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Sofia O. Sanchez
Alabama Cooperative Extension System at Auburn University, sos0011@auburn.edu

Katie Funderburk
Alabama Cooperative Extension System at Auburn University, kem0017@auburn.edu

Erin Reznicek
Alabama Cooperative Extension System at Auburn University, emr0024@auburn.edu

Sondra M. Parmer
Alabama Cooperative Extension System at Auburn University, parmesm@auburn.edu

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How Does Your Garden Grow? Development of a Calculator to Evaluate the Economic and Dietary Impact of Edible Gardens

Sofia O. Sanchez[1], Katie Funderburk[1], Erin Reznicek[1], and Sondra M. Parmer[1]

AUTHORS: [1]Alabama Cooperative Extension System at Auburn University.

Abstract. Edible gardens can increase fruit and vegetable availability and access. Weighing produce is a method to evaluate gardens, however there are limited methods that translate garden yields to dietary yields and that document Supplemental Nutrition Assistance Program – Education (SNAP-Ed) garden yields. We developed a Garden Harvest Calculator to evaluate edible garden economic and dietary impact. Over three spring-to-summer growing seasons, 12 – 18 gardens produced 6,499 pounds of produce worth $11,606.95. This equates to 24,922 cups, enough for 4,984 adults to meet dietary recommendations. SNAP-Ed supported gardens may positively contribute to dietary needs while reducing barriers to food access.

INTRODUCTION

Food and nutrition security are major public health concerns in the United States, particularly as disparities in the affordability and availability of healthful food exist among limited-resource populations (Andreyeva et al., 2015). The Supplemental Nutrition Assistance Program—Education (SNAP-Ed) plays a critical role in improving food and nutrition security through community-based interventions. One common SNAP-Ed approach involves initiating, maintaining, or improving edible gardens in schools and communities. Gardens are used to address health disparities among SNAP-eligible populations, as they are associated with increased fruit and vegetable (FV) access and availability and improved community health (Rivera et al., 2019; Stluka et al., 2019). Weighing garden produce is a documented method to evaluate gardens, and peer-reviewed strategies have been developed to implement rigorous weighing protocols (Henning et al., 2018). However, limited methods translate produce yields into nutritional yields (Conk & Porter, 2016), and limited data document SNAP-Ed garden yields.

We sought to develop and implement a Garden Harvest Calculator that would achieve two primary aims: converting raw produce weight into (a) estimated economic value and (b) cups of edible produce, which would determine the capacity of a harvest to support participant dietary needs based on the U.S. Dietary Guidelines.

METHODS

Gardens were included based on the following criteria: (a) partnership with a SNAP-Ed educator and (b) proximity to a public school where at least 50% of students received free or reduced-priced lunch through the National School Lunch Program. First, we developed a list of FV, including pulses (e.g., cowpeas), that grow in Alabama per U.S. Department of Agriculture (USDA) Plant Hardiness Zones. We surveyed SNAP-Ed educators to validate FV diversity and commonly planted produce in Alabama gardens.

Second, we identified validated, publicly available databases to obtain weights, edible forms, and retail prices of produce. Prior work obtained harvest weights by using commercial hanging scales, weighing matter in pounds and ounces (Henning et al., 2018). Using the raw weights as starting values, we converted pounds of a given food into total ounces of edible yield (i.e., produce minus inedible stems, shoots, and leaves; U.S. Department of Agriculture, 2022). Total ounces were converted into total grams by using the conversion factor 28.3495 grams equals 1 ounce.

Next, we determined the edible portion in cups and cost at retail. As the Dietary Guidelines are based on cups, we converted grams of a given food to cups by using FoodData Central (U.S. Department of Agriculture, Agricultural Research Service, 2019). For example, 1 cup of apple is equivalent to 109 grams in weight. We also relied on MyPlate

portion sizes for individual foods (e.g., 2 cups of raw leafy greens equal 1 portion cup). We approximated uncooked foods to cooked where MyPlate specifies cooked as the portion size (Bowman et al., 2013). Using the USDA Fruits & Vegetables Market Report, we selected filters for produce based on geographical region, varietal, and unit of produce (U.S. Department of Agriculture, Agricultural Marketing Service, 2021). At this step, all produce was normalized to price per pound. The weighted average price was extracted and used to estimate cost at retail.

