Efficacy or a Five-Lesson Nutrition Education Curriculum For High School Students Administered Via Pennsylvania Snap-Ed Programming.

Abigail D Gilman[1], Judith Ensslin[1], Jessica Cullison[1], Ann Marsteller[1], Jennifer Quinlan[1], Stella L Volpe[2]*

[1]Department of Nutrition Sciences, Drexel University, Philadelphia, PA, USA

[2]Department of Human Nutrition, Foods and Exercise, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

Abstract

Background: The Pennylsvania (PA) Supplemental Nutrition Assistance Program – Education (SNAP-Ed) provides nutrition education to students in schools where a significant proportion of the students are SNAP eligible. A solid foundation in nutrition knowledge is critical to empower young people to develop lifelong healthy eating patterns and lifestyles. The purpose of this research was to examine the efficacy of a five-lesson high school nutrition curriculum on influencing nutrition-related knowledge, attitudes, and behaviors among high school students in Philadelphia, PA.

Methods: SNAP-Ed nutrition educators provided the five-lesson curriculum to students enrolled in 18 PA SNAP-Ed eligible high schools. The modified Youth Risk Behavior Surveillance Survey was used to assess nutrition-related behaviors at baseline (n=1100) and post-intervention (n=972). A curriculum-specific, supplemental questionnaire was added at baseline (n=852) and post-intervention (n=753) in the second and third year of the intervention. The questionnaire was added to assess nutrition knowledge and attitudes. Data were analyzed to determine changes in nutrition-related knowledge, attitudes, and behaviors of students after they were exposed to the educational intervention.

Results: After completing the five-lesson curriculum, students reported significant increases in consumption of 100% fruit juice (p=0.0008), non-fried potatoes (p=0.005), carrots (p=0.0360), and milk (p=0.0057), and significant decreases in soda consumption (p=0.0330). Students significantly improved nutrition knowledge and attitudes after completing the intervention (p=0.0002). Specifically, students improved their overall score, as well as in six of the 18 knowledge and attitude questions.

Conclusion: The five-lesson curriculum was effective in improving nutrition-related behaviors, knowledge, and attitudes. This study provides evidence of the success of a nutrition curriculum specific to high school students.

Keywords: Adolescent, Nutrition curriculum, High school, Supplemental Nutrition Assistance Program, Education.

Accepted on July 08, 2021

Introduction

Obesity affects nearly one quarter of children and adolescents 2 to 19 years of age in the United States [1]. Obesity in childhood tends to track into adulthood and is associated with the development of chronic disease [2-5]. While influenced by a number of factors, dietary intake plays a critical role in the development of obesity. Dietary intake can be influenced by nutrition knowledge and attitudes, but having a strong understanding of nutrition does not always translate into healthy dietary choices. Adolescents report that food and nutrition knowledge is important, but they often fail to meet the daily recommendations for certain food groups, such as fruit and vegetables [6].

The eating behaviors of children change from early childhood throughout adolescence with a reduced consumption of fruits and vegetables. The consumption of fruits and vegetables is inversely associated with the risk of developing chronic diseases, such as diabetes mellitus and cardiovascular disease, later in adulthood [7]. There is a need for effective nutrition education interventions for youth regarding healthy food choices. Because adolescents spend a significant amount of time in school and consume a large portion of their daily energy intake in schools, school-based interventions are a logical place for nutrition interventions [8-12]. However, school nutrition curricula specifically targeting the dietary behaviors of adolescents in high school are limited. The Supplemental Nutrition Assistance Program – Education (SNAP-Ed) is a United States Department of Agriculture (USDA) grant-funded program that aims to educate SNAP-eligible individuals to make healthy food and lifestyle choices, in accordance with the Dietary Guidelines for Americans, to prevent diet-related chronic disease [13].

