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Maximizing Dietary Knowledge and Behavior through a Teens as Teachers Approach

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Abstract. The teens as teachers model is a promising approach to impact teen behavior. The current study evaluated dietary knowledge and behavior among teen teachers participating in a 4-H youth development program (N = 46; M_{age} = 15.5 years; 67% female; 48% Hispanic; 37% White Non-Hispanic, 15% Other). A paired sample t test was conducted on pre-and post-program surveys to identify significant improvements in dietary knowledge and behaviors. Findings suggest teens as teachers is generally effective in promoting healthy dietary knowledge and behavior. We recommend this approach be disseminated within Extension 4-H youth development healthy eating active living programming.

INTRODUCTION

Strategies to promote healthy dietary knowledge and behaviors among adolescents commonly focus on preventing the rise of obesity and chronic diseases (Centers for Disease Control and Prevention [CDC], 2021). Despite these strategies, the prevalence of obesity among adolescents ages 12 to 19 in the United States remains alarming (22%; CDC, 2022). From a developmental perspective, changes in dietary behaviors between childhood and adolescence lead to a decline in overall dietary quality (Lytle, 2002). Teens who are overweight and obese are likely to remain so into adulthood, increasing the likelihood of developing obesity comorbidities such as type 2 diabetes, heart disease, and hypertension (World Health Organization, 2020); this continuation suggests a need to target teens in this developmental period with effective health promotion programs. Therefore, this study focuses on using the teens-as-teachers (TAT) model within an Extension 4-H youth development program to address the continued prevalence of youth obesity and promote healthy dietary knowledge and behavior amongst teens.

DIETARY KNOWLEDGE

Dietary knowledge includes knowledge of dietary recommendations, how to make healthy food choices, food intake-energy expenditure, the importance of a healthy diet, how to read nutrition labels, and how to prepare and cook food (Wardle et al., 2000). Nutrition education programs can increase dietary knowledge and promote positive health and developmental outcomes among teens to reduce chronic health conditions (Hamulka et al., 2018). Dietary knowledge is a contributing factor in the adoption of healthy dietary behaviors (Thomas, 1994), as dietary knowledge is correlated with healthy food choices and less consumption of unhealthy foods such as sweets and sugary drinks (Grosso et al., 2013). Therefore, a lack of dietary knowledge can directly impact dietary behaviors. However, previous research suggests that an increase in dietary knowledge will not always translate into the skills and competencies individuals need to make healthy dietary choices (Shepherd & Towler, 1992; Spronk et al., 2014), suggesting a need for programs to increase participants' engagement by incorporating experiential learning and hands-on activities that allow teens to put into practice the skills they are learning.

DIETARY BEHAVIORS

Healthy dietary behaviors include the consumption of a variety of fruits and vegetables, whole grains, fat-free and low-fat dairy products, sources of protein, healthy oils, and water, and limiting calories from saturated and trans fats, added sugars, and sodium (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020).

Additional examples of healthy dietary behaviors include being mindful of portion sizes, reading food labels, and eating breakfast (Smith, 2014; Weybright et al., 2018). Healthy dietary behaviors can reduce the likelihood of becoming overweight or obese (Epstein et al., 2001; Nicklas et al., 2003) and the risk of developing chronic health conditions like high blood pressure, heart disease, type 2 diabetes, and cancer (Dietary Guidelines Advisory Committee, 2015). Poor dietary behaviors in teens are associated with impaired growth and development (Spear, 2002), negative health status (Lytle, 2002), and lower academic achievement (Kim et al., 2016). Despite the benefits of healthy dietary behaviors, teens commonly practice poor dietary behaviors and do not meet dietary recommendations (Banfield et al., 2016). Nonetheless, it is important to continue promoting healthy dietary behaviors during adolescence to prevent negative health outcomes across the lifespan—as the literature shows that eating habits often track into adulthood (Due et al., 2011).

NUTRITION EDUCATION PROGRAMS

Nutrition education programs often target youth with information about healthy dietary knowledge and behaviors in an attempt to improve nutrition and promote healthy living. Some program findings indicate positive associations between high levels of dietary knowledge and healthy dietary behaviors (Asakura et al., 2017; Spronk et al., 2014; Wardle et al., 2000) while others find gaps between knowledge and practicing (Mirmiran et al., 2007; Stafleu et al., 1996). These mixed findings may be due to the programs' varying levels of engagement and whether engagement meets the adolescents' unique developmental needs. Knowledge- and behavioral-based nutrition programs are the two most common approaches to health promotion efforts. However, behavioral-based nutrition programs have greater success in improving dietary behavior among school-aged children (Hoelscher et al., 2002). Despite a decade-long history of implementing education-only nutrition programs across the United States, they demonstrate limited effectiveness in changing teen dietary behaviors; most teens continue to fall short of national nutritional guidelines, specifically when it comes to fruit and vegetable recommendations (Larson et al., 2007; Moore et al.,2017). This shortcoming suggests the need to adjust methods used to deliver nutrition education programs to teens to improve dietary knowledge and behaviors and ultimately optimize development and long-term health outcomes.

