FEATURE

By Melinda Anderson and Melinda Swafford

# Hydroponic Garden Promotes Hands-on Learning, Healthy Eating

"THE PROJECT DESCRIBED IN THIS ARTICLE PROVIDED AN OPPORTUNITY FOR EDUCATORS IN GREENHOUSE MANAGEMENT, NUTRITION AND FOODS, AND FAMILY AND CONSUMER SCIENCES TO **ALIGN COURSE STANDARDS AND CURRICULUM WHILE COLLABORATING ON PLANS TO ADDRESS THE PROBLEM OF OBESITY IN THE LOCAL SCHOOL AND COMMUNITY.**"

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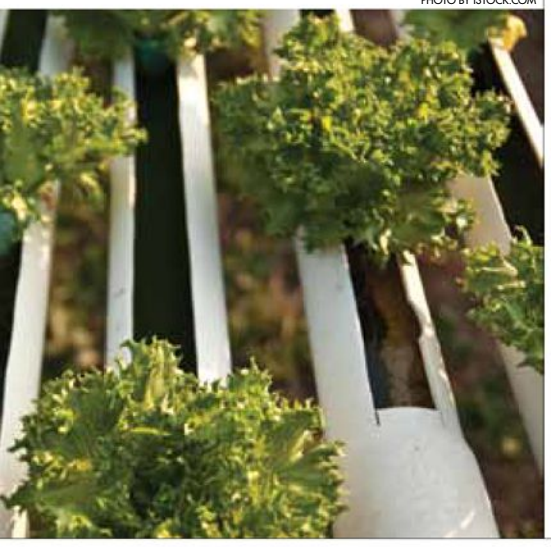

**THE CARL D. PERKINS CAREER TECHNICAL** Improvement Act of 2006 encourages integration of academic instruction to improve student learning, impact employment skills of students, and enhance problem-solving skills by using authentic real-world situations. Academic integration is accomplished by integrating concepts of English, math, science, technology, etc., into career and technical education (CTE) course content, or by two teachers from different content areas collaborating to align and team-teach course standards. The project described in this article provided an opportunity for educators in Greenhouse Management, Nutrition and Foods, and Family and Consumer Sciences (FACS) to align course standards and curriculum while collaborating on plans to address the problem of obesity in the local school and community.

## Factors Affecting Obesity and Food Choices

Obesity is a national public health concern that results in a reduced quality of life, as evidenced from the increased risk of developing heart disease, hypertension, and type 2 diabetes. Data from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) revealed that an estimated 17 percent of adolescents (ages 12-19) are obese (Ogden and Carroll, 2010). A variety of environmental, genetic, physiologic, metabolic, behavioral and psychological factors are known to influence obesity; therefore efforts to prevent and treat obesity are also complex. A key factor in preventing obesity is understanding how individuals make food choices. Pollard, Kirk and Cade (2002) described a food choice framework that included such factors as: food availability, sensory appeal, habits and culture, social interaction, media and advertising, and health knowledge.

One method of understanding food choices is to look at the frequency of certain foods eaten. Diets that are low in fruits have been linked to a higher Body Mass Index (BMI) in both children and adults (Lin and Morrison, 2002). Conversely, diets high in fruit and vegetable intake have been linked to decreased risk of chronic disease (U.S. Department of Health and Human Services [HHS], 2005). The role of fruits and vegetables in improving health status and maintenance of a healthy weight is promising. Fruits and vegetables are naturally low in calories, and higher in fiber, which promotes a feeling of fullness or satiety.

Research has shown that children's intake of fruits and vegetables tracks into adolescence (Resnicow, Smith, Baronowski and Baronowski, 1998), and that eating habits and food preferences established early in life continue into adulthood. Fruit and vegetable intake among adolescents is lower than recommended amounts (U.S. Dept. of HHS, 2005). Understanding why children and adolescents do or do not consume adequate amounts of fruits and vegetables is important in designing nutrition interventions tailored to their needs.

Knai, Pomerleau, Lock, and McKee (2006) found multi-component interventions to be most effective. Examples were: activities that focused on specific fruits and vegetables rather than nutrition in general, and hands-on activities related

to fruits and vegetables (taste testings and preparation). Additional activities involved special training of teachers and peer leaders, active participation and encouragement by the school food service staff, active involvement of parents at school and home, development of a school nutrition policy, community involvement and length of follow-up. The authors conclude that creating an "enabling environment" for fruit and vegetable consumption that includes multiple components is most likely to succeed. In addition, Zabinski *et al.* (2006) suggest effective dietary change interventions for adolescents should include multiple components.

## The Role of CTE Programs and Families in Addressing Obesity

Families provide important role models and are responsible for creating the food environment within the home. In addition, CTE classes such as Nutrition and Foods, FACS, school lunch programs, and agriculture classes such as Greenhouse Management, Aqua Culture Hydroponics, Plant Biotechnology and Plant and Soil Science classes provide another avenue for creating an environment that promotes increased consumption of fruits and vegetables. Adolescents above age 13 can be taught to use theory-based behavior change strategies and decision-making skills to improve intake of fruits and vegetables.

## Using Hydroponic Growing Methods to Address Obesity

Using a combination of Knai *et al.*, (2006); Zabinski *et al.* (2006) and Pollard *et al.*, (2002) as the theoretical foundation, researchers at a southeastern university recently collaborated with CTE teachers and students attending a rural, southern high school. The purpose of this project was to address obesity factors by increasing availability and improving sensory appeal of fruits and vegetables, while employing hands-on activities by learning to use hydroponic growing methods. This model of hydroponic vegetable growing was tested for its efficacy in reducing obesity indices in at-risk population of young people. The objectives of the research project were: to determine the cost-effectiveness of growing hydroponic vegetable gardens in high school CTE classrooms for rural adolescents and their families, and to determine the impact of class-produced hydroponically grown vegetables on obesity indices in participants.