Programming encompasses a combination of nutrition education, social marketing, and policy, systems, and environmental changes. A combination of these programs is provided to interested schools, early childhood centers, or

community settings where federal funds are received. Schools are a common location for SNAP-Ed programming, and those that receive reimbursement through the National School Lunch Program (NSLP) are eligible to receive SNAP-Ed Programming. The exact type, intensity, and duration of programming depend on the needs of the individual community. The effectiveness of the SNAP-Ed programming is largely attributed to the community nature of each local SNAP-Ed agency. Each agency tailors the programming to fit the needs of their community. In Philadelphia, the demand is driven largely by a high poverty rate matched by a high percentage of households eligible for SNAP assistance. Eat Right Philly (housed in the Department of Nutrition Sciences at Drexel University) is one of the local SNAP-Ed agencies and primarily focuses programming in the school setting. All schools within the School District of Philadelphia, as well as many Charter schools in Philadelphia, receive federal reimbursement through the National School Lunch Program and are eligible for SNAP-Ed programming through Eat Right Philly. One approach of Eat Right Philly's SNAP-Ed programming is to provide direct nutrition education to individuals and groups through the provision of evidence-based curriculum. Often these direct nutrition lessons are provided in schools in combination with other nutrition interventions such as policy, systems, and environmental changes.

The lessons are meant to be evidence-based and incorporate features that have been shown to be effective, such as behaviorally-focused strategies, multi-level approaches that reinforce the materials, and culturally and individually tailored programs [13]. While evidence-based curricula are the preferred method for providing nutrition education, few curricula are available for SNAP-Ed programming in the high school population. The objective of the study was to administer a five-lesson nutrition education curriculum to high school students and determine the efficacy of the curriculum to enable students to change their nutrition-related behaviors, such as increasing the consumption of fruits and vegetables, low-fat milk, and calcium-rich foods, and increasing physical activity. Additionally, we sought to determine if the curriculum influenced the nutrition-related knowledge and attitudes of adolescents.

Research Methodology

The study was approved by the Drexel University Institutional Review Board and the Research Review Committee at the School District of Philadelphia. We conducted a quasi-experimental study that was administered over three academic school years, from 2012 to 2015. Each year, eligible high schools were recruited to receive a five-lesson nutrition curriculum for their students. New schools were recruited each year and no school was included for more than one year. Baseline and post-intervention surveys were used to determine changes in nutrition-related behaviors, knowledge, and attitudes in students. Baseline assessments were completed before any lessons from the curriculum were provided. A curriculum-specific supplemental questionnaire was used in the second and third year of the study to assess specific nutrition-related knowledge and attitudes taught throughout the curriculum. Depending on the needs of each individual school, the five-lesson curriculum was conducted over the course of several weeks to several months. Post-intervention surveys were completed at the conclusion of the five-lesson curriculum.

Five-lesson high school curriculum

The curriculum consisted of five progressive lessons:

1) Build a Healthy Plate,

2) Fast Food: Figuring out the Facts,

3) Choosing Healthy Beverages,

4) Calcium and Vitamin D, and

5) Understanding Energy Balance.

The curriculum underwent an iterative development process and was reviewed by SNAP-Ed state management prior to implementation. The curriculum was taught by trained Drexel University Eat Right Philly nutrition educators. Educators were trained to conduct each lesson in a way that maintained lesson and intervention fidelity. This was accomplished by training each nutrition educator through regular peer-led reviews and ample job training. Each lesson was provided as intended in the lesson plan and educators noted any specific information about the lesson and/or classroom conditions that may have influenced the provision of each lesson. Students enrolled in the study received no additional SNAP-Ed-sponsored nutrition lessons or activities during the intervention time period. However, schools were permitted to provide assemblies and food tastings, as applicable to each individual school. Other health-related education curricula continued as it fit within individual students' schedules, and varied depending on the pre-determined scheduling and curricula established in each school.

Baseline and post-intervention assessment

The Youth Risk Behavior Surveillance Survey (YRBSS) is administered and monitored by the Centers for Disease Control and Prevention and assesses six categories of health-related behaviors in children that contribute to the leading causes of death and disability in young adults. The survey is public domain and able to be used for free by the public [14]. A modified version of the YRBSS was used for this study and included self-reported demographic information and questions pertaining to nutrition and physical activity attitudes and behaviors. In 2012, the YRBSS included questions asking for self-reported height and body weight, calcium intake, and internet access. The modified YRBSS used in this study included 28 questions. The survey was administered by trained Drexel University Eat Right Philly nutrition educators. Surveys were provided to enrolled students in the study before and after the completion of the five-lesson curriculum. Each nutrition educator provided the surveys in-person in each classroom.

