Extension Education Methods

Eat Your Way to Better Health: Evaluating a Garden-based Nutrition Program for Youth

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Summary. **Eat Your Way to Better Health (EYWTBH) is a garden-based nutrition education program that was conducted and evaluated for 3 years in Indiana third-grade classrooms. Program participants started and maintained their own school gardens as a part of an authentic experiential learning curriculum designed to reconnect youth with where their food comes from and educate about healthy eating habits. Implementation lasted between 8 and 12 weeks and outcomes were evaluated using pre- and postprogram questionnaires. Results showed that upon completion of the EYWTBH program, youth reported a higher healthy food choice self-efficacy, as well as a higher variety of fruit and vegetable consumption. Relationships among the variables were identified and discussed in the context of improving future school garden nutrition programs.**

Eat Your Way to Better Health is a multisensory educational program established to reconnect youth with their food by having them grow and taste produce in an effort to provide education about healthy eating and increase fruit and vegetable consumption. The program was implemented as an authentic experiential learning garden-based school nutrition program offered in third-grade classrooms across Indiana through a collaborative effort between a land-grant university, county extension educators, school principals, and elementary teachers. Third-grade classrooms were targeted due to this stage of childhood being a crucial time for developing lifelong nutritional behaviors and minimizing the risk of adult diet-related diseases (Dzewaltowski et al., 2002; Taylor et al., 2005). Programming was made possible by grant funding from the state department of health. Goals for the program were to have youth learn about and taste a variety of fruits and vegetables, start and maintain their own classroom gardens, and engage students' parents and guardians in a dialogue about healthy eating and nutrition. A unique attribute of EYWTBH is that these goals were addressed by an integrated three-pronged outreach effort: disseminating classroom lessons and activities, starting and maintaining a school garden, and providing take-home materials for students' parents and guardians. EYWTBH curriculum was adapted from the Junior Master Gardener® program developed by Texas A&M University (Junior Master Gardener, 2014). County extension educators partnered with school principals and elementary teachers to deliver 1 h of instruction per week for 6–10 weeks (length of program depended on localized factors) using curriculum and resources supplied by the university EYWTBH team.

EYWTBH was offered through extension because of the university's local presence in every county in the state. Extension can play a crucial role in addressing critical systemic issues in the surrounding community by being a trustworthy source of information (Awa and Van Crowder, 1978; Smith et al., 2012) and facilitating collaborative and interdisciplinary projects. Food illiteracy is an example of a critical systemic issue that occurs when citizens and youth in local communities do not understand enough about the food system to make healthy food choices. One way this disconnect can manifest itself is through low levels of fruit and vegetable consumption that result in unhealthy eating habits and lead to an increased risk of developing obesity. These issues are present throughout the general population, especially concerning is the prevalence of these unhealthy trends in youth. In the United States, the adult obesity rate is 34.9% and the youth obesity rate is 16.9% (Ogden et al., 2014). As such, adults report eating a median of 1.1 servings of fruit and 1.6 servings of vegetables per day (Centers for Disease Control and Prevention, 2013). Those data, along with a presence in the literature of a correlation between parental/guardian with that of peer and youth consumption of fruits and vegetables (Benton, 2004; Blanchette and Brug, 2005; Boutelle et al., 2007; Bower and Sandall, 2002; Brug et al., 2008; Johnson et al., 2007; Libman, 2007; Nanney et al., 2007; Robinson-O'Brien et al., 2009; Scaglioni et al., 2008), show that low levels of fruit and vegetable consumption is a multifaceted issue that requires an integrated solution of local community educators.

The EYWTBH program development, implementation, and evaluation were informed by social cognitive theory [SCT (Bandura, 1986, 1989)]. Bandura posited that

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behaviors are influenced by personal and environmental factors. While SCT views knowledge as a personal factor and something that can be transferred by social means, Bandura adds that behavior is mediated by self-efficacy, or one's self-confidence to perform the behavior. Self-efficacy is critical to the point that even if a person has the ability necessary to perform a behavior, if he or she does not think he or she can perform the behavior, it is likely to not occur.