TAT FOR NUTRITION EDUCATION PROGRAMS

One promising approach to nutrition education programs is using the TAT approach to teach nutrition education curricula to younger youth; this approach is grounded in social cognitive theory (SCT; Bandura, 1977). Using the TAT approach, teens internalize the material as they teach the curriculum and apply the learned knowledge by practicing healthy behaviors in their daily life (Dudley et al., 2015; Güldal et al., 2012). Internalization of knowledge can convert explicit knowledge into tacit knowledge through personal experiences and the incorporation of behaviors or actions that result from learned knowledge (Nonaka & Takeuchi, 1995). Learning by doing, learning by observing, on-the-job training, and face-to-face meetings are examples of activities resulting in internalization (Masrek & Zainol, 2015). Moreover, behavior change theories like the integrated theory of health behavior change suggest that enhancing knowledge, self-regulation skills and abilities, and social facilitation can change behaviors (Ryan, 2009). Therefore, the TAT approach offers teens an excellent opportunity to internalize knowledge and change behavior.

Other health promotion efforts—such as those for sex education and tobacco and alcohol prevention—have also utilized the TAT approach (Emil et al., 2007; Mellanby et al., 2000), as have efforts in broader content areas such as agriculture and safe driving (Bolshakova et al., 2018; Jordan et al., 2015), which demonstrates the method's versatility. Previous evaluations of TAT programs found positive outcomes for both the teens participating as teachers and the younger youth participants (e.g., Murdock et al., 2003; Wolfe, 2014; Worker et al., 2019). Therefore, the TAT approach—which actively engages teens in the process of teaching rather than only providing teens with information—is likely to be an effective approach for improving dietary knowledge and promoting healthy dietary behaviors (Arnold et al., 2016; Weybright et al., 2018). This study addresses an important disconnect between delivery of nutrition education programming and behavior change in teens by evaluating their dietary knowledge and behaviors after participating in Youth Advocates for Health (YA4-H!), an Extension 4-H youth development program that uses TAT.

YA4-H! Program

YA4-H! follows a three-step implementation model: a) youth and adult partners attend a 2-day, 12-hour train-the-trainer training event, b) coordinators recruit on a community level and train both youth and adult partners, and c) the teams implement a nutrition education curriculum such as Choose Health: Fun, Food, Fitness (CHFFF; Cornell University, 2014). The training event covers topics such as TAT, youth-adult partnerships, nutrition, and positive youth development using the 4-H essential elements. After teens and adult partners return from attending the statewide training, they continue recruiting and training additional teens in their communities. Trained teens receive ongoing follow-up support from their local adult partners as they co-facilitate the delivery of CHFFF curriculum to younger

youth. The program is delivered in a variety of settings, including after-school programs, summer camps, day-long 4-H events known as "Super Saturdays", and/or family and community education events; the length of time for which teens participate depends on the setting. Each county differs in the number of lessons and the topics that teens can teach. Some teens may have the opportunity to deliver the program more than once.

Curriculum

CHFFF is a comprehensive nutrition and fitness curriculum consisting of six hands-on lessons for youth ages 8 to 12 years. The curriculum is intended for Extension educators and designed to be co-taught by teens (Cornell University, 2014). The program provides teens with tools to prepare for the lessons, such as lesson scripts, skills learned during their training, and support from local adult partners. The local adult partners assist the teens in preparing by meeting with them prior to the lesson. Coordinators also provide the teens with all of the materials needed to deliver the lesson, like visual aids and game pieces. The lesson content and activities align with SCT, as each incorporates interactive nutrition activities, problem-solving, goal-setting, and participatory experiences to enhance learning and skills (Wolfe, 2018). Examples of hands-on activities include measuring sugar in sweetened beverages or fat in fast foods. Teens also participate in teaching youth how to read food labels, emphasizing how to make healthy meals or snacks, and playing active games. A key construct of SCT is self-efficacy, which may be responsible for the increase in knowledge and behavior change; self-efficacy is the belief in one's ability to perform a certain behavior and achieve a desired outcome (Bandura, 1998). The program provides teens with the competencies they need to lead a healthier lifestyle. Lessons 1 and 6 focus on replacing sweetened beverages with low-fat milk and water. Lessons 2, 4, and 6 focus on eating more fruits, vegetables, and whole grains. Lessons 3, 5, and 6 focus on eating fewer high-sugar and high-fat foods. All lessons focus on increasing physical activity (Cornell University, 2014).