Supplemental questionnaire

In years two and three of the study, a curriculum-specific, 18-question supplement was added to the modified YRBSS to better assess how nutrition information taught throughout the curriculum affected students' knowledge and attitudes. The supplemental questionnaire was developed by nutrition

educators and SNAP-Ed staff. Each question was reviewed by nutrition faculty and experts for content validity before being included in the supplemental questionnaire. Following development, the supplemental questionnaire was included with the modified YRBSS and provided at the same time as the baseline and post-intervention surveys. All surveys were completed anonymously. Surveys were coded to identify the type of survey collected (baseline, post-intervention), school, classroom, and individual survey number. Survey responses were logged and sent to the Pennsylvania State University survey center for compilation of survey data.

Participants and recruitment

Eligible schools included those that were SNAP-Ed eligible for three years prior to the beginning of the study. SNAP-Ed eligibility is defined as schools that receive federal reimbursement through the National School Lunch Program. Schools also had to have had SNAP-Ed programming for at least one year prior to being enrolled in the study. Eligible schools were then randomly selected to be included in the study each year. Four or more schools were enrolled per year and each school provided at least three classrooms for inclusion in the study. At least 50 students per school were needed to be eligible to enroll in the study and no classroom was permitted to have more than 60 students. An individual school was eligible for only one year of program intervention, and subsequently removed from the eligibility pool for future years of the intervention. Four schools were recruited in year one, six in year two and eight in year three. All participants in the study were high school students enrolled in 9th through 12th grades. Each participant was enrolled in the study only once and completed one baseline and one post-intervention survey. Changes in matriculation and school absences led to different baseline and post-intervention sample sizes. Participants did not complete the post-intervention survey if they were unavailable to complete it during the scheduled time for the class.

Data analyses

Statistical analyses utilized aggregate scoring from survey responses to assess change in behaviors. Baseline modified YRBSS survey and supplemental questionnaire responses from each year were analyzed together as one aggregate baseline assessment. Post-interventions modified YRBSS survey and questionnaire responses from each year were analyzed together as one aggregate assessment. The following methods were used to assess nutrition-related behaviors, knowledge, and attitudes.

Nutrition-related behaviors: Nutrition-related behaviors were assessed by analyzing the responses of the modified YRBSS survey and did not include the supplemental questionnaire. A total of 1,100 baseline modified YRBSS surveys were collected and analyzed throughout the three-year intervention; 972 post-intervention modified YRBSS surveys were collected and analyzed. Comparisons of the median of baseline and post-intervention scores were conducted using a two-sample Wilcoxon test due to our inability to pair unidentified, anonymous baseline and post-intervention results. Data were tested for normality, variance distributions, and assumptions for non-parametric testing due to survey sampling. Pooled variance and Satterthwaite variances with a two-sample t-test were used to compare overall variances (spread) between baseline and post-intervention survey responses. The creation of a new scoring rubric based on survey responses was used to assess change in nutrition-related behaviors. The newly created rubric assigned higher values to survey responses that indicated higher frequencies of consumption of that food or beverage. For example, a response of "never or less than 1 time per month" was assigned 0; a response of "4 or more times per day" was assigned 4. Using the newly created scores, t-tests were used to test for significant differences between mean baseline and post-intervention scores. Significance of $p<0.05$ was set a-priori.

Nutrition-related knowledge and attitudes: Nutrition-related knowledge and attitudes were assessed by analyzing the supplemental questionnaire provided in years two and three. A total of 852 baseline supplemental questionnaires were collected and analyzed; 753 post-intervention supplemental questionnaires were collected and analyzed. Chi-square test was used to test to evaluate significant differences between the results of the baseline survey responses and post-intervention responses. Main areas of knowledge and attitudes that were influenced by the intervention were identified and highlighted.

Results

Survey collection

In year one, four schools were recruited with 248 baseline modified YRBSS surveys, and 219 post-intervention modified YRBSS surveys completed. No supplemental questionnaires were collected in year one. In year two, six schools were recruited with modified YRBSS and supplemental questionnaires collected from 407 participants at baseline, and 342 participants post-intervention. In year three, eight schools were recruited. Modified YRBSS surveys and supplemental questionnaires were completed by 445 participants at baseline, and 411 participants post-intervention. In total, 1100 baseline modified YRBSS surveys were completed and 972 post-intervention surveys were completed. A total of 852 supplemental questionnaires were completed at baseline and 753 were collected post-intervention. Differences in baseline and post-intervention survey collection sample size were due to changes in matriculation and student absences.