The purpose of this study was to describe differences between pre- and postprogram outcomes, as well as any personal and environmental factors that may be related to the postprogram youth fruit and vegetable consumption outcome. There were two research objectives: 1) determine if youth participants reported higher levels of fruit and vegetable consumption upon completion of the EYWTBH program and 2) determine if selected variables (i.e., youth preprogram fruit and vegetable consumption; postprogram youth healthy food choice self-efficacy, interest/preferences in fruits and vegetables as a snack, and healthy food social intentions; family postprogram fruit and vegetable consumption; household postprogram fruit and vegetable availability) were related with postprogram youth fruit and vegetable consumption.

Materials and methods

The EYWTBH program implementation included the following steps: 1) county educators worked with grade school principals and third-grade teachers to determine interested parties, 2) county extension educator trainings were offered, 3) preprogram evaluations were administered to youth in participating classrooms, 4) extension and elementary teachers collaborated to offer EYWTBH lessons weekly for 6–10 weeks, and 5) postprogram evaluations were administered to youth in participating classrooms. An example timeline for EYWTBH program implementation included the administration of the preprogram assessment to both youth participants and their parent or guardian; 6–10 weekly lessons were then conducted and followed by the administration of the postprogram assessment to both youth participants and their parent or guardian.

Preprogram training and organization. County extension staff first partnered with local schools agreeing to offer EYWTBH in third-grade classrooms on a weekly basis for 6–10 weeks through an e-mail request for participants via extension electronic mailing lists. An informational conference call(s) was used with extension educators to help determine final participants in the program based on availability, readiness of school participants, and willingness to complete the program and associated research. Participation of at least 20 counties was estimated with up to 40 counties per semester ultimately participating over a 3-year period. About 60 extension educators were involved, although a finite number is hard to determine due to staff changes, and school and community needs and differences.

Following selection, participating extension staff was required to attend a 1 d (8 h) training session, which included information about the Junior Master Gardener® and EYWTBH programs, as well as potential benefits of the program, such as an increase in nutrition knowledge and an improvement in learning by being in a contextualized multisensory garden environment. EYWTBH lessons were paired with the Junior Master Gardener® Health and Nutrition from the Garden® curriculum, and selected for content and age appropriateness to the third-grade audience. Educators were introduced to research methods and implementation of pre- and postprogram survey instruments. A participatory training methodology (Pant, 2008) was used to teach educators objectives of the lessons. This included active participation of extension staff who completed example youth activities and took part in discussions on the strengths and possible issues with each activity. Participants in the training were provided with EYWTBH program materials consisting of gardening supplies, such as trowels, materials to build raised garden beds, seeds, and funds to purchase fruits and vegetables for tasting.

Questionnaire administration. Before classroom implementation of EYWTBH lessons, extension educators and elementary teachers partnered to administer preprogram questionnaires. At the same time, preprogram questionnaires for the parents/guardians were sent home with youth, along with program information, and instructions for the parent/guardian to complete and return their questionnaire with the student within the following week.

EYWTBH lessons. EYWTBH lessons were taught through cooperation between extension educators and elementary teachers. Lessons took place as part of a normal school day once per week for at least 1 h and were tailored to fit school period length. Each lesson consisted of an overarching topic, construction of nutrition knowledge, disciplined inquiry into nutrition and plant science, and adding value beyond the classroom by connecting food choices and nutrition to the household and family. Ten lessons were matched for the program, as seen in Table 1, and teachers could select up to eight lessons that best fit the needs of their school and community. Mandatory lessons on gardening and fruits and vegetables were used to anchor the program. In addition to hands-on classroom activities, each lesson contained take-home activities that aimed to engage parents/guardians in the learning process by having meaningful conversations with their child about food and healthy eating. Classroom teachers and extension staff were asked to provide feedback on program success, challenges, and deviations from the expected outcomes. A paper form was used to collect that feedback and those data were used to improve future program implementation.

