two cohorts were selected as a small convenience sample. HS sites were not randomized and were selected due to an established partnership with researchers. Each HS preschool had an enrollment of 38 children during the study period. Parents were recruited from mandatory parent orientations for the preschool the week before preschool began. Preschool administrators introduced the research project and team and encouraged families to participate. Researchers further explained the program, answered questions, and conducted the consenting process. To reduce attrition and increase retention, participants provided contact information, and efforts were made to collect data with as little particpant burden as possible (e.g., pairing baseline data collection with HS orientation). Consenting participants were trained at HS orientation about how to complete all study instruments. Parents were asked about allergies to any of the potential FVs, and none were indicated. Ineligibility criteria included chronic disease or participation in FPFS at another HS site. All participants provided voluntary, informed consent to participate in the study prior to the collection of any data. All procedures and the protocol were reviewed and approved by Virginia Tech Institutional Review Board. Ultimately, 51 families participated in FPFS.

Instruments

The parents completed all study instruments. Demographics (i.e., age, gender, race/ethnicity, marital status, number of children, education, income level, WIC [Women, Infants, and Children] enrollment, SNAP enrollment), food security, and weight status were measured at pre-test to characterize the population. Parents that declined participation were asked to complete a brief sociodemographic survey (i.e., age, gender, race/ethnicity, marital status, number of children enrolled in HS, education, income level, WIC enrollment, SNAP enrollment, food security status). Representativeness of the participating parents was measured by comparing demographics of those who agreed to participate versus those who declined.

Participants completed 24-hour recalls with assistance from the research team, using a protocol described by Thompson and Byers (1994) at pre- and post-test. The pre-test dietary recall was conducted at preschool orientation with a researcher. At post-test, the dietary recall was sent home and completed by the parent. Researchers then made telephone calls to clarify discrepencies. Dietary recalls were used to assess daily changes in total calories (kcal); protein (g); total fat (g); saturated fat (g); sugar (g); vitamins A (RE), C (mg), and D (ug); calcium (mg); iron (mg); fiber (g); and FV intake (servings).

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Participants also completed a validated FV checklist adapted from Cullen and Bartholomew (2003). The researchers modified the FV checklist each week to reflect contents in the delivery bag and ask participants to report the number of FV cups consumed, shared, or wasted. A weekly 'Fruit and Vegetable Report' was created based upon produce included in bags. A detailed list of fruit and vegetable varieties and number of servings were included with the report on a pamphlet titled 'In This Bag.' Participants were asked to match number of servings on 'In This Bag' with number of servings consumed, shared, or wasted on the fruit and vegatable report. Simple instructions and examples were included with the report. The report was sent home inside produce bags for completion and return by the next delivery.

The ERS/USDA 10-item Food Security Module was adminstered at pre-test (U.S. Department of Agriculture, Economic Research Service, 2008). Validity and reliability studies have successfully utilized this food security questionnaire in measuring household food security (Bhattacharya, Currie, & Haider, 2004; Frongillo Jr., Rauschenbach, Olson, Kendall, & Colmenares, 1997; Stuff et al., 2004). Individuals are categorized as having high (raw score = 0), marginal (raw score = 1), low (raw score = 2 - 5), or very low (raw score = 6 - 9) food security (Bickel, Nord, Price, Hamilton, & Cook, 2000). Classification of food security status was determined using these ERS guidelines.

Height and weight were measured by trained researchers in a private location at pre-test using a Seca™ 217 stadiometer and Tanita™ BWB-800 digitical scale. Height and weight data were calculated for body mass index (BMI) using the Centers for Disease Control and Prevention's calculator (2012). Due to the short length of the program, we did not repeat the Food Security Module or height and weight measurements at post-assessment as changes were not anticipated.