Upon completion and testing of the first version of the calculator, we met with Internet technology specialists to determine the feasibility of creating an online tool with optimized user navigation. We conducted a yearly update to include additional FV and to update prices in the calculator. As this project did not measure human subjects, it was deemed not human subjects research by the Auburn University Institutional Review Board, #22-360.

RESULTS

Gardens were evaluated from May 2020 to September 2022 over 3 federal fiscal years (FY), which encompassed three spring-to-summer growing seasons. Produce was harvested multiple times throughout the year, depending on site planning and maintenance schedules (see Table 1). The number of gardens varied each FY, ranging from 12 in FY20 to 18 in FY22. Each year, 50%–75% of gardens were in community settings (e.g., parks, libraries) and located in rural counties. On average, at each garden, eight to 17 different crops yielded 26–67 cups of FV that contributed to the U.S. Dietary Guidelines for Americans recommendations. Gardens produced 13,414 total cups in FY20 to 5,871 total cups in FY22, worth up to $4,355.00 each FY. Since calculator implementation, gardens produced in total 6,499 pounds of produce worth $11,606.95. This equated to 24,922 cups of FV, enough for 4,984 adults to meet the U.S. Dietary Guidelines for Americans daily FV intake recommendations.

Table 1. Garden Evaluation Results

Variable	FY20	FY21	FY22
Number of gardens	12	14	18
Urban	3	6	8
Rural	9	8	10
Garden type			
School	5	5	7
Community	7	9	11
Average number of FV planted per garden	17	16	8
Average number of cups of FV per garden	104	33	56
Average number of MyPlate cups of FV per garden	67	26	42
Average value of FV per garden	$21.89	$18.05	$23.86
Total number of cups of FV	20,627	7,295	7,840
Total number of MyPlate cups of FV	13,414	5,637	5,871
Total estimated cost of FV	$4,355.00	$3,935.62	$3,316.33

Note. Cups = portion size; FY = fiscal year; FV = fruits and vegetables.

DISCUSSION

The primary finding of this project is that the calculator was successful in evaluating the economic and dietary impact of gardens in limited resource, rural communities in Alabama. Despite the small number of gardens evaluated, each garden yielded thousands of cups of FV annually, signaling their possible utility in filling food-access gaps. A secondary finding is the demonstrated potential role of SNAP-Ed in supporting individual dietary needs and decreasing food and nutrition security disparities, particularly in rural communities where food access is more limited (Bardenhagen et al., 2017). Compared to other years, FY20 data were collected during the COVID-19 pandemic when outdoor activities dominated SNAP-Ed programming in place of indoor nutrition education, explaining the largest output of FV.

The calculator has become a novel, accessible way to communicate with partners the value gardens and SNAP-Ed bring to a community and its residents. For example, the calculator was used to compute the yield from 2,000 strawberry seeds planted at an elementary school teaching garden, 100% of which students harvested and brought home for consumption. This project yielded 553 pounds 4 ounces of strawberries, which translated into 1,534 cups of fruit worth $1,416.32, enough for 1,022 children to meet the U.S. Dietary Guidelines for Americans daily FV intake recommendation.

Since the calculator's implementation, more than 1,200 data points have been collected, including data beyond garden productivity metrics. Other common applications in SNAP-Ed initiatives were identified over time, such as incorporating the calculator into math-based lessons in a classroom, where it was used to illustrate real-world problems with the costs of various produce. Another user entered weights of produce gleaned from a farmers market as a method to quantify the goodwill of vendors. To address COVID-19 pandemic challenges, data from the tool demonstrated the role local food systems have in filling unmet needs due to food supply chain disruptions. For example, the calculator computed the amount of produce from local growers to assist an emergency food assistance program in determining how much produce should be allocated to each client's package so that food was distributed equally.

Other potential calculator applications were considered for further study. Prior to evaluation, nutrition yields could be anticipated based on what is planted (i.e., distribution of different crops). Although not captured in this project, it could be used to conduct return-on-investment analyses of SNAP-Ed projects beyond gardens by comparing cost inputs to calculator outputs. In addition, food pantries self-evaluate based on pounds of food distributed. These organizations could use the calculator to enumerate the nutritional value of produce they provide to clients in terms of daily FV recommendations. Data could also be used to demonstrate to donors a need for increased produce donations if calculations were below the recommendations.

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