CURRENT STUDY

The purpose of the current study is to evaluate the impact of participating as a teen teacher in the YA4-H! Extension 4-H program on the teens' dietary knowledge and behaviors. For the current study, we use the term teen teachers to refer to the teens themselves and TAT to refer to the approach. Oregon State University originally developed and implemented YA4-H!, and Washington State has since also implemented the program. A previous qualitative evaluation of 61 teen teachers who participated in Washington State University's YA4-H! program indicated a positive impact on teens' understanding of how to read food labels and the frequency with which they added new foods from different food groups into their diets (Weybright et al., 2018). The current study builds on the qualitative study by evaluating teen dietary knowledge and behavior outcomes from a quantitative approach—using survey data and increasing the validity of prior qualitative findings—as the findings from the qualitative study are not generalizable to other populations. We hypothesized that teen teachers' dietary knowledge would increase regarding how to make healthy food choices, what makes up a balanced diet, why it is important to eat a healthy diet, and what specific foods or food groups should be eaten daily. We also hypothesized that teen teachers' dietary behaviors would improve to include increased consumption of fruits, vegetables, whole grains, and water.

METHODS

PARTICIPANTS AND DATA COLLECTION

The sample for this study included 46 teen teachers (M_{age} = 15.5 years; 67% female; 33% male; 48% Hispanic; 37% White Non-Hispanic, 15% Other) participating in the 2015–2017 YA4-H! program across 11 counties in Washington State. Participants completed pre- and post-program survey questionnaires; the amount of time between the two surveys varied by site. Generally, participants who attended the training completed the pre-survey before the training, while those participants who did not attend the training completed the pre-survey before program implementation. All participants completed the post survey after completion of the program. We utilized the National 4-H Common Measures, which is an instrument used to measure the following subjects: science, healthy living, citizenship, and youth development. For this study, we focused on survey items related to dietary knowledge and behaviors around choosing foods consistent with the USDA Dietary Guidelines. These dietary guidelines include increasing consumption of fruits, vegetables, whole grains, and fat-free or low-fat milk and decreasing consumption of unhealthy foods, such as added sugars, solid fat, and refined grains. For our analysis, we focused on seven key outcomes of dietary knowledge and behavior.

MEASURES

Dietary Knowledge

Four items on the survey assessed dietary knowledge. Pre-survey items began with the phrase "I know" and concluded with (a) how to make healthful food choices (b) what makes up a balanced diet, (c) the foods that I should eat every day, and (d) why it's important for me to eat a healthy diet, respectively. Post-survey items began with "As a result of participating in a 4-H Healthy Living Program I…" and concluded with (a) learned about how to make healthful food choices, (b) know what makes up a balanced diet, (c)

know the foods that I should eat every day, and (d) know why it's important for me to eat a healthy diet, respectively. Responses were numerical, based on a 4-point Likert-type scale (1 = *strongly disagree* to 4 = *strongly agree*).

Dietary Behavior

Three items assessed dietary behavior. Pre-survey items began with "I eat/drink…" and concluded with (a) fruits and vegetables, (b) water, and (c) whole grains, respectively. Post-survey items began with "As a result of participating in a 4-H Healthy Living Program I eat/drink more…" (a) fruits and vegetables, (b) water, and (c) whole grains, respectively. Responses were numerical and based on a 4-point Likert-type scale (1 = *strongly disagree* to 4 = *strongly agree*).

DATA ANALYSIS

We ran paired-samples *t*-tests for each item to determine if there was a significant change in dietary knowledge and behavior between the pre- and post-program surveys. We conducted a one-tailed paired-samples *t*-test, as we expected an increase in dietary knowledge and behaviors. We applied Holm's Sequential Bonferroni procedure to reduce the possibility of statistically significant results created by the use of multiple tests.

RESULTS

Table 1 includes the means and standard deviations of each item as well as the paired samples *t*-test results, *p*-values, Holm's sequential Bonferroni alpha levels, and effect sizes.

DIETARY KNOWLEDGE

Comparisons from pre- to post-surveys indicated dietary knowledge items of how to make healthy food choices (M_{pre} = 3.07, M_{post} = 3.61), what makes up a balanced diet (M_{pre} = 3.02, M_{post} = 3.57), and what foods to eat every day (M_{pre} = 3.17, M_{post} = 3.54) significantly increased from before to after the program. No significant change was found for why eating a healthy diet is important. All areas of dietary knowledge had large effect sizes, except knowing the importance of a healthy diet had a medium effect size.