Classroom garden. To provide an experiential learning opportunity for the youth participants, a classroom garden was requested of each participating school to be started at the beginning of the EYWTBH program, either outdoors or in the classroom under full-spectrum lighting depending on regional gardening conditions. Gardens were installed with provided supplies, and extension staff, school staff, and community volunteers were recruited to help with construction of outdoor garden beds. Easy to germinate and fast-growing seeds were used, including garden pea (*Pisum sativum*), leaf lettuce (*Lactuca sativa*), common bean (*Phaseolus vulgaris*), radish (*Raphanus sativus*), and

Table 1. Sample 6-week Eat Your Way to Better Health classroom programming based on Junior Master Gardener® (JMG®) Health and Nutrition from the Garden® curriculum.[z]

Week no.	JMG® lesson or activity (options)	Objective or goal or theme	Assessment
Preprogram	Garden installation and set-up		Preprogram questionnaire given; send home preprogram parent questionnaire
1	Cylinder Gardening or Paper Pots or Paper Towel Gardening	Growing techniques	Collect parent survey
2	Food Pyramid or Hamburger Plant with fruit or vegetable taste test	Food pyramid and food groups	
3–5[y]	Choose from: Bold Molds Label Reader Robust Rainbow Recipes Apple Surprise Symmetry Snacks Seed Bank Junk Food Blues Taste Test Beauty Contest UB the Judge	Healthful snacks, ABCs of healthful eating, basic knowledge of differences between fruits and vegetables	Send parent postprogram questionnaire home week 5
6	Fruit and Veggie Laboratory	Harvesting, preparing, and sampling fruits and vegetables; healthful snacks	
Postprogram			Postprogram questionnaire given; collect parent questionnaire

[z]Programming ranged from 6 to 10 weeks.
[y]Choose lesson combination that best fits situation and time constraints and include a fruit and vegetable taste test each week.

spinach (*Spinacia oleracea*), so that youth could experience the breadth of the gardening experience, such as planting, watering, weeding, and harvesting, during the length of the program.

Postprogram questionnaire administration. Postprogram questionnaires for parents/guardians were sent home with youth 1 week before the completion of the program, with instructions to complete and return the questionnaire within 1 week. Upon returning the postprogram questionnaire, parents/guardians were provided with a pack of EYWTBH-branded recipe cards containing healthy meal and snack ideas that incorporated vegetables participants potentially grew in the classroom garden during the program. After the classroom and gardening lessons were completed, postprogram questionnaires were administered to youth participants within 1 week by either the extension or elementary teachers. Upon completing postprogram questionnaires, students received EYWTBH certificates of program completion.

Instrument design. EYWTBH program evaluation questionnaires measured food behaviors [YFB (33 possibly consumed fruit and vegetable items; participants were presented with a checklist and asked to put an X next to all fruits and vegetables they ate in the past week)], food interest [YFI (27 fruit and vegetable items; participants were presented with a checklist and asked to put an X next to all fruits and vegetables they liked eating as a snack)], and healthy eating self-efficacy [YSE (11 items on a 4-point Likert-type scale, e.g., "for a snack, I think I can choose my favorite fruit instead of my favorite candy bar" with possible answers being "disagree a lot," "disagree a little," "agree a little," and "agree a lot")] as self-reported by youth participants. Additionally, familial food behaviors [FFB (33 possibly consumed fruit and vegetable items using same checklist as youth questionnaire)] and household food availability [HFA (checklist of 27 possibly available fruit and vegetable items)] were provided by the youth participants' parent/guardian.

Questionnaires were developed by experts in the field of program evaluation, analyzed for content validity (Light, 2007), and tested for readability and appropriateness among 7- to 10-year-old children. Cronbach α was used as a measure of internal reliability. All reliability coefficients were in the range of acceptable to good (George and Mallery, 2003). Observed coefficients for variables were preprogram YFB = 0.83, postprogram YFB = 0.85; preprogram YFI = 0.85, postprogram YFI = 0.85; preprogram YSE = 0.86, postprogram YSE = 0.88; preprogram FFB = 0.73, postprogram FFB = 0.77; and preprogram HFA = 0.84, postprogram HFA = 0.86.

Data analysis. The study did not have a true control group and thus was conducted using a one group pre-experimental design. Data were collected from 25 different classrooms across Indiana that offered EYWTBH in one of three semesters from 2009 to 2010. Demographics were collected in only one semester, Fall 2010, due to an omission of demographic items from the instrument in previous semesters. Demographics observed were generally representative of Indiana as a whole, with youth data indicating that 78% of the 222 youth participants during this semester were White and not Hispanic (Indiana population is ≈82% White), and guardian data indicating that the median

household income of the 111 respondents during this semester was between $40,000 and $60,000 (Indiana population median household income is $45,000). Statistical analyses were completed using SPSS (SPSS Statistics for Windows version 23.0; IBM, Armonk, NY) and included descriptive statistics, as well as Pearson correlations (r), and paired sample t tests. Differences in interest, behaviors, self-efficacy, and knowledge were deemed statistically significant if $P < 0.05$.

