Changes In Food Choices Of Rural Preadolescent And Adolescent Children Following A Theory-Based After-School Nutrition Intervention

By: **Melissa Gutschall PhD, RD** and Jennie Settle, MS, RD

Abstract

This study implemented and evaluated a 12-week, theory-based nutrition intervention, incorporating hands-on activities, healthy snack preparation, and goal setting among rural children (ages 8-15, n = 44). Paired samples t tests measured participant changes in outcomes from pretest to posttest, including anthropometric measures, self-efficacy, and nutrition knowledge and behaviors. Significant decreases in servings per week of sweetened beverages (22.3 ± 9.7 to 16.8 ± 7.8, P < .001), sweet snacks (11.3 ± 8.1 to 7.5 ± 4.4, P = .03) and salty snacks (6.5 ± 4.2 to 3.7 ± 2.5, P = .001) were reported. More changes to diet may occur in situations where children are able to choose their own food.

Gutschall, Melissa PhD, RD; Settle, Jennie MS, RD. (2013). Changes in Food Choices of Rural Preadolescent and Adolescent Children Following a Theory-Based After-School Nutrition Intervention. *Topics in Clinical Nutrition*, October/December 2013. Vol. 28, no. 4 -- p 356-363.doi:10.1097/01.TIN.0000437412.51317.1a. Publisher version of record available at: https://journals.lww.com/topicsinclinicalnutrition/Fulltext/2013/10000/Changes_in_Food_Choices_of_Rural_Preadolescent_and.5.aspx

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DATA from the National Health and Nutrition Examination Survey 2009-2010 indicate that 17% of children and adolescents aged 2 to 19 years (approximately 12.5 million children) are obese.[1] Obese children are at risk for a variety of health problems, including psychosocial stress, cardiovascular disease, and type II diabetes mellitus.[1] The US Department of Health and Human Services recommendations for Healthy People 2020 include reducing the proportion of children and adolescents who are overweight or obese, as well as the prevention of inappropriate weight gain in youth.[2] Rural children, in particular, are at increased risk of overweight and obesity due to barriers such as economic conditions, lack of access to health care services, and insufficient healthful food selections.[3]

Reducing the prevalence of overweight and obesity and preventing inappropriate weight gain requires the promotion of healthy eating behaviors from a young age. Preliminary results from after-school, community-based interventions have found positive outcomes in food preparation skills, food choices, and body mass index.[4,5] However, further research is necessary to determine how interventions can be most effective in rural populations.

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The authors acknowledge the contributions of Appalachian State University, University Research Council, and Appalachian and the Community Together.

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

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While there is only a limited theory basis for child nutrition interventions in the literature, social cognitive theory (SCT) holds some promise of success.[6-8] Social cognitive theory posits that personal characteristics such as behavioral capability and self-efficacy constantly interact with environmental factors to affect behavioral outcomes.[9] Behavioral capability refers to sufficient knowledge acquisition and skill development to enable individuals to perform the behavior correctly, while self-efficacy indicates the perceived level of confidence for performing the behavior in specific circumstances. Several SCT constructs also represent social support and influences (environment, observational learning, and reinforcements) that have been related to food choices among rural youth.[10,11] The preadolescent and adolescent years pose a special challenge when these influences become increasingly indicative of health decisions and behaviors. Thus, SCT may help explain, predict, and initiate health behavioral change of rural youth when applied to interventions.[9,12] The purpose of this study was to implement and evaluate a pilot after-school nutrition education intervention incorporating constructs from SCT among rural preadolescent and adolescent children.