Nutrition-related behaviors

Wilcoxon tests indicated that students reported an increased consumption of 100% fruit juice ($p=0.0008$), non-fried potatoes ($p=0.005$), carrots ($p=0.0360$), and milk ($p=0.0057$) after completing the intervention and a decrease in consumption of soda ($p=0.0330$) after completion of the intervention (Table 1).

Fruit and vegetable consumption: Pooled variance t-tests indicated an increased percentage of students reporting consumption of 100% fruit juice ($p=0.0260$), non-fried potato consumption ($p=0.0155$), not including French fries, fried potatoes, or potato chips, and carrot consumption ($p=0.054$). Consumption of whole fruit and vegetables did not change after the intervention.

Other beverage consumption: Wilcoxon tests showed a significant shift in the distribution of milk ($p=0.0057$) and soda

Table 1. *Percent of student responses to modified youth risk behavior surveillance survey questions significant changes after the intervention.*

Variables	100% Fruit Juice		Potatoes (Not French fries, fried potatoes, or potato chips)		Carrots		Milk (Not in cereal)		Soda	
	Baseline[a] (%)	Post-Intervention[b] (%)	Baseline[a] (%)	Post-Intervention[b] (%)	Baseline[a] (%)	Post-Intervention[b] (%)	Baseline[a] (%)	Post-Intervention[b] (%)	Baseline[a] (%)	Post-Intervention[b] (%)
Did not Eat or Drink	23.9	17.8	41.3	33.6	66.3	62.6	40.2	34.4	21.3	23.9
1 to 3 times/ week	32.8	32.6	35.6	39.0	19.8	18.8	24.6	24.9	28.2	29.5
4 to 6 times/ week	13.8	16.0	7.0	8.9	3.8	4.8	9.5	13.9	17.5	16.6
1 time/day	8.1	11.2	8.1	7.8	4.3	6.2	11.0	11.5	7.5	6.5
2 times/day	9.8	8.3	2.3	2.0	1.7	2.1	6.7	8.2	7.8	9.5
3 times/day	4.7	6.5	2.2	2.0	1.0	1.5	5.2	4.9	6.0	4.9
4 times per day	4.4	5.3	1.2	1.7	1.3	1.4	N/A[c]	N/A[c]	9.2	6.5
No Answer	2.5	2.4	2.4	2.7	2.6	2.6	2.9	0.8	2.6	3.7

[*]All food and food groups presented had significant shifts in the distribution of student responses as determined by two-Sample Wilcoxon tests, with significance established *a-priori* at $p<0.05$.
[a]Sample size at baseline survey collection was 1100.
[b]Sample size at post-intervention survey collection was 972.
[c]4 times per day was not an available response for this question.

($p=0.0226$) consumption post-intervention.

Nutrition-related knowledge and attitudes

Students demonstrated a significant improvement in overall nutrition knowledge from baseline to post-intervention ($p=0.0002$). The mean score for nutrition knowledge and attitudes at baseline was 45.3 and improved to 48.1 after the five-lesson curriculum. Significant improvements in knowledge and attitudes were identified in six of the 18 questions from baseline to post-intervention. Improvements were seen in some knowledge questions, such as identifying components of a healthy diet. Only 16.8% of participants identified the correct answer of soda as "empty calories" at baseline survey collection. After completing the five-lesson curriculum, the correct response rate statistically improved ($p<0.001$), with 30.5% selecting the correct answer. Improvements were also seen in questions addressing current behaviors, such as opting for the stairs instead of an escalator (Table 2).

Discussion

The purpose of this study was to determine if a five-lesson nutrition education curriculum for high school students enabled students to improve their nutrition-related behaviors, knowledge, and/or attitudes. There were several behaviors that were positively influenced by the intervention. Students reported an increased consumption of 100% fruit juice, non-fried potatoes, carrots, and milk, and a decreased consumption of soda. Additionally, several markers of nutrition related knowledge and attitudes were significantly influenced by the intervention. An increased proportion of students reported consuming 100% fruit juice after the intervention. There is ample evidence that fruit and vegetable intake is associated with a reduced risk of many chronic diseases including cardiovascular disease, diabetes mellitus, and certain forms of cancer [15,16].