DIETARY BEHAVIORS

Comparisons of items related to dietary behaviors indicated that fruit and vegetable consumption increased significantly (M_{pre} = 3.39, M_{post} = 3.61) between the pre- and post-program surveys. We found no significant difference for the consumption of whole grains or drinking water as a result of the TAT program. Consumption of fruits and vegetables had the largest effect size; we found a medium effect size for consumption of water and a small effect size for consumption of whole grains.

DISCUSSION

Study results demonstrate that being a teen teacher promoted greater internalization of curriculum content regarding both dietary knowledge and behaviors. We hypothesized that dietary knowledge would increase and identified increases in three of four measures. We also hypothesized that scores related to dietary behaviors would increase, and we identified increases in one of the three indicators. These findings add to the growing body of literature that assesses the outcomes of TAT and demonstrate that participation as a teen teacher increases knowledge, behaviors, and positive developmental outcomes (Weybright et al., 2016, 2018; Worker et al., 2019). Although the TAT approach has been more popular in other education content areas (e.g., animal science; Smith, 2004),

Table 1. Results of Paired-Samples t-Test of Dietary Knowledge and Behavior

Variable	Pre-test		Post-test		*t*	*p*-value	α (Alpha)	Cohen's *d*
	M	*SD*	*M*	*SD*				
Dietary knowledge								
Healthy food choices	3.07	0.51	3.61	0.42	3.59	0.0004*	0.01	1.1
Balanced diet	3.02	0.29	3.57	0.38	4.56	0.0000*	0.007	1.60
Foods to eat daily	3.17	0.37	3.54	0.48	3.69	0.0003*	0.008	0.87
Importance of healthy diet	3.38	0.38	3.62	0.38	1.98	0.0272	0.025	0.65
Dietary behavior								
Eating veggies & fruits	3.39	0.29	3.61	0.24	2.66	0.0054*	0.013	0.82
Drinking water	3.46	0.61	3.72	0.25	2.14	0.0190	0.017	0.56
Eating whole grains	3.10	0.58	3.27	0.61	1.66	0.0515	0.05	0.30

Note. $N = 46$ for all items except "importance of healthy diet" and "eating whole grains," for which N = 45. Response options were on a 4-point scale (1 = *strongly disagree* to 4 = *strongly agree*). α calculated using Holm's Sequential Bonferroni procedure.
*Significant at α.

this study focused solely on dietary knowledge and behavior outcomes. The findings also serve to strengthen the body of research on nutrition education. Thus far, few studies have used a TAT approach for nutrition education. The results support previous findings from a prior qualitative TAT study that focused on dietary knowledge and behavior (e.g., Weybright et al., 2018) and provide additional evidence for the effectiveness of the TAT approach.

In this study, the only positive behavior change observed was the consumption of more fruits and vegetables, which may have been a result of the food preparation component of the program. In each lesson, teens helped youth prepare a kid-friendly recipe that included at least one fruit or vegetable. Previous studies have found that food preparation is associated with both healthful choices and better diet quality (Chu et al., 2014; Woodruff & Kirby, 2013). Assisting youth with preparing kid-friendly recipes may help increase the teens' behavioral capacity and self-efficacy when it comes to preparing their own meals and/or snacks—with the recommended amounts of fruits and vegetables—at home (Wolfe, 2018). The positive dietary knowledge outcomes that we observed may be a result of a combination of factors, including the knowledge they learned during the training, the time they spent learning the lesson material, and the lesson activities that required teens to apply their newly acquired knowledge.

Some dietary knowledge and behavior items did not show significant changes between pre- and post-program surveys. We found no significant improvements in participants' understanding of why it is important to eat a healthy diet. Most teens have a general idea of why eating healthily is important, but the issue comes down to the need for teens to translate their dietary knowledge into healthy dietary behaviors. The barriers to this translation include lack of concern for dietary recommendations, insufficient availability of healthy foods, and limited time (Croll et al., 2001; Rasmussen et al., 2006). Behaviors showing no significant improvements could also be the result of the teens' level of participation in the program, as the number of lessons and topics taught varied for each participant. Therefore, if teen teachers shared instruction and only one taught a lesson focusing on whole grains, we expect that teen teacher would better internalize knowledge about whole grains than about the other topics—which may then influence dietary behaviors. If a teen teacher missed one or more lessons, this may also impact internalization of knowledge. The length that teens served as teachers also differed, as some teens delivered the program more than once. The setting of the program also impacted the length of time that teens served as teachers; summer day camp programs were shorter. In addition to the level of participation, the amount of initial and ongoing training varied across teen teachers. Teen teachers who attended the train-the-trainer weekend retreat likely received a more intensive training session than training that occurred later (at the county level).