PROCEDURES

A total of ten, 60-minute nutrition education sessions, based on SCT, were conducted among children aged 8 to 15 years. Participants were recruited on the basis of enrollment in an established community-based after-school program within rural Appalachia that was seeking a nutrition education component. The children were separated by age for educational sessions, with preadolescents (8-12 years) in one group and adolescents (13-15 years) in another. Table 1 provides details regarding the application of SCT constructs within the intervention. Worksheets, games, and hands-on activities accompanied the lessons to increase knowledge and skills required to perform healthful behaviors. Each lesson included the preparation and sharing of a snack that coordinated with the education theme of the week (Table 2). Participants created a weekly personal goal for either healthy eating or physical activity behaviors and reported on goal achievement weekly. Mentors and peers provided positive feedback and encouragement to reinforce the healthful behaviors achieved through goal setting. To promote encouragement of consumption and home availability of fruits and vegetables, children had a weekly homework assignment to try a self-selected, new fruit or vegetable and describe their experience to the class.

To support a healthy home environment, parental involvement was encouraged through a weekly newsletter that reflected the key messages in the nutrition education component of the program. The weekly newsletter also reminded parents of participants' homework and goal-setting assignments to encourage home participation. Parents were invited to attend nutrition education sessions with their children. At the end of the program, each participant was given a booklet with all of the snack recipes that were made during the lessons to support the continuation of preparing healthy snacks at home.

The primary investigator and a graduate research associate worked closely to develop the detailed intervention plan, including lessons, activities, snack ideas, and evaluation measures. The graduate research associate served as the lead teacher of the intervention and helped train 5 other graduate students, who assisted with snack preparation and activities. Fidelity was assessed by periodic visits to education sessions by the primary investigator, as well as continual reports and regular debriefing with graduate students regarding intervention delivery.

The study design included a pretest, posttest assessment using a previously validated self-efficacy questionnaire[13]; a participant knowledge and behavior survey; a food frequency questionnaire with targeted dietary items[14] (beverages, cereals and grains, dairy products, vegetables, fruits, condiments, mixed meals, and snacks and sweets);

Table 1. Major Concepts in Social Cognitive Theory and Applications to the Intervention[a]

Concept	Definition	Application
Environment	Factors physically external to the person	Provided opportunities for social support in a group setting from peers, parents, and college students through participation in activities and group discussion
Behavioral capability[b]	Knowledge and skill to perform a given behavior	Promoted skill development through discussion, games, problem-solving activities, food preparation, and reinforced concepts of healthy eating at home via homework and newsletter activities
Expectations	Anticipatory outcomes of a behavior	Discussed the relationship between healthy eating and actual health (eg, milk for bone health, fiber for gastrointestinal health)
Expectancies	The values that the person places on a given outcome; incentives	Emphasized the health outcomes in terms of feeling good, having healthier bodies, and having energy to play and do school work
Self-control	Personal regulation of goal-directed behavior or performance	Provided opportunities for participants to set goals to try new fruits or vegetables weekly and to set a weekly goal for a new healthy eating behavior
Observational learning	Behavioral acquisition that occurs by watching the actions and outcomes of others' behavior	Modeled healthful eating practices through discussion with parents and college students, as well as preparation and sharing of weekly snack
Reinforcements	Responses to a person's behavior that increase or decrease the likelihood of reoccurrence	Provided weekly review of goals and discussion of curriculum activities with encouragement and feedback from the group
Self-efficacy[b]	The person's confidence in performing a particular behavior and in overcoming barriers to that behavior	Facilitated curriculum activities that involved brainstorming and problem solving for application of desirable behaviors, as well as goal-setting activities that included self-monitoring
Reciprocal determinism	The dynamic interaction of the person, behavior, and the environment in which the behavior is performed	Targeted the child, skill-building, and the child's home environment, including parental support for healthful environment, in the behavior change process

[a]From Baranowski et al.[12]

[b]Constructs directly measured before and after intervention.

and a parent feedback survey, which was included at posttest only. Anthropometric measures of weight (digital scale), height (wall-mounted stadiometer), body fat percentage (Tanita BIA, Tanita Corporation of America, Inc, Arlington Heights, Illinois), blood pressure (Omron Healthcare Inc, Lake Forest, Illinois), and waist circumference were also collected at pre- and posttest time points. Inclusion criteria were attendance at a minimum of 6 nutrition education sessions and completion of data at pre- and posttest assessments.