Results

There were three key findings. The first was that five measured variables were significantly correlated with youth postprogram fruit and vegetable consumption (Table 2). Youth preprogram fruit and vegetable consumption (pre-YFB) had a strong positive relationship with youth postprogram fruit and vegetable consumption (post-YFB) (r = 0.54), while youth postprogram healthy food choice self-efficacy (post-YSE) had a weak positive relationship (r = 0.27), family postprogram fruit and vegetable consumption (post-FFB) had a moderate positive relationship (r = 0.31), household postprogram fruit and vegetable availability (post-HFA) had a moderate positive relationship (r = 0.30), and youth postprogram fruit and vegetable interest (post-YFI) had a strong positive relationship (r = 0.58). Means and standard deviations, as well as the scales on which the variables were measured, can be seen in Table 3.

The second finding was that upon completion of the EYWTBH program, youth reported a higher mean healthy food choice self-efficacy (Table 4). This supports prior research by Gist and Mitchell (1992), which states that self-efficacy, is malleable and can be improved through intervention through mastery and modeling experiences.

The third finding was that youth reported a higher diversity of fruit and vegetable consumption after completing the EYWTBH program (Table 4). This supports prior research that found fruit and vegetable consumption diversity increased after a targeted intervention (Cason, 1999; Heim et al., 2009; Hilgers et al., 2008).

Discussion

Upon completion of the program, youth reported a higher healthy food choice self-efficacy. This finding was significant because SCT contextualizes self-efficacy as a critical component influencing behavior. If healthy food choice self-efficacy is increased, then this can improve personal factors that relate to healthy food choice behaviors, such as fruit and vegetable consumption. The result of healthy food choice self-efficacy being related to fruit and vegetable consumption also confirms the findings of previous studies (Brug et al., 2008; Reynolds et al., 1999; Strecher et al., 1986; Vereecken et al., 2005), which found that self-efficacy

Table 2. Pearson correlations (r) for variables measured by Eat Your Way to Better Health (EYWTBH) pre- and postprogram questionnaires administered to both EYWTBH program participants and their parent/guardian.

Variable[z]	Pre-YFB	Post-YFB	Post-YSE	Post-FFB	Post-HFA	Post-YFI
Pre-YFB	1					
Post-YFB	0.54*	1				
Post-YSE	0.22*	0.27*	1			
Post-FFB	0.26*	0.31*	0.08	1		
Post-HFA	0.23*	0.30*	0.08	0.64*	1	
Post-YFI	0.44*	0.58*	0.38*	0.21*	0.27*	1

[z]Pre-YFB = youth preprogram fruit and vegetable consumption; post-YFB = youth postprogram fruit and vegetable consumption; post-YSE = youth postprogram healthy food choice self-efficacy; post-FFB = family postprogram fruit and vegetable consumption; post-HFA = household postprogram fruit and vegetable availability; post-YFI = youth postprogram fruit and vegetable interest.
*Significant at $P < 0.05$.

Table 3. Descriptions and descriptive statistics of variables measured by Eat Your Way to Better Health (EYWTBH) pre- and postprogram questionnaires, administered to both EYWTBH program participants and their parent/guardian.

Variable reference no.	Mean	SD	Cases (no.)	Scale
Youth preprogram fruit and vegetable consumption (pre-YFB)	9.35	6.00	905	33 possible fruits and vegetables
Youth postprogram fruit and vegetable consumption (post-YFB)	10.69	6.24	817	33 possible fruits and vegetables
Youth postprogram healthy food choice self-efficacy (post-YSE)	3.09	0.71	762	4-point Likert type (11 items)
Family postprogram fruit and vegetable consumption (post-FFB)	11.36	4.65	412	33 possible fruits and vegetables
Household postprogram fruit and vegetable availability (post-HFA)	9.27	5.24	414	27 possible fruits and vegetables
Youth postprogram fruit and vegetable interest (post-YFI)	13.96	6.33	690	27 possible fruits and vegetables

Table 4. Youth healthy food choice self-efficacy and fruit and vegetable consumption diversity paired t tests showing significant increases in both variables following Eat Your Way to Better Health program participation.