## Data Collection

Thirty students enrolled in CTE classes (both FACS and Ag classes) at a rural high school and their families completed permission forms. The first set of data collection included height and weight on each student. Data collection instruments included: Youth and Adolescent Food Frequency Questionnaire (YAQ), National Institutes of Health Fruit and Vegetable Screener, and the Five a Day Stages of Change. Data on food intake (YAQ, Fruit and Vegetable Screener, and Stages of Change) was collected four times yearly on the students.

## Academic Integration and CTE

Hydroponics gardening systems, with organic nutritients, were installed in the Ag classroom greenhouse at the rural county high school. Students were involved in the set-up, care and maintenance of the systems. Moreover, students participated in collecting yield data from each plant, as well as following standardized procedures for growing the plants hydroponically. Individual "Aerogarden" hydroponics systems were set up in FACS classrooms for use in the Nutrition and

Foods and FACS labs. Data on how much and what kinds of produce families took home and consumed was collected weekly during harvesting. Simple recipes were distributed to the students and families on utilizing the produce in the home and FACS classroom. English, math, science, technology and economics were integrated into the CTE courses—thus meeting Perkins guidelines and demonstrating to the students the relevance of these skills in everyday life.

## Students Reflect on the Project

Focus groups were conducted with purposely selected students twice during the two-year project; the goal was to involve them in reflection and assessment on the project and to obtain qualitative data about their eating habits. Each group of seven students was a mixture of males and females from both the Ag and FACS classes. Utilizing the same open-ended questions yearly for standardization, students were asked about food habits, meal preparation in the home, and access to fruits and vegetables. The results of the inquiry indicated that many students in the focus group were involved in meal/food preparation in their homes. However, the dominant way of preparing fruits and vegetables was fried or boiled (using large amounts of water and for long periods of time). Access to fresh fruits and vegetables was limited to what was grown in their home gardens. Students stated the vegetables they most often consumed were corn, various types of beans, and potatoes. The cost of fresh fruits and vegetables in the grocery store prohibited most of the families from purchasing fruits and vegetables from that source. In addition, the students expressed interest in learning different ways of preparing the produce. This provided the framework for the simple recipes and test tasting in the FACS classroom. During the interviews the students indicated they enjoyed the various activities involved in hydroponic gardening and felt the project had value beyond the classroom.

## Results

Physical data regarding height and weight revealed that the average Body Mass Index (BMI) for both males and females was 24.9, which is considered a healthy weight for adults. BMI for adolescents is measured on the Centers for Disease Control Growth Charts, and these measurements were converted to adult BMI numbers for purposes of analysis. The BMI did not significantly change during the two-year

"BY SELECTING STRATEGIES THAT ENGAGE STUDENTS IN RESEARCH AND RIGOROUS ACADEMICS, THIS PROJECT DEMONSTRATES THAT THROUGH COLLABORATION, CTE TEACHERS CAN PROVIDE OPPORTUNITIES FOR STUDENTS TO LEARN METHODS OF GROWING A GREATER VARIETY OF FRUITS AND VEGETABLES AND USE COURSE STANDARDS AND CURRICULUM AS THE FOUNDATION OF PROMOTING HEALTHIER EATING HABITS."

study period. Data from the Stages of Change survey did not reveal any statistical difference in intent to consume more fruits and vegetables from the beginning to end of the two-year study. In addition, fruit and vegetable consumption patterns did not statistically change during the study; the adolescents did not consume any more fruits and vegetables at the end of the study than at baseline. However, the food frequency data did reveal that the adolescents in this study did consume the recommended five or more servings of fruits and vegetables.

Cost data revealed that the hydroponic growing systems used in this experiment were not cost-effective for a high school greenhouse to maintain. However, other types of less-expensive hydroponic growing systems could be used, and partnerships with local nurseries/garden centers could provide the opportunity for donated systems/supplies. Culture, habits, intergenerational dietary patterns, and meal preparation techniques may also account for the results.

Limitations of this study were small sample sizes and unforeseen challenges related to set-up of the hydroponic systems. Although the results cannot be generalized to all adolescents, the food consumption patterns revealed in the food frequency data provide a snapshot of the eating habits of these rural southern teenagers. Although hydroponically grown vegetables did not impact obesity indices (BMI) in this sample, the lack of variety of fruits and vegetables consumed identifies potential deficiencies in certain vitamins and minerals. Multicomponent interventions aimed at improving variety and number of servings of fruits and vegetables in this group would be warranted.

## Academic Integration Impacting Lifelong Health Habits

By selecting strategies that engage students in research and rigorous academics, this project demonstrates that through collaboration, CTE teachers can provide opportunities for students to learn methods of growing a greater variety of fruits and vegetables and use course standards and curriculum as the foundation of promoting healthier eating habits. Subsequently, an avenue for academic integration was available when teachers committed to improve the intellectual quality of student learning, which required students to manipulate information and ideas, and used authentic equipment and school grown fruits and vegetables to address obesity issues. Parent and community involvement was increased by providing information on new and appealing ways to prepare the harvested produce. Students were also exposed to a wider variety of foods and food preparation techniques.

This project could easily be duplicated without the help of university researchers, and could be expanded to include additional academic integration of high-level science, math and CTE classes. This will allow teachers to plan and be responsible for relevant and engaging student activities, ultimately extending lifelong learning beyond the classroom and impacting lifelong dietary habits. T

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