Outcome measures included changes in anthropometric measures, self-efficacy factors

Table 2. Weekly Lesson Plans and Snacks Provided During Intervention

Lesson Plan	Lesson Activity	Snack
The importance of breakfast	Created a power-up breakfast (breakfast with 3 food groups represented)	Yogurt and fruit breakfast smoothie
The food guide pyramid	Designed a meal that included all food groups	Turkey wrap and juice to represent foods from "whole pyramid"
Fruits and vegetables (F&V)	Blind-folded F&V taste-testing	Fresh fruits, veggies, and hummus
The grains group	Created school lunch menu with whole grains	Whole wheat mini burritos
The dairy group	Dairy, physical activity and strong bones quiz	Fruit and yogurt parfait
Healthy snacks	Used food packages to find healthier snacks	Trail mix
Healthy beverages	Measured amount of sugar in soda	Fruit Juice Fizz (Homemade soda with seltzer and 100% juice)
Portion sizes	Used visuals to learn appropriate portion sizes	Measured fruit, vegetable, and cheese kabobs
Reading labels	Used food packages to learn key parts of food label	Mini rice cake stacks (fat free cream cheese and strawberries or peanut butter and banana)
Comprehensive review	Food pyramid bingo	Kids' choice snack

of decision-making and goal setting, nutrition knowledge and behaviors, food choices converted to servings per week equivalents, and parental feedback. A paired samples *t* test was conducted to measure participant changes in these outcomes from pretest to posttest, and a chi-square test with cross tabulation was used to compare the frequency of participants reporting specific dietary behaviors at pretest and posttest. Descriptive statistics were used to analyze parental feedback and involvement in the nutrition sessions. Parents' open-ended responses were reviewed regarding receptiveness to and feasibility of their involvement in the child's nutrition education, including the nutrition messages shared in the home. A parental involvement composite score (0-5) was created on the basis of the number of activities parents were involved in (eg, newsletter, homework, goal setting, attendance). This number was correlated with changes of scores from pretest to posttest on other outcomes measured to explore the relationship between parental involvement and amount of change in outcomes. Data were analyzed using the Statistical Package for the Social Sciences (version 20.0; SPSS, Inc, Chicago, Illinois). Results were considered statistically significant at $P < .05$. The institutional review board of the sponsoring institution approved this study. Parental consent and child assent forms were collected prior to study participation.

RESULTS

Of the 68 children who began this intervention, 44 participated in at least 6 education sessions and completed both pretest and posttest measures. The participants included in this analysis attended an average of 9 sessions. While none of the children or parents refused participation, those who did not complete all requirements became involved in other afterschool commitments that affected regular attendance at nutrition education sessions.

Baseline characteristics of the sample are included in Table 3. The sample was 15.5%

Table 3. Baseline Anthropometric and Socioeconomic Data for Participants of Intervention (n = 44)

Variable	Mean (± SD)
Age	12.6 (± 1.9)
Siblings	2.0 (± 2.1)
Income	38 400 (± 21 150)
Weight, lb	100.8 (± 29.0)
Body fat, %	15.3 (± 6.8)
BMI, kg/m^2	19.0 (± 2.8)
Variable	**%**
Gender	
Male	75.5
Female	24.5
BMI for age classification	
Overweight	13.6
Obese	11.3

Abbreviation: BMI, body mass index.

Hispanic, 84.5% white, and predominantly male (75.5%). Nearly a quarter of the participants (24.4%) were classified as overweight or obese, according to the CDC (Center for Disease Control and Prevention) body mass index for age percentiles. There were no significant changes in anthropometric measures over the course of the study. Likewise, no statistically significant changes in nutrition knowledge items, or any self-efficacy factors, were found at the posttesting period, although an increase in the mean self-efficacy for goal setting related to healthy eating behaviors was observed following the intervention (from 3.9 ± 0.98 to 4.08 ± 0.84, P = .257 on a 5-point scale).