The Dietary Guidelines for Americans recommend that fruit be included in a healthy diet, especially as whole fruit [17]. Although 100% fruit juice is lower in fiber than whole fruit, intake of 100% fruit juice is not associated with excess weight gain in children [18]. Juice consumption may actually help children, especially those of lower socioeconomic status with less access to fresh, whole-fruit, improve their nutrient intake and overall diet quality [19]. The Dietary Guidelines for Americans recognize that 100% fruit juice can play a role in assisting those living in the United States in meeting their daily fruit recommendations [17]. Rosi et al. [20] reported that most adolescents, 10 to 19 years of age, living in North America, Europe, and Oceania, do not meet fruit intake recommendations. Kimmons et al. [21] reported that fewer than one in every 10 Americans meet the fruit or vegetable intake recommendations, and that the primary contributors of total fruit intake among adolescents was from 100% fruit juice. Byrd-Bredbenner et al. [22] reported that, compared to non-consumers, children who consume 100% fruit juice come closer to meeting daily fruit needs and had better diet quality than those who did not. In children, 100% fruit juice consumption is associated with increased intake of vitamin C, folate, and potassium. These results are congruent with the changes that were observed in our research.

Although students did not significantly increase their whole fruit consumption, they reported increased 100% fruit juice consumption after completing the intervention. While we did not directly quantify the servings of fruit consumed, the increased 100% fruit juice consumption may have facilitated an improved overall intake of key nutrients found in fruit. There was also a shift in the consumption of other beverages after the five-lesson curriculum intervention. Students reported a decreased intake of sugar-sweetened beverages (e.g., soda/pop), and increased milk consumption. This is important because beverages contribute approximately 20% of energy to the diets

Table 2. *Responses of nutrition-related knowledge and attitudes questions.*

Questions Assessing Nutrition Attitudes and Behaviors	Response Options[1]	Correct Responses Baseline (%)[a]	Correct Responses Post-Intervention (%)[b]	Chi-square p-value
As part of healthy eating each day, I try to	A. Eat a variety of foods from the five food groups	42.5	49.4	0.0064*
	B. Exercise at least 60 minutes			
	C. Do both A and B[1]			
	D. Do none of the above			
Identify the drink with "empty Calories"	**A. Soda**	16.8	30.5	<0.0001*
	B. Smoothie			
	C. 100% juice			
	D. Skim Milk			
When I am physically active or playing my favorite sport for less than 60 minutes, I..	**A. Drink water**	70.0	74.8	0.0379*
	B. Drink soda			
	C. Drink a sports drink			
	D. Drink lemonade			
I get Vitamin D from	**A. Fish**	22.6	27.7	0.0248*
	B. Beans and Legumes			
	C. Fruits			
	D. Vegetables			
Physical Activity is important for	A. Stronger muscles and bones	54.3	60.9	0.0106*
	B. Maintaining a healthy body weight			
	C. Sleeping well at night			
	D. All of the above			
If I went to a shopping mall, I would take	A. Escalator	41.6	47.1	0.0370*
	B. Stairs			
	C. Elevator			

[1]Bolded options are the correct answer [a] Sample size at baseline survey collection was 852; [b] Sample size at post-intervention survey collection was 753.

of children and adolescents [23]. While the beverage choices of high school students have changed in the past two decades, with students consuming fewer sugar-sweetened beverages [24] these high-energy beverages continue to contribute to excess energy intake in children [25]. High school students, in particular, are vulnerable to making unhealthy beverage decisions as they gain autonomy of their dietary decisions. Evans et al. [25] studied beverage consumption of ethnically diverse high school students in Texas and reported that milk and juice consumption declined steadily with each grade level, with a concomitant increase in soda consumption.

In contrast, results from this study showed high school students choosing healthier beverage options after completing the five-lesson curriculum. The percentage of students who reported never consuming milk decreased by 14.5%, and those who consumed milk four to six times per week increased consumption nearly 50% after completing the intervention. This was paired with an overall reduction in those reporting consuming soda three or more times per day. Our results provide strong evidence that the use of our five-lesson curriculum for high school students enabled healthier beverage choices. Potato and carrot intakes were also reported to have been influenced by the intervention. Students reported increases in both categories of food after students completing the five-lesson curriculum. Daily consumption of potatoes, excluding French fries, fried potatoes, or potato chips, increased by 13% after the intervention. This can generally be seen as an improvement to the overall diet of adolescents.