Data Analysis

All statistical tests were conducted using Statistical Package for Social Sciences (version 18.0, 2009, SPSS Inc, Chicago, IL). Representativeness was evaluated by comparing sociodemographic characteristics (i.e., age, gender, race/ethnicity, marital status, number of children enrolled in HS, education, income level, WIC enrollment, SNAP enrollment, food security status, BMI) between those that completed post-test assessments and those that did not (Glasgow, Klesges, Dzewaltowski, Bull, & Estabrooks, 2004; Glasgow, Vogt, & Boles, 1999) using Kruskal-Wallis tests for interval or ordinal data and Fisher's Exact tests for categorical data. In outcome analyses, missing post-test values were replaced with the pre-test value (therefore, assuming no change) by carrying the observation forward (i.e., intent-to-treat analyses (Twisk, 2003). Information from the 24-hour recall was entered into Nutritionist Pro Diet Analysis Module version 2.5 (Axxya Systems, Stafford, TX, USA). The diets were compared to U.S. Dietary Guidelines Americans for FV cups (U.S. Department of Agriculture, 2010). Unpaired *t*-tests at pre- and post-test were used to determine the effect of the intervention on

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dietary intake for total calories (kcal/day), total fat (percentage of total kcal), saturated fat (percentage of total kcal), sugar, and FV intake ($p<0.05$). Descriptive statistics were used to assess food security status and BMI, as well as to describe sample demographics.

Results

Participation

Overall, 31 adults in HS1 and 36 in HS2 were eligible to participate in FPFS. In total, 76% (N = 51; HS1 n = 21; HS2 n = 30) of eligible participants (N = 67) signed informed consent and enrolled in the FPFS program. See Table 1 for demographic results.

Table 1. Descriptive Sociodemographics of Participants in Produce Program at Head Start, 2009 and 2010

	Participants (*N* = 51)
Age (M ± SD in years)	32.5 ± 8.6
Gender (%)	
Female	94.1
Male	5.9
Race/ethnicity (%)	
White	54.9
Asian	17.6
Black or African American	27.5
Non-Hispanic/Latino	100.0
Marital status (%)	
Single	47
Married	53
Number children enrolled in Head Start (μ)	1.1 ± .4
Education (%)	
Some high school	15.7
High school graduate/GED	29.4
Some college	25.5
College degree (BS/BA)	15.7
Graduate degree (MS, PhD)	13.7
Income level (%)	
Less than $10,000	33.3
$10,000 to $24,999	52.9
$25,000 to $49,999	7.8
Other	6.0
WIC enrollment (%)	19.6
SNAP enrollment (%)	23.5

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For representativeness, there were no significant differences based on sociodemographics between participants that completed pre- and post-tests (n = 29) and the intent-to-treat analysis (n = 51). Those who declined to participate in this study were significantly ($p < .05$) more likely to be white, have more children attending HS, and participate in SNAP.

Dietary Quality

Participants reported a mean of 1539.9 kcal/day at pre-test and 1615.7 kcal/day at post-test, a slight, but not significant increase (See Table 2). Overall, no significant differences were found in the amount of calories, carbohydrates, total fat, or saturated fat reported at pre- and post-test. Between pre- and post-test, significant increases were found in intake of fiber (p = .01), vitamin A (p = .01), vitamin C (p = .01), vegetable servings (p = .00), and FV combined servings (p = .00). On average, participants increased their number of cups of FV by 1.4. Still, recommendations for fruit, vegetable, and FV cup servings combined were *not* met across observations. The FV checklist results showed that study participants consumed an average of 6.1 cups of vegetables and 3.6 cups of fruit, shared an average of 6.5 cups of vegetables and 3.2 cups of fruit with their family, and threw away an average of .13 cups of fruit and 1.88 cups of vegetables per week.