Significant differences were found for specific eating behaviors and consumption frequencies represented by the nutrition knowledge and behavior questionnaire and food frequency questionnaire. Following intervention, a greater number of children reported making their own breakfast (P = .0004), and consuming whole grains (P < .001). Fewer children also reported purchasing sweetened beverages from vending machines (P = .007). As for specific food choices, significant decreases in weekly servings of sweetened beverages, sweet snacks, and salty snacks were reported following the intervention (Table 4).

Parents provided positive feedback about the program. They were interested in greater participation in the program, such as continuing to receive the weekly newsletter with lesson details, activities, and snack ideas; however, few parents were interested in attending the nutrition education sessions. Twenty percent of the parents attended one education session with their child, while 88% read the information in the weekly newsletter and helped their child with weekly homework. Many parents (77%) discussed the

Table 4. Changes in Weekly Servings of Selected Food Choices Following Intervention (n = 44)

Categories	Mean (± SD) Pretest Frequency	Mean (± SD) Posttest Frequency	Significance (P)
Fruit	14.9 (± 11.1)	15.9 (± 13.9)	.67
Fast food	1.7 (± 1.2)	1.8 (± 1.6)	.67
Dairy	18.4 (± 9.1)	15.8 (± 11.5)	.20
Vegetables	22.0 (± 17.8)	20.7 (± 19.2)	.71
Whole grains	8.0 (± 4.6)	6.0 (± 4.4)	.03[a]
Sweet snacks	11.3 (± 8.1)	7.5 (± 4.4)	.03[a]
Salty snacks	6.5 (± 4.2)	3.7 (± 2.5)	.001[a]
Sweetened beverages	22.3 (± 9.7)	16.8 (± 7.8)	<.001[a]

[a]Statistically significant P < .05.

nutrition lesson with their child and helped the child work toward their weekly goal. Greater parental involvement was only significantly related to children making their own breakfast ($r = 0.77$, $P = .02$).

DISCUSSION

Theory-based interventions that teach skills for improving food-selection behavior may help to reduce the prevalence of overweight among rural children.[15] Meaningful changes in preadolescent and adolescent food consumption were shown over a relatively short duration. Children may be able to make more dietary changes when they are responsible for their own food selection, that is, energy-dense snack foods and sugar-sweetened beverages. No significant changes were seen in the major food groups or combination meals, possibly because these changes may be determined more by the parents or household habits. These results suggest that greater alterations to diets of children may occur in areas where they make their own food choices. However, it may take more than 10 weeks with additional parental involvement to make dietary changes in areas where youngsters have little choice over food selection.

Parental involvement is critical to assisting young children in creating positive changes that are outside of their control. A systematic review found that high levels of parental involvement in interventions are associated with more positive outcomes; however, the best methods to incorporate parents into interventions are not yet known.[16,17] In this study, greater parental involvement was related to children making their own breakfast. Children did report asking parents for the new foods that they wanted to try for their homework assignments. Aside from the weekly newsletter, parents generally did not want to get more involved in the nutrition education program; however, they do serve as the gatekeepers for food in the household. Creative ways to target parents as part of interventions requires further evaluation. Their role is an essential component that could be reinforced more and could affect the outcomes.

The decline in sweetened beverage intake is particularly salient, as previous reports suggest that sugar-sweetened beverage consumption is increasing in this age group and is higher among rural populations.[18,19] Sugar-sweetened beverage intakes have recently been independently associated with compromised lipid profiles, inflammatory markers, and increased waist circumference in a nationally representative sample of children.[20] Thus, one finding of this study, a meaningful decrease in sugar-sweetened beverage intake with a relatively short intervention, may have lasting health benefits. The theoretical basis and methods presented could guide future intervention development for this population with examination of cardiovascular and metabolic benefits over time.

