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Garden-to-Table Food Education Strategies to Induce Healthy Food Choices & Reduce Risk of Obesity in NYC Middle & High School Students

Ali Bukhari, MS, Columbia University, Institute of Human Nutrition, NYC; Lynn Fredericks, Founder, FamilyCook Productions, NYC; Judith Wylie-Rosett Ed.D., R.D., Albert Einstein College of Medicine, Yeshiva University, Bronx, NY

Abstract

As the number of adults and children who are obese has reached epidemic proportions, the need for effective interventions for preventing obesity and related health risks has similarly intensified. Multi-sensory nutrition education that includes cooking has been shown to be especially effective in addressing dietary behaviors among children. Dietary behavioral changes, as a result of such nutrition education, have been observed in adolescents as well and were found to persist in individuals over time.. The curriculum used for this project was titled "Diet for a Healthy Planet" and developed by FamilyCook Productions (New York, NY) for use with ninth-grade students. The curriculum was designed for this age group and highlights successful components from existing FamilyCook programs such as multi-cultural recipes and inquiry-based nutrition activities, with the addition of the study of food production systems and gardening. Like all FamilyCook programs, they utilize the SCT and self-efficacy theoretical behavior change models. Students in the intervention group reported an increase of dietary quality by 20.37% (p=0.01). This outcome is supported by previous studies that found improved positive behaviors when students were exposed to a garden-based nutrition education program. Future research should expand on the effect of longitudinal nutrition education in adolescents both behaviorally and physically.

Introduction

As the number of adults and children who are obese has reached epidemic proportions, the need for effective interventions for preventing obesity and related health risks has similarly intensified. It is currently estimated that approximately 30% of children are either overweight or obese[1,2]. Overweight in children is defined as being between the 85th and 95th percentile of the sex-specific BMI for age growth chart, as defined by the 2000 CDC growth charts[3].

Adolescence can provide an auspicious opportunity for preventive efforts and the urgency is clear from the trend data. Among adolescents 12 to 19 years of age, the percentage of those considered obese (previously classified as overweight) increased from 4.6% to 17.4% (a 278% relative increase) between 1966–1970 (for adolescents 12 to 17 years of age) and 2003–2004[4].

Such numbers are particularly alarming since overweight children tend to become obese adults[5] and because this association is only strengthened as children age[5]. Once obese, there are a multitude of associated increased health risks such as cardiovascular disease, stroke, diabetes, and some forms of cancer, such as prostate, breast (in post-menopausal women), renal, and esophageal[6,7]. In addition, certain metabolic risk factors including, but not limited to, hyperlipidemia, hypertension, and abnormal glucose tolerance have been

found to track into adulthood regardless of adult BMI[8]. Therefore, it is vital that we address the epidemic of overweight in children before complications arise now or later on in life.

Adolescents display a variety of poor dietary habits including increased fast food consumption, meal skipping, and inappropriate dieting[9-11]. Their diet is typically composed of high levels of saturated fats, cholesterol, and sodium, while being low in fruits and vegetables, as well as numerous micronutrients[12].

The growing independence associated with adolescence extends to independent food choices, which can be influenced by advertisements, peers, and other factors. Currently food advertising accounts for approximately a quarter of all television ads viewed by adolescents[13]. Most of the products' advertised are high-sugar sweets and snacks or fast food, all items that the child is able to purchase himself/herself[13]. Hence, prevention interventions based on changes in the child/adolescent's environment are particularly attractive for changing behavior in this age group to achieve population-based prevention of obesity[14].

These observations, taken together, suggest multiple avenues for addressing childhood obesity. The American Dietetic Association (ADA) recommends a multifaceted approach that includes a combination of family, school, community, and environmentally based initiatives when dealing with pediatric overweight[15]. Components of such programs should include an approach encompassing behavioral counseling, promoting physical activity, dietary counseling, and nutrition education[15]. Yet, in contrast to the extensive list of existing research on obesity treatment, efforts to identify best practices for obesity prevention is still at a relatively early stage[14, 16-18].

Nutrition education is understood to be a vital component in addressing dietary behaviors among children. Behavioral changes, as a result of nutrition education, have been observed in adolescents[19] and were found to persist in individuals over time[20,21]. As a result, nutrition education can be as a cost-effective measure[22] that can lead to reducing the two trillion dollars spent yearly on healthcare costs nationwide[23].

One of the most useful theories used in nutrition education has been Bandura's Social Cognitive Theory (SCT)[24]. SCT provides a framework in which behavior, personal factors, and environmental influences interact simultaneously[22]. It is

logical that, if an individual has no ability to change his food environment, little change can be expected regardless of comprehension of information presented. SCT works to address both individual behaviors and environment through its approach.