Table 2. Mean Nutrient Intakes at Pre- and Post-Test of Participants in Produce Program at Head Start during 2009 and 2010

	Pre-test (*N* = 51)	**Post-test (*N* = 51)**
Total calories (kcal)	1539.9 ± 607.6	1615.7 ± 569.9
Protein (g protein/kg body weight)	71.7 ± 32.6	72.3 ± 24.5
Carbohydrates (g)	202.4 ± 98.4	215.9 ± 95.8
Total Fat (g)	54.8 ± 27.7	54.1 ± 26.2
Saturated Fat (g)	18.5 ± 11.5	17.6 ± 9.9
Vitamin A (RE)	659.3 ± 765.6	1004.9 ±1270.4[b]
Vitamin C (mg)	91.0 ± 133.0	135.9 ±144.5[b]
Vitamin D (ug)	3.2 ± 3.3	3.3 ± 3.2
Calcium (mg)	738.6 ± 463.1	755.5 ± 485.2
Iron (mg)	13.1 ± 9.7	14.8 ± 10.6
Sugar (g)	84.7 ± 65.5	88.1 ± 63.5
Fiber (g)	12.3 ± 7.1	15.5 ± 7.8[b]
Vegetable Servings[a]	1.4 ± 1.3	2.3 ± 2.2[b]
Fruit Servings[a]	.73 ± 1.3	1.2 ± 1.3
Fruit and Vegetable Servings[a]	2.1 ± 1.6	3.5 ± 2.5[b]

[a]Based upon Dietary Guidelines recommendations for serving sizes
[b]Significantly different than pre-test values, based upon intent-to-treat analysis using paired t-test ($p < .05$)

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Food Security Status

Thirty-seven percent of participants reported very low food security, 20% of participants reported low food security, 20% of participants reported marginal food security, and 23% of participants reported high food security.

Weight Status

Four percent of participants were underweight, 31% of participants were healthy weight, 22% of participants were overweight, and 43% of participants were obese. The mean BMI was 29.3, considered overweight.

Discussion

There were several promising outcomes from FPFS. This study is the first known pilot study that reports impacts of a direct delivery program on FV intake of HS families. Notably, on average, participants significantly increased their FV consumption by 1.4 cups each day. This is particularly meaningful given the results from a review of 44 health behavior interventions, finding an increase ranging between 0.1 to 1.4 servings of produce per day (Pomerleau, Lock, Knai, & McKee, 2005). This is compelling evidence that delivering produce to the home through preschool children riding the bus impacts produce consumption, even without nutrition education. These findings suggest that this type of produce delivery model can help overcome several of the top barriers facing limited resource populations, such as transportation, access, and food costs (Beaulac et al., 2009; Dean & Sharkey, 2011; Story et al., 2008) to prevent obesity in low-income families.

Barriers to implementing obesity prevention policies and practices at HS and within HS families have been identified as a lack of time, money, and knowledge (Hughes, Gooze, Finkelstein, & Whitaker, 2010). FPFS targeted each of these barriers. FPFS was built into the existing infastructure of the HS by utilizing volunteers to pack produce bags and the bus system to transport the food bags, which reduced time resources required to facilitate the program. Further, the program, being free, was cost-effective for families. After testing the pilot program, farmers and researchers agreed that a sustainable model for funding needed to be explored for continued program adoption and sustainability. Last, FPFS included educational materials which were utilized by program participants to increase knowledge about produce cooking and consumption. Results from FPFS indicate that similar interventions are warranted to further explore time, money, and knowledge barriers to implementing sustainable obesity prevention policies and practices at HS and within HS families for increasing FV intake.

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This study was conducted with a rural population, commonly reporting poor access to healthy foods (Dean & Sharkey, 2011). In additon, low-income individuals report consuming fewer FVs (Lin, 2005). This pilot study successfully demonstrated a food delivery strategy through a preschool as an effective way to remedy these disparities. In qualitative results, not reported in this paper, the delivery model that involved the children bringing the produce bags home with them on the bus was highly successful because (a) the mechanism coincided with the structure of the HS program and the parent's day, and (b) the children felt ownership and were excited to provide food for their families. This is very informative for future obesity prevention efforts targeting low-income families for involving children in the delivery of healthy foods and for creating buy-in.