Although not statistically significant, the mean for self-efficacy related to goal setting for healthy eating behaviors increased following the intervention. Children who self-select their own goals enjoy making the effort to achieve the goal.[21] Pretest scores for self-efficacy measures were high among participants, indicating that participants had high self-efficacy prior to the intervention. It is possible that participants in this age range may not have sufficient knowledge about the commitment required for healthy eating prior to the intervention and, therefore, scored erroneously high. Future research should investigate the mediation effect of self-efficacy on dietary changes in this population.

A similar effect was seen with inconsistent reporting regarding whole grain intake. While children reported consuming a greater number of servings of whole grains on the behavior survey, the result was not supported by actual consumption reported on the food frequency questionnaire. They could have been confused about what grains actually constitute whole grains and inflated the reporting of actual intake. Children may have an unclear idea of what counts as a whole grain

when queried about specific whole grain food items.

Nutrition knowledge scores were fairly high at pretest and showed no change, supporting the need for reinforcement and practical skills to translate nutrition messages into food selection behaviors. Children are more likely to try a food if they have helped prepare it. Exposure to basic food preparation may increase consumption of healthful foods. Studies involving food preparation found that children report enjoying the activity [4,22] and the children consume more nutrient-dense foods after preparing them.[23,24]

Children may have nutrition knowledge but require longer exposure to healthful foods and preparation to make more changes to actual food selection behaviors, and this should be a consideration for future interventions. On a related note, the exposure to healthful food options with topics such as healthy snacks and beverages may have influenced bias in recall as there was limited time between when they were taught and the posttest evaluation measures.

The study has some additional limitations to consider. Changes in food-selection behaviors did not translate into significant differences in anthropometric measures during this short time frame. Future studies should include longer-term follow-up measures to evaluate the lasting impact of the intervention on health-related outcomes. Changes in health outcomes may be greater for those needing more dietary alterations, but the small sample precluded further investigation of this effect. While studies could target only children who are at risk for overweight and obesity, the opportunity to instill healthy habits in all children may be missed. Future research should include a control group that ultimately receives the intervention following the final outcome measures. Future studies might also consider separating children by gender. While there were no significant differences in outcomes by gender with the distribution of this sample, observations were made of different levels of participation between male and female participants at education sessions. Given that adolescence is a time when social influences are becoming more important, gender differences regarding health and body image may be better targeted in gender-specific interventions. Finally, attendance rates were variable and depended on participation in the after-school programs, which decreased usable data because of the inclusion criteria. Attendance in such programs may be an issue based on costs and transportation in rural areas. The sample size likely affected the ability to identify significant outcomes, but the outcomes presented are meaningful. These findings could translate into notable health benefits for this population if barriers to participation and attendance can be overcome, and greater numbers could receive nutrition education.

IMPLICATIONS FOR RESEARCH AND PRACTICE

In addition to transferring knowledge, theory-based nutrition education gives children the opportunity to gain confidence and practical skills in choosing and preparing foods for themselves through hands-on learning activities. Social cognitive theory holds promise for building self-efficacy among children, which may help them make healthier, independent decisions regarding food choices and lifestyle behaviors. Further research is necessary to contribute to the understanding of how specific behavioral constructs, such as self-efficacy, facilitate behavior change in rural children. Future interventions should continue to incorporate self-efficacy exercises, including goal setting and skill building, to evaluate effectiveness for making healthy food choices. These experiences allow participants to apply information immediately on how to improve the nutritional quality of their meals and may lead to meaningful behavioral changes over time. More parental involvement in child nutrition education programs may support healthier eating and food selection in preadolescent and adolescent children. Interventions of longer duration, with

increased parental involvement in classes, are likely needed to see additional changes in children's diets. This is especially critical for rural children who are at increased risk for overweight and obesity and lack access to nutrition information and programs.

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