This intervention is a comprehensive nutrition education program that was administered to ninth graders in a local New York City high school within Brooklyn (Urban Assembly – School of Music and Art). SCT was the primary modality used, as the program incorporates both general aspects of health and nutrition knowledge, as well as including a hands-on component designed to increase adolescent cooking skills and involvement in meal planning and preparation thereby affecting environment and belief in their ability to make dietary improvements.

The ideas of self-efficacy presented throughout SCT are paramount in the FamilyCook curriculum. Our setting is Downtown Brooklyn, a location plagued with poor graduation rates and high poverty levels[25]. As of 2006, 22.6% of the Brooklyn population **was** below the poverty level. Moreover, 32.3% of children under 18 years of age were under the poverty level. These facts coupled with a 31% dropout rate fuel negative thoughts of inability to succeed and lowered self-confidence. Utilizing SCT for the framework in our setting was vital as it implicitly addresses the concept of self-efficacy allowing for a change in perception, behaviors, and environment simultaneously.

Through skill-building in cooking and gardening, it is believed that students' confidence levels in their ability to prepare healthful recipes and positively impact their health will rise, enabling them to make healthier food choices. This environmental and self-efficacy approach has a two-pronged effect as it is designed to not only reinforce nutritional knowledge and practices but also increase the frequency of meals eaten with the family, particularly dinner.

In-class activities include classroom lecture, inquiry-based problem-solving activities and development of gardening and cooking skills. The curriculum is structured to allow students to follow the farm-to-table progression. This layout facilitates an appreciation for freshly grown fruits and vegetables and other healthful food products over processed and prepackaged foods, enjoyed as a social occasion with friends and family.

A number of studies have documented the benefits of eating meals with one's family[26,27]. Family meals were found to be positively associated with increased intake of fruits and vegetables, as well as of whole grains and calcium-rich foods[26]. Moreover, as dinner is typically the meal where the largest number of calories is consumed[28], it should follow, then, that increasing the frequency of family dinner meals would result in greater overall health and wellness. Family meal frequency for adolescents declines during the transition from middle school to high school[26]. As a result, the increased independent food selection by adolescents coupled with this decline in family meal frequency is assumed to contribute significantly to the serious deficits witnessed in adolescents regarding consumption of fruits and vegetables, whole grains, and calcium-rich foods[12].

Our primary outcomes include increasing dietary habits as measured by the CDC Youth Risk Behavior Survey (YRBS) with an emphasis on fruits and vegetables and are consistent with our qualitative data. The YRBS is the measurement tool of the Youth Risk Behavior Surveillance System (YRBSS) set up by the CDC to monitor six categories of priority health-risk behaviors among youth and young adults[29]. The highlight of this survey for purposes of our project is the measurement of unhealthy dietary behaviors. The YRBS is national school-based survey conducted by the CDC and other state or local health agencies[29].

The increased nutritional needs of adolescents during puberty[30], coupled with the disordered eating and unhealthy practices common during this time[31-33], can have serious long-term effects, including cardiovascular disease, type 2 diabetes mellitus, and some types of cancer.

Methods and Materials

Curriculum

The curriculum used for this project was titled "Diet for a Healthy Planet" and developed by Lynn Fredericks and FamilyCook Productions (New York, NY) for use with ninth-grade students. The curriculum was designed particularly for this age group to highlight successful components from a multitude of existing FamilyCook programs and others, utilizing SCT[22], self-efficacy and garden-based interventions[34].

The curriculum was organized into weekly themes (Table 1) that were designed to increase understanding and retention. Each theme concluded with a session devoted to reflecting on thoughts and ideas presented that week through focus groups,

classroom discussions, and/or journal entries.

Table 1. Weekly Theme Descriptions

Theme	Key Topics
1. What Influences My Diet	Body Image, General Nutrition Information Recipe preparation
2. Where to Find Reliable Information on Nutrition	Nutrition Information Resources, Eating by Color
3. Becoming a Smart Consumer	Health Claims, Healthy Snack Preparation
4. Food is Personal	Food & Mood Recipe preparation
5. Neighborhood Food Assessment – Part 1	Survey of Local Stores & Markets, Presentation Development
6. Neighborhood Food Assessment – Part 2	Mapping activity of healthful vs. non-healthful, Presentations
7. What is Food? Production Effects on Human & Environmental Health	Ecosystem Effects, Food Web Evaluation Recipe preparation
8. Meet the Farmer	Alternative Food Resources: CSA, Farmers Markets, Food Co-ops Recipe preparation
9. Food Politics	Food Policy, Areas for Change Recipe preparation

Tied into each theme was also the development of cooking and gardening skills, which were vital in raising the self-efficacy of the students in being able to change their meal preparation skills and hence their own food environment. Table 2 outlines weekly objectives related to enhancing gardening skills.