This study did not provide sufficient time to observe changes in BMI; however, an increase in FV intake in a diet long-term may positively impact weight and/or chronic disease status, especially beyond 8 weeks (Hung et al., 2004). Overall, pre-tests indicated that participants fell below the Recommended Daily Allowance (RDA) for vitamin A and exceeded the RDA at post-test. For vitamin C, pre-tests indicated that participants met the RDA, and post-tests indicated that participants exceeded the RDA. Participants met the RDA for iron at both measurement time-points, but did not meet the RDA for vitamin D or calcium at either time-point. Furthermore, recommendations for fiber, fruit, vegetable, or FV cups combined, according to the Dietary Guidelines for Americans (U.S. Department of Agriculture, 2010), were not met, but intake did increase as a result of the study. Given the high rates of food insecurity noted in this study population, this type of produce delivery can be particularly effective for hunger- and health-related outcomes.

Although preliminary evidence shows that increasing access to locally produced foods through farm-to-fork initatives at schools may increase FV intake (National Farm to School Network, 2013; Urban & Environmental Policy Institute, 2013), there is limited knowledge on how this may impact families enrolled in HS, especially in the long-run. Families were not actively involved in delivering produce, though they provided input into the program design before, during, and after the intervention. As food gatekeepers and role models of nutrition (Birch, 1999), the involvement of parents in nutrition is essential in a preschool program and should be considered for longer term delivery programs. Some differences were noted between HS sites, including race, education, and food security status; however, differences did not exist for increases in FV consumption or completion of study instruments between the two cohorts.

Other limitations of this pilot study include self-reported data, attrition rates, sample size, and representativeness. The researchers took into account the potentential for underestimation on self-reported food records. Although there are several methods to enhance validity, such as using Goldberg's method for calculating estimated energy expenditure (EER; Black, 2000; Goldberg et al., 1991), researchers decided to include all data as reported given the food security

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status of this population and the ease and low burden of self-report measures. For attrition, no significant differences ($p < .05$) on all tested characteristics (e.g., age, income) were found between participants that completed both pre- and post-tests ($n = 29$) and the intent-to-treat analysis ($n = 51$). The small sample size may hamper the study's generalizability. As this study was a pilot in nature, further studies with larger sample sizes are warranted. Last, there were significant differences ($p < .05$) between study participants and nonparticipants based upon race/ethnicity, number of children attending HS, and enrollment in SNAP. Nationally, 36% of children attending HS are Hispanic/Latino, 33.5% are African American, 22% are White, and 8.5% are other (U.S. Department of Health and Human Services, 2013). These differences may threaten external validity, and future studies should focus on recruiting more representative populations both for their community and the HS population overall.

Implications

Direct produce delivery programs have the potential to increase FV consumption and ultimately reduce obesity for limited resource, preschool families. Further research should examine the feasibility and impacts of FV delivery programs on a larger scale, with diverse populations, and longitudinally. Other programs could focus on increasing nutrients of importance for the intended population (e.g., heart healthy foods for cardiovascular disease risk). Future studies should focus on understanding the dimensions of sustainability that support a FV delivery systems as means for increasing FV intake. Particular attention should be given to setting up FV delivery systems that complement the intervention site's schedule, infastructure, and participant needs. Funding models that are cost-effective for participants, researchers, and FV suppliers should be explored for program maintenance. In addition, instruments should be developed and tested for validity, reliability, and feasibility for different delivery programs targeting disparate populations. Health promotion researchers and practitioners should consider partnering with farm-to-school programs, hospitals, senior centers, and other sites where nutritionally at-risk audiences could benefit from FV delivery programs. A FV delivery program has potential for effectively changing nutrition outcomes, possibly related to weight status, in high-need audiences to positively impact public health.

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