Although potatoes are generally thought to contribute to the consumption of excess energy and the development of chronic disease, [26,27] the change in consumption patterns among our participants is beneficial. Veronese et al. [26] identified that people who ate fried potatoes twice per week saw an increased risk of death, but failed to identify a correlation between non-fried potato consumption and risk of death. Non-fried white potato consumption may add important nutrients to the diet and improve overall health in children. White potatoes are low in fat and high in potassium, magnesium, dietary fiber, and vitamin C [28].

Replacing white potatoes with other vegetables may deplete potassium levels and decrease the overall diet quality in children. Nicklas et al. [29] analyzed the National Health and Nutrition Examination Survey (NHANES) 2005 to 2012 24-hour dietary recall data using replacement modeling. They reported that, by replacing potato consumption with an equivalent amount of other vegetables, the potassium intake significantly decreased. Carrot intake also increased after completing the five-lesson curriculum. Children were likely to have had exposure to carrots prior to this intervention and they are often a preferred vegetable choice [30].

Before receiving the five-lesson curriculum, 66.3% of participants reported that they did not eat carrots at all. This percentage dropped to 62.7% after completing the intervention.

Students who reported eating carrots daily also increased from 4.3% at baseline to 6.2% after receiving the five-lesson curriculum. This increase may have been attributed to the repetitive exposure of this vegetable. The repetitive exposure to novel foods tends to increase food acceptability in adolescents [31]. The five-lesson curriculum introduced the adolescents to carrots, and provided lessons highlighting the nutrition and importance of vegetables including carrots in healthy diet. The intervention also influenced the nutrition-related knowledge and attitudes of students. The percentage of students who correctly answered the knowledge and attitudes question increased significantly for six of the 18 questions. Improvements were seen in correct answers to questions asking students to identify the components of a healthy lifestyle, identify the importance of physical activity, and identify ways to increase physical activity.

Improvements were also seen in identifying sources of empty calories, vitamin D, and proper hydration sources during exercise after completing the five-lesson curriculum. In addition, improved attitudes were identified, with a larger percentage of students choosing to take the stairs instead of the escalator or elevator. Changes in nutrition-related behaviors, knowledge and attitudes showed that the five-lesson curriculum was effective in educating students on nutrition and a healthy lifestyle. Some researchers suggest that improvements in nutrition-related knowledge through ecological school-based interventions can translate to improvements in behaviors as well [32]. Whereas other researchers have reported that even with improvements in knowledge, nutrition behaviors are left unchanged [33,34]. Although the literature is equivocal in the association of knowledge and attitudes influencing nutrition behaviors, we found that improvements in nutrition-related behaviors and attitudes were simultaneously paired with improvements in nutrition behavior.

Strengths and limitations

The intervention was provided to a large sample of students receiving SNAP-Ed programming in SNAP-eligible high schools. There are limited curricula specific to the needs of high school students available for SNAP-Ed programming. Our research furthers the field of nutrition education for high school students and demonstrated significant improvements in nutrition-related behaviors, knowledge, and attitudes among the high school students who completed the curriculum. This curriculum is universal for high school students and is adaptable if nutrition requirements and recommendations change. A limitation of the study was the use of survey responses, which are not always reliable estimates of actual intake. Newer technologies may allow for more accurate assessment of dietary intake in adolescents [35]. Additionally, the research was unable to match baseline surveys to post-intervention surveys for individual students. This prevented us from conducting individual level analyses on a yearly basis. While survey responses were analyzed as collective baseline and post-intervention responses, our research was not able to determine change over time based on the intervention.

Implications for research and practice

Nutrition behaviors are influenced by a plethora of real-life factors such as food access, [36] parental behaviors, [37] and gender, [38] among others; but, a strong platform of nutrition education remains essential to supporting improved knowledge and behaviors of adolescents. Comprehensive programs addressing more than knowledge may be beneficial in changing nutrition behaviors.23 The joint position of the Academy of Nutrition and Dietetics, Society of Nutrition Education and Behavior and School Nutrition Association state that, "comprehensive, integrated nutrition programs in pre-school through high school are essential to improve the health, nutritional status, and academic performance of our nation's children," [39] validating the need for evidence-based curricula development. SNAP-Ed currently does not have evidence-based curriculum specific to high school students. There are currently 134 curricula available, but only 32 of them are relevant for high school students. Of the 32 high school curricula available, all are practice-based rather than evidence-based [40].