Table 2. Weekly Gardening Objectives

Week	Objective
1	Seed Germination
2	Compost
3	Soil Study & Garden Planning
4	Planting & Plant Life Cycle
5-6	Plant Growth Comparisons
7-10	Garden Care & Recipe Preparation

The gardening component of the intervention was particularly important as a previous study witnessed significant increases in fruits and vegetables intake among students exposed to a garden-based nutrition education program[34].

Additionally, an after-school, self-selected component titled "Teen Iron Chef" was also evaluated for its efficacy. Students met for two hours once a week for seven weeks during which they worked collaboratively in small groups to complete multi-cultural recipes within allotted time. Presentation skills were also developed as the students were put in charge of explaining not only their process and execution but also the cultural and nutritional background of their assigned recipes to a larger group.

Recruitment

100 ninth-grade students from the Urban Assembly School of Music and Art (Brooklyn, NY) participated in the project. They were randomized to either participate in the intervention or serve as controls. Students within the intervention group received instruction daily over the course of one 5-month semester for approximately 60 minutes at a time. Students in the control group participated in other non-nutritional electives to avoid any overlapping material.

A total of 49 students (29 intervention, 20 control) were included in the analyses as these students completed both pre- and post-intervention surveys. Seven students from the Teen Iron Chef component were also analyzed.

Time Frame

The intervention ran from February 2008 to May 2008. This time frame allowed students to practice not only culinary and gardening skills but also observe plant growth and extensive strategies in the utilization of fresh fruits and vegetables.

Measurement Tool and Outcome

The CDC's Youth Risk Behavior Survey (YRBS) was used to measure dietary behaviors. The YRBS is a validated, measurement tool designed to assess behaviors in adolescent populations[35]. The twelve questions asking about various food intake and frequency are presented in the survey (Table 3).

Table 3.

During the past 7 days, how times did you eat/drink …
1. 100% Fruit Juice
2. Fruit
3. Green Salad
4. Potatoes
5. Carrots
6. Other Vegetables
7. Hamburger, Hot Dog, Fried Chicken, Sausage (Poor Behavior)
8. Green, Leafy Vegetables
9. Soda or Pop (Poor Behavior)
10. Milk
11. Sweet Snacks (Poor Behavior)
12. Salty Snacks (Poor Behavior)

To measure success of the program, a zero-to-six point scale was devised and assigned per question so that healthier practices received higher scores. A scale such as this was devised to properly associate overall success of the program. This scale allows for an overall indicator of student dietary quality as opposed to random observation of important dietary quality in one or two areas alone.

Statistical Analysis

All data were double entered to reduce error. Surveys with missing values were excluded from tests for which a response was required. Power will be outlined for each test run. SPSS v14.0 will be used for all statistical tests. T-tests one-way ANOVAs comparing the two groups will be utilized after controlling for age and gender. Additionally, bivariate correlations will be used to identify program effectiveness.

Results

Main Outcome

Table 4. Dietary Quality Change

Group	Dietary Change	% Change	p-value
FamilyCook (Intervention)	+4.86	+20.37%	0.01*
Control	+1.55	+5.69%	0.46
Teen Iron Chef	+6.29	+22.81%	0.08

*Significant to p=0.05

Students in the intervention group reported an increase of dietary quality by 20.37% (p=0.01). The control group had a non-significant increase of 5.69%. Additionally, the Teen Iron Chef students experienced a 22.81% (p=0.08) as a result of

the program. These outcomes are consistent with qualitative data accrued through focus group, performance evaluations, and reflective exercises. For instance, the following was revealed in a reflective exercise with 23 students in the program:

Table 5. Qualitative Attitudinal Changes

Attitude	Attitudinal Improvement (%)	Behavior Change (%)
About Cooking	65%	8.7%
About Food Choices From Learning How Food is Produced	45%	41%
Willingness to Try New Food	70%	57%
About Eating Healthy	61%	N/A

Secondary Outcomes

Students were also evaluated on the effectiveness of the SCT framework used for the intervention. Significant correlations between dietary change and a number of self-efficacy, attitudinal and environmental factors were observed.

