ORIGINAL RESEARCH

CURRENT DEVELOPMENTS IN NUTRITION

Nutrition Education

Forecasting Your Future: Nutrition Matters Curriculum with Teacher Training Promotes Students to Try New Fruits and Vegetables

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ABSTRACT

Background: Many high school students do not consume the recommended amounts of fruits and vegetables.

Objective: This study evaluated student outcomes from a new nutrition curriculum that includes messages from the 2015–2020 Dietary Guidelines for Americans with a teacher training component for high school Family and Consumer Sciences (FACS) teachers.

Methods: A cluster-randomized controlled study was conducted with 1104 students in FACS classes from 35 schools, taught by teachers trained in implementing a new curriculum (intervention) and teachers using their usual curricula (control). Students completed online surveys at the beginning and end of the semester, that is, pre- and postexposure to the nutrition curricula. Intention-to-treat analyses as hierarchical linear modeling were performed to determine if the intervention students had significant changes compared with the control students for knowledge of nutrition concepts, familiarity of, preferences for, affinity toward, number of times trying new, and daily times eating fruits and vegetables. Per-protocol analyses used the same hierarchical linear model but instead of control and intervention groups, students were split into 3 levels describing the amount of the new curriculum they received (0%, 1–50%, and 51–100%).

Results: Students exposed to 51–100% of the new curriculum tried more fruits and vegetables than both the control students and the students that received 1–50% of the curriculum ($P = 0.009$ for fruits and $P = 0.002$ for vegetables). Additionally, there were higher increases in the number of times intervention students tried a new fruit ($P = 0.027$) and vegetable ($P = 0.022$) compared with the control students, regardless of the amount of curriculum received.

Conclusions: Our findings show that the curriculum, *Forecasting Your Future: Nutrition Matters*, has promise for increasing exposure to new fruits and vegetables for students. If teachers use most of the curriculum, students are likely to try more new fruit and vegetables, which could ultimately contribute to improved health. *Curr Dev Nutr* 2020;4:nzaa101.

Keywords: high school students, nutrition curriculum, fruits, vegetables, exposure, Family and Consumer Sciences

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Data are available from the authors upon reasonable request.
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Introduction

The consumption of fruits and vegetables is an important component of a healthy eating pattern and is associated with many positive health outcomes for adolescents. The combined intake of dairy, grains, fruits, and vegetables has been shown to be inversely associated with central obesity in adolescents (1). In addition, adolescents who eat more fruit and vegetables have lower blood pressure compared with those who do not regularly eat fruits and vegetables (2). Positive eating habits in adolescence can also have health benefits extending through adulthood (3–5). A recent study found that higher intakes of whole fruits and vegetables as young adults were associated with better cognitive performance in midlife (4). In addition, a higher habitual flavonoid consumption from fruits and vegetables in adolescence has been shown to be associated with a lower risk of type 2 diabetes in early adulthood (5).

Despite the health benefits, many US high school students do not consume the recommended amounts of fruits and vegetables (6). In 2017, the Center for Disease Control Youth Risk Behavior Survey found that only 18% of 9th grade students reported consumption of fruit or 100% fruit juice *three times or more* over the last 7 d. In the same analysis, only 13.9% of students reported the consumption of vegetables more than twice a day over the last 7 d (6).

In response to this issue, the Indiana Department of Education created a new nutrition curriculum, *Forecasting Your Future: Nutrition*