RECOMMENDATIONS FOR ADOPTING A TEEN TEACHER PROGRAM

For others interested in implementing a TAT program, we recommend using Lee and Murdock's (2001) essential elements as a guide to achieving positive outcomes. Successful TAT programs incorporate critical practices such as high-quality training, positive interdependence, and the allocation of time for both reflection and evaluation (Murdock et al., 2003). Other studies have expanded on Lee and Murdock's essential elements to emphasize the importance of the initial training for both teens and their adult partners in ensuring the development of positive youth-adult partnerships. As noted by Weybright et al. (2016, 2018) it is not enough for these adults to be supportive—they must also be adequately trained to develop real and positive partnerships. Furthermore, for a successful experience, the initial TAT training needs to provide teen teachers with the essential competencies and support they will need throughout the implementation of the program. Programs should draw from Lee and Murdock's (2001) essential elements and other evidence-based frameworks that align with the program, as recommended by the National 4-H Healthy Living Task Force (Hill et al., 2008).

LIMITATIONS

The findings from this study do have potential limitations. Community-based programming like YA4-H!—and any programming with teens—requires flexibility. In this study, there was variability across sites and programmatic factors such as program delivery and level of participation; there was also a difference between teens' levels of initial and ongoing TAT training. Program delivery format varied based on site needs; often, teens were either teaching weekly in after-school settings, daily during spring break and in summer camps, or once during "super Saturdays." That said, teens' exposure to the program and the number of opportunities teens had to lead lessons varied across sites. Most teens had the opportunity to teach at least one lesson, while other teens had the opportunity to teach multiple lessons. The level of involvement also varied across sites, as some teens served as more of a teaching assistant—providing class assistance to whoever was leading the lesson—while other teens had the opportunity to lead a lesson with the assistance of their adult partner.

An additional limitation relates to construct measurement. Participants self-reported their dietary knowledge and behavior measures, and responses may be vulnerable to inherent biases, content validity, sensitivity, and issues regarding reliability. Previous studies report that adolescents tend to under-report their food intake, and the

likelihood of this practice is especially influenced by the adolescents' body weight status (Livingstone & Wallace, 2004). Researchers believe that the practice of under-reporting food intake is more common among girls because of the preoccupation with body image and social approval often present during this stage; this preoccupation may lead to a stigma around many eating habits (Wardle & Beales, 1986). Furthermore, the assessment of changes in dietary knowledge and behavior is susceptible to response-shift bias and overestimation of adherence to healthy behaviors (Howard & Dailey, 1979). Specifically for dietary behavior, teen teachers may overestimate their positive dietary behaviors prior to implementing TAT. After implementing TAT, the teen teachers may have been more realistic about their dietary behaviors—which could have masked true changes in the pre- and post-program surveys. Previous nutrition education programs report similar findings with teen subjects (Shilts et al., 2008; Shilts & Townsend, 2012). In future studies, a retrospective pre-test method may be of value (Pratt et al., 2000; Rohs et al., 2001; Shilts et al., 2008), but it is also important to consider possible limitations with the retrospective pre-test method (e.g., Hill, 2020). Future studies assessing dietary behavior change should incorporate additional dietary intake measures— such as food frequency questionnaires and/or dietary screener questionnaires—to utilize inexpensive and widely-used methods of measuring dietary changes (Hackett, 2011). Despite these limitations, the results suggest that teen teachers demonstrate improved nutrition knowledge and behavior from participation in the program.

CONCLUSIONS

The findings from this study strengthen the body of literature that analyzes the effectiveness of nutrition education and suggest the need for broader dissemination of the TAT approach in nutrition education programs—not only to engage teens, but to increase retention of dietary knowledge and behaviors. Future studies should focus on understanding long-term health impacts on participants and those around them, such as their families. Nutrition education programs may benefit from implementing a family component, as most teens rely on their parents for food preparation and availability of healthy food options in the home (Rasmussen et al., 2006; Savage et al., 2007). Implementing a family component in the program could promote positive communication between teens and parents and provide teens with an additional opportunity to share the material they are learning and teaching.

The TAT approach has proven to be a versatile and engaging delivery method. Therefore, use of the TAT approach throughout 4-H youth development programming could enhance internalization of material and promote positive development of life skills in multiple areas.

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