Table 6. Parametric Correlation of Observed Variable Change to Dietary Quality Change

Variable Observed	Pearson Correlation (r)	p-value
Help Plan Breakfast, Lunch, Dinner	.243	.221
Help Cook for Family	.235	.229
Chose Fruits/Vegetables as Snack	.644	.0001*
Prepared Healthful Snack for Self	.481	.013*
Frequency of Sit-down Meals w/ Family	.546	.004*

*Significant to p=0.05

Results presented are on FamilyCook (Intervention) students only unless otherwise specified. Low power prevented us from finding any significant findings in the Teen Iron Chef group.

Discussion

The main outcome of the intervention resulted favorably in that a significant increase was witnessed in the students exposed to the FamilyCook curriculum (Table 4). The use of nutrition education in adolescents has shown mixed results on the whole as no two curricula are ever the same. However time and again, interventions that utilize a SCT framework

have produced positive results[22]. This effect can be attributed directly to the impact on the child's improved self-efficacy, improved, and changing environment.

Additionally, qualitative results compiled from reflective exercises (Table 5) parallel these improvements in areas surrounding healthy eating beliefs, cooking thoughts, and willingness to try new foods. A sample of student comments are presented below to highlight the overall attitude students presented towards healthy eating.

Table 7. Examples of Student Comments

"I used to think eating healthy was eating a fruit a day and taking your vitamin. Now I see it is more than that. I love to eat fruits and vegetables to keep healthy."
"I always wanted to learn to cook; now I love doing it!"
"I used to think the food I ate was good; now it's better!"
"I used to think if it smells bad, I wouldn't eat it. Because of this cooking class, I ate something that smelled bad but tasted good."
"I used to think I should try new foods; now I do it!"
"I used to think eating healthy was boring; now I think it's good for your body."

Another positive outcome, while not significant, was the dramatic increase in dietary quality among students in the Teen Iron Chef component (Table 4). It is encouraging to see that such striking improvements were witnessed that were close to reaching significance ($p=0.08$) with only seven students. Moreover, Teen Iron Chef students improved significantly in preparing healthy snacks for themselves (data not shown) and showed nonsignificant increases similar to FamilyCook program students. It is therefore assumed that an increased amount of students in the Teen Iron Chef program would most likely produce significant results in a variety of outcomes. It should be noted that the project design called for a 30-student cohort in the Teen Iron Chef component. Unfortunately, due to school resource issues, only one 10-student cycle was conducted.

Several key differences exist between the FamilyCook curriculum and the Teen Iron Chef component. One of these differences is the method of student selection. The primary intervention and control groups were established through randomized design while the Teen Iron

Chef students chose to participate in the program. This inclusion of self-selection introduces bias instantly. Moreover, Teen Iron Chef students ranged from ninth to eleventh graders. It is possible that the age difference would allow for greater understanding and comprehension.

Large and significant correlations were witnessed for FamilyCook students in both questions regarding snacking behaviors (Table 6). Student improvement in dietary quality correlated positively with improved snacking behaviors including both "choosing fruits and vegetables as between-meal snack" and "preparing a healthy snack for themselves". The SCT framework of the intervention supports this finding. As personal choices (improved self-efficacy) regarding one's environment were stressed throughout the curriculum it should follow that student's would address those environmental factors that they were able to change (snacking as opposed to family meals).

Students comments compiled from essays (Table 7) highlight the improved attitudes regarding independent eating/cooking behaviors. As such, it is important to consider that adolescent dietary quality is significantly affected, both positively and negatively, by the quality/quantity of their snacks.

Prior research found that adolescent snacking has an impact on macronutrient intake and can drastically affect the amount of discretionary calories consumed[36]. By advocating a curriculum that addresses personal food choices and environment, students will be more aware of healthy recommendations when snacking.

A number of problems arose throughout the study including behavioral issues among students and survey collection. Behavioral issues among students were barriers to student learning during most times and prevented maximum understanding and adherence of the material presented. This issue extends well beyond the scope of our study and is being addressed simply because it created a significant barrier to learning. Perhaps along these lines, survey collection was hindered by a lack of disregard on behalf of the students and unwillingness to pursue survey fulfillment on behalf of the teachers. In a population where approximately 100 surveys were possible (50 intervention, 50 control), only 49 were accounted for. Increased power would have allowed for a greater chance to find further significant effects.

The FamilyCook curriculum provided a solid foundation of nutrition education utilizing the SCT framework

effectively as shown through the results witnessed within the study. Future research should expand on the effect of snacking on adolescent diet quality.

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