Conclusion

Although practice-based curricula have use in the high-school setting, a validated curriculum with significant nutrition outcomes will provide strength to SNAP-Ed programming. The use of the five-lesson curriculum for high school students described here can provide the evidence-based foundation necessary for nutrition education in for high school students and begin the process of changing nutrition-related behaviors.

Acknowledgement

Funding provided by USDA's Supplemental Nutrition Assistance Program (SNAP) through the PA Department of Human Services.

References

1. Ogden CL, Fryar CD, Hales CM, et al. Differences in obesity prevalence by demographics and urbanization in US children and adolescents, 2013-2016. JAMA. 2018; 319(23):2410-18.
2. Singh AS, Mulder C, Twisk JW, et al. Tracking of childhood overweight into adulthood: a systematic review of the literature. Obes Rev. 2008; 9(5):474-88.
3. Yan Y, Hou D, Zhao X, et al. Childhood adiposity and non-alcoholic fatty liver disease in adulthood. Pediatr. 2017; 139(4): e20162738.
4. Marietti M, Bugianesi E. Childhood obesity: time bomb for future burden of chronic liver disease. Nat Rev Gastroenterol Hepatol. 2016; 13(9):506-7.
5. Anderson LN, Lebovic G, Hamilton J, et al. Body mass index, waist circumference, and the clustering of cardiometabolic risk factors in early childhood. Paediatr Perinat Epidemiol. 2016; 30(2):160-70.
6. Ronto R, Ball L, Pendergast D, et al. Adolescents' perspectives on food literacy and its impact on their dietary behaviours. Appetite. 2016; 107:549-57.
7. Tian Y, Su L, Wang J, et al. Fruit and vegetable consumption and risk of the metabolic syndrome: a meta-analysis. Public Health Nutr. 2018; 21(4):756-65.
8. Glickman D, Parker L, Sim LJ. Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation Washington, DC National Academies Press. 2012.
9. Wang Y, Cai L, Wu Y, et al. What childhood obesity prevention

programmes work? A systematic review and meta-analysis. Obes Rev. 2015; 16(7):547-65.