NUTRITION MATTERS LESSON PLANS
Pacing Guide

Unit 1	Dietary Guidelines through MyPlate Tools and Nutrition Facts Labels	Recommended Minimum Time
Lesson 1	MyPlate Food Groups, Nutrients, and Checklists	4 d
Day 1	▪ Introduction to MyPlate	
Day 2	▪ MyPlate Presentations	
Day 3	▪ MyPlate Daily Checklist	
Day 4	▪ Pitcher Your Smoothies	
Lesson 2	Meeting Goals with MyPlate and Food Labels	3 d
Day 1	▪ Wellness Contracts	
Day 2	▪ Food Labels	
Day 3	▪ Serving Size and Calories	
Lesson 3	Nutrients to Get Less of and Nutrients to Get More of: Track Your Snack	2 d
Day 1	▪ Healthy Snacks	
Day 2	▪ Added Sugars	
Unit 2	Implementing Food Policy through the School Meal Program	
Lesson 1	Healthy School Lunch Challenge	2 d
Day 1	▪ Nutrition Standards for School Meals	
Day 2	▪ Lunchroom Posters	
Lesson 2	Recipes for Healthy Eating	3 d
Day 1	▪ Modifying Recipes	
Day 2	▪ Food Safety	
Day 3	▪ Cook a Mini School Lunch	
Lesson 3	Career Development	2–4 d
Days 1–4	▪ FCCLA Career Connection and Career Investigation Project	
Unit 3	Factors Affecting Fruit and Vegetable Consumption	
Lesson 1	Find Your Favorite	3 d
Day 1	▪ Seasonal Fruits and Vegetables	
Day 2	▪ Comparing Cooking Methods	
Day 3	▪ Comparing Fresh, Frozen, and Canned Fruits and Vegetables	
Lesson 2	Eat the Rainbow	3 d
Day 1	▪ Introduction to Vegetable Subgroups	
Day 2	▪ Taste-testing Vegetables	
Day 3	▪ Taste-testing Vegetables	
Lesson 3	Shifting	3 d
Day 1	▪ Planning Public Service Announcements	
Day 2	▪ Making Public Service Announcements	
Day 3	▪ Presenting Public Service Announcements	

FIGURE 1 *Forecasting Your Future: Nutrition Matters* curriculum Table of Contents. FCCLA, Family, Career, and Community Leaders of America, career and technical organization for 6th–12th grade students in school Family and Consumer Sciences education.

Matters, and introduced Family and Consumer Sciences teachers to each of the components of the curriculum in a training session. The aim of this study was to evaluate the nutrition knowledge, fruit and vegetable attitudes, reports of daily variety, and willingness to try new fruit and vegetables of the students who received the curriculum from trained teachers compared with students receiving the usual curricula, in Family and Consumer Sciences classes.

The curriculum

The newly created nutrition curriculum, *Forecasting Your Future: Nutrition Matters,* is intended to teach high school students about the nutrition concepts and behavioral messages from the 2015–2020 Dietary Guidelines for Americans. It uses experiential lessons to improve student knowledge and skills about healthy eating patterns, as well as student attitudes toward fruits and vegetables and the consumption of fruits and vegetables.

The curriculum is divided into 3 units. The first unit teaches the Dietary Guidelines through MyPlate tools and Nutrition Facts labels. This unit is designed to improve knowledge of the benefits of a healthy eating pattern and to teach students how to choose healthy foods by interpreting Nutrition Facts labels. The second unit is about implementing the food policy through the school meal program. It is designed for students to understand the nutrition standards for school meals and to connect with the food service director. It also gives students more insight into