Variable	Cases (no.)	Pretest mean (1–4 scale)	SD	Post-test mean (1–4 scale)	SD	Mean difference	SD	P value
Youth healthy food choice self-efficacy[z]	674	3.03	0.69	3.11	0.72	0.08	0.62	0.01*
Youth fruit and vegetable consumption diversity[y]	769	9.08	5.88	10.71	6.28	1.63	5.84	<0.01*

[z]Self-efficacy mean index contained 11 items (Light, 2007); 1 = disagree a lot; 2 = disagree a little; 3 = agree a little; 4 = agree a lot. Higher scores were more positive in regards to self-efficacy.
[y]Fruit and vegetable index is number of diverse fruit and vegetable items consumed per week.
*Significant at $P < 0.05$.

plays a role in youth fruit and vegetable consumption.

Another key finding was that family fruit and vegetable consumption (as reported by the parent/guardian) was related to youth fruit and vegetable consumption upon completion of the program. This finding supports that parents/guardians can be seen as an environmental factor that plays a role in informing behaviors. In addition, this confirms the findings of previous studies (Benton, 2004; Blanchette and Brug, 2005; Boutelle et al., 2007; Bower and Sandall, 2002; Brug et al., 2008; Nanney et al., 2007; Robinson-O'Brien et al., 2009; Scaglioni et al., 2008), which found a connection between family and youth fruit and vegetable consumption.

Youth also reported a higher level of fruit and vegetable consumption diversity upon completion of the program. However, the strongest relationship with youth postprogram fruit and vegetable consumption was with youth preprogram fruit and vegetable consumption ($r = 0.54$), which suggests eating a variety of fruits and vegetables before the program was related to eating a variety of fruits and vegetables after the program (i.e., previous behavior informs current behavior). EYWTBH was a relatively brief program (8–12 weeks in length including pre- and postprogram questionnaire administration), and while other variables were also related to consumption, this result shows that food consumption behavior can be persistent, and it can be difficult to make a large difference in such a behavior over a relatively brief period of time. This finding supported previous research, which found that food consumption behaviors are very conservative (Jager, 2003; O'Donnell and Yamauchi, 2005).

One implication that emerges from this study is that food behaviors, especially youth food behaviors, are a complex, community-based, and systemic issue. The results show that there can be several variables that correlate with youth fruit and vegetable consumption. Although the EYWTBH program aimed to address multiple variables, future program offerings should include more parental/guardian involvement in the education process wherever possible, because two variables related with youth fruit and vegetable consumption were household fruit and vegetable availability and family fruit and vegetable consumption.

One potential area for future focus could be the availability of healthy snacks in the home. This could provide an additional emphasis on the need for healthy food consumption, so that an improvement of youth fruit and vegetable consumption can more confidently represent a replacement of caloric-dense food intake instead of an addition to existing caloric intake.

This study also confirms the findings of prior research (Dirks and Orvis, 2005; Klemmer et al., 2005) regarding garden-based education as an effective pedagogical tool. The multisensory educational opportunities of EYWTBH were embedded within the curriculum to connecting youth with their food through a gardening experience. The connection between growing food and healthy food choices appears to have been made by youth. Therefore, school garden educators should continue to explore how these connections are made and developed. Although not collected in this study, future studies should collect demographic data, which can help determine program benefits for particular population segments.

Another factor to consider is that EYWTBH was an extension program implemented in a midwestern U.S. state with a Cooperative Extension Service office in every county. Therefore, the methods of this study could be transferable to other midwestern U.S. states that have a similar extension system to replicate the integration among extension, schools, and the community that was seen in EYWTBH. Finally, the results and claims were limited due to the study being a sample of convenience. Although this descriptive study provided meaningful findings, EYWTBH should be studied moving forward using quasi-experimental or experimental designs to support causal program outcome claims. Future studies should also consider using observations and interviews to help triangulate with the self-reported data.

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