10. Zenzen W, Kridli S. Integrative review of school-based childhood obesity prevention programs. J Pediatr Health Care. 2009; 23(4):242-58.
11. Waters E, De Silva-Sanigorski A, Burford BJ, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2011(12): CD001871.
12. Gonzalez-Suarez C, Worley A, Grimmer-Somers K, et al. School-based interventions on childhood obesity: a meta-analysis. Am J Prev Med. 2009; 37(5):418-27.
13. https://snaped.fns.usda.gov/
14. Eaton DK, Kann L, Kinchen S, et al. Youth risk behavior surveillance-USA, 2007. MMWR Suppl. 2008; 57(4):1-31.
15. Aune D, Giovannucci E, Boffetta P, et al. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-A systematic review and dose-response meta-analysis of prospective studies. Int J Epidemiol. 2017; 46(3):1029-56.
16. Slavin JL, Lloyd B. Health benefits of fruits and vegetables. Adv Nutr. 2012; 3(4):506-16.
17. DeSalvo KB, Olson R, Casavale KO. Dietary guidelines for Americans. JAMA. 2016; 315(5):457-8.
18. Auerbach BJ, Wolf FM, Hikida A, et al. Fruit juice and change in BMI: A meta-analysis. Pediatr. 2017; 139(4): e20162454.
19. Murray RD. 100% fruit juice in child and adolescent dietary patterns. J Am Coll Nutr. 2020; 39(2):122-7.
20. Rosi A, Paolella G, Biasini B, et al. Dietary habits of adolescents living in North America, Europe or Oceania: A review on fruit, vegetable and legume consumption, sodium intake, and adherence to the Mediterranean Diet. Nutr Metab Cardiovasc Dis. 2019; 29(6):544-60.
21. Kimmons J, Gillespie C, Seymour J, et al. Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. Medscape J Med. 2009; 11(1):26.
22. Byrd-Bredbenner C, Ferruzzi MG, Fulgoni III VL, et al. Satisfying America's fruit gap: summary of an expert roundtable on the role of 100% fruit juice. J Food Sci. 2017; 82(7):1523-34.
23. Miller G, Merlo C, Demissie Z, et al. Trends in beverage consumption among high school students—United States, 2007–2015. MMWR Morb Mortal Wkly Rep. 2017; 66(4):112.
24. Mesirow MS, Welsh JA. Changing beverage consumption patterns have resulted in fewer liquid calories in the diets of US children: National Health and Nutrition Examination Survey 2001-2010. J Acad Nutr Diet. 2015; 115(4):559-66.
25. Evans AE, Springer AE, Evans MH, et al. A descriptive study of beverage consumption among an ethnically diverse sample of public school students in Texas. J Am Coll Nutr. 2010; 29(4):387-96.
26. Veronese N, Stubbs B, Noale M, et al. Fried potato consumption is associated with elevated mortality: an 8-y longitudinal cohort study. Am J Clin Nutr. 2017; 106(1):162-7.
27. Muraki I, Rimm EB, Willett WC, et al. Potato consumption and risk of type 2 diabetes: results from three prospective cohort studies. Diabetes care. 2016; 39(3):376-84.
28. Camire ME, Kubow S, Donnelly DJ. Potatoes and human health. Crit Rev Food Sci Nutr. 2009; 49(10):823-40.
29. Nicklas TA, Liu Y, Islam N, et al. Removing potatoes from children's diets may compromise potassium intake. Adv Nutr. 2016; 7(1):247S-53S.
30. Raggio L, Gámbaro A. Study of the reasons for the consumption of each type of vegetable within a population of school-aged children. BMC Public Health. 2018; 18(1):1-1.
31. Woo T, Lee KH. Factors affecting vegetable preference in adolescents: stages of change and social cognitive theory. Nutr Res Pract. 2017; 11(4):340-6.
32. Wang D, Stewart D, Chang C. Is an ecological school-based nutrition intervention effective to improve adolescents' nutrition-related knowledge, attitudes and behaviour in rural areas of China? Glob Health Promot. 2017; 24(4):81-9.
33. Cown MH, Grossman BM, Giraudo SQ. Nutrition education intervention to improve nutrition-related knowledge, attitudes, and behaviors for Hispanic children. Ecol Food Nutr. 2017; 56(6):493-513.
34. Nagy-Penzes G, Vincze F, Sandor J, et al. Does Better Health-Related Knowledge Predict Favorable Health Behavior in Adolescents? Int J Environ Res Public Health. 2020; 17(5):1680.
35. Cade JE. Measuring diet in the 21st century: Use of new technologies. Proc Nutr Soc. 2017; 76(3):276-82.
36. Hager ER, Cockerham A, O Reilly N, et al. Food swamps and food deserts in Baltimore City, MD, USA: Associations with dietary behaviours among urban adolescent girls. Public Health Nutr. 2017; 20(14):2598-607.
37. Yee AZ, Lwin MO, Ho SS. The influence of parental practices on child promotive and preventive food consumption behaviors: A systematic review and meta-analysis. Int J Behav Nutr Phys Act. 2017; 14(1):1-4.
38. Sprake EF, Russell JM, Cecil JE, et al. Dietary patterns of university students in the UK: A cross-sectional study. Nutr J. 2018; 17(1):1-7.
39. Hayes D, Contento IR, Weekly C. Position of the Academy of Nutrition and Dietetics, Society for Nutrition Education and Behavior, and School Nutrition Association: Comprehensive nutrition programs and services in schools. J Acad Nutr Diet. 2018; 118(5):913-9.
40. https://snapedtoolkit.org/

***Correspondence to:**

Stella Lucia Volpe
Professor and Department Chair
Human Nutrition, Foods, and Exercise
Affiliate Faculty
Center for Advanced Innovation in Agriculture
Virginia Polytechnic Institute and State University
295 West Campus Drive (MC 0430)
338 Wallace Hall
Blacksburg, Virginia, USA
Tel: 540-231-3805
E-mail: stellalv@vt.edu