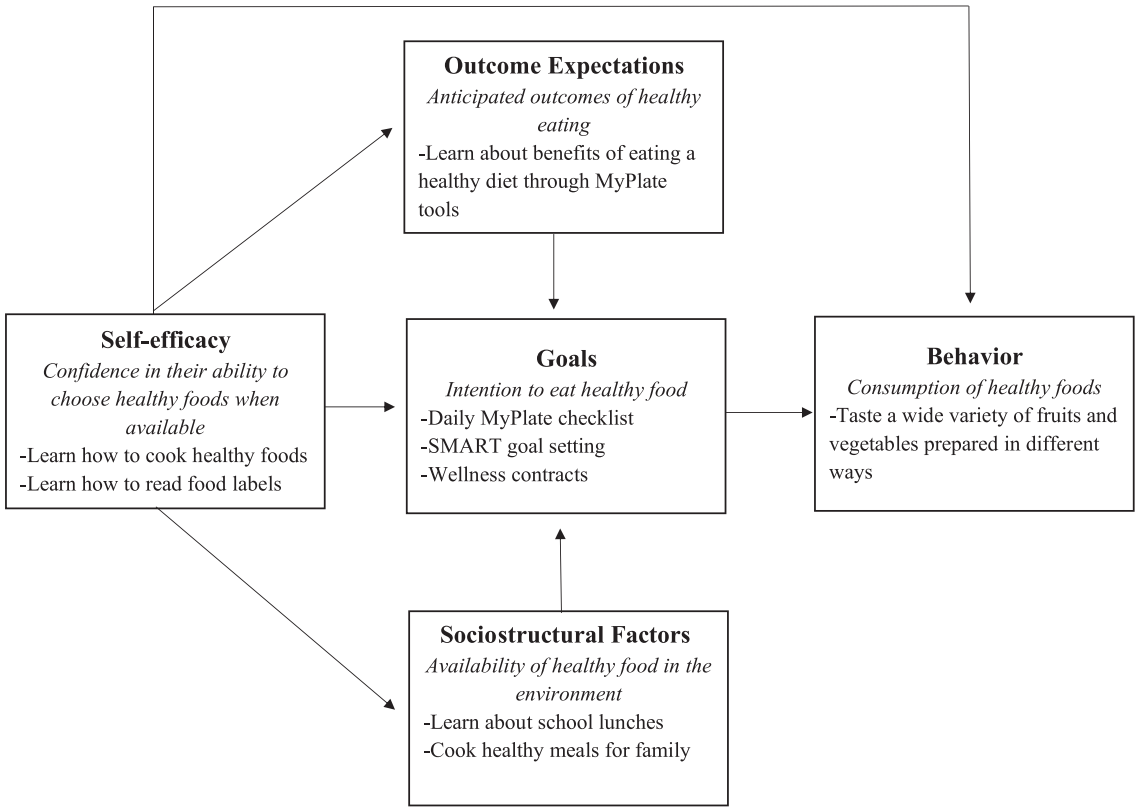

FIGURE 2 Social Cognitive Theory Constructs and curriculum components. SMART, goals that are specific, measurable, achievable, relevant, and timebound.

the process of creating and serving school meals. The third unit is about factors affecting fruit and vegetable consumption and includes experiential lessons designed to improve student attitudes toward and the consumption of fruits and vegetables. This unit includes hands-on learning experiences in which students cook and prepare fruits and vegetables in a variety of ways. The Table of Contents for the curriculum is shown in **Figure 1**.

Theoretical framework

The curriculum is informed by Social Cognitive Theory, which is 1 of the dominant theories of behavior change used in the development of programs for adolescents (7, 8). It provides a reciprocal model where behavior, personal factors, and environmental influences continuously interact and affect each other (9). **Figure 2** delineates the model of behavior change applied to dietary intake along with corresponding objectives in lessons from the curriculum (10).

Methods

Study design and population

This was a cluster-randomized controlled study. The teachers were recruited to participate in the training at an annual Family and Consumer Sciences professional development conference and through a weekly newsletter. The eligibility criteria were that participants needed to be a Family and Consumer Sciences teacher at any high school in Indiana. Participants were stratified by geographic locale and school size using data from the National Center for Education Statistics (11). They were then randomly assigned to the intervention group or the delayed intervention group (to serve as controls). The teachers in the intervention group attended the training in the spring of 2018. The teachers in the control group received delayed training in the spring of 2019, after the study was completed. Students in Family and Consumer Sciences classes taught by teachers in the intervention and control groups were surveyed at baseline (beginning of fall semester, 2018) and post (end of fall semester, 2018).

All teachers gave their students a study information sheet to take home to their parents or caretakers. The teachers were told that student participation in the surveys was completely voluntary and no incentives or disincentives could be attached to the completion of the survey. The Qualtrics survey gave students 2 opportunities to decline to participate. Teachers received a copy of the curriculum and a professional development stipend of $366 per teacher as well as a $160 stipend for fruit and vegetable purchases through Piazza Produce. The protocol was reviewed and approved by the Indiana University Institutional Review Board (Protocol number 1,807,322,029).

Instrument

The 44-item survey was offered online through Qualtrics and included items on demographics (age, gender, grade, and race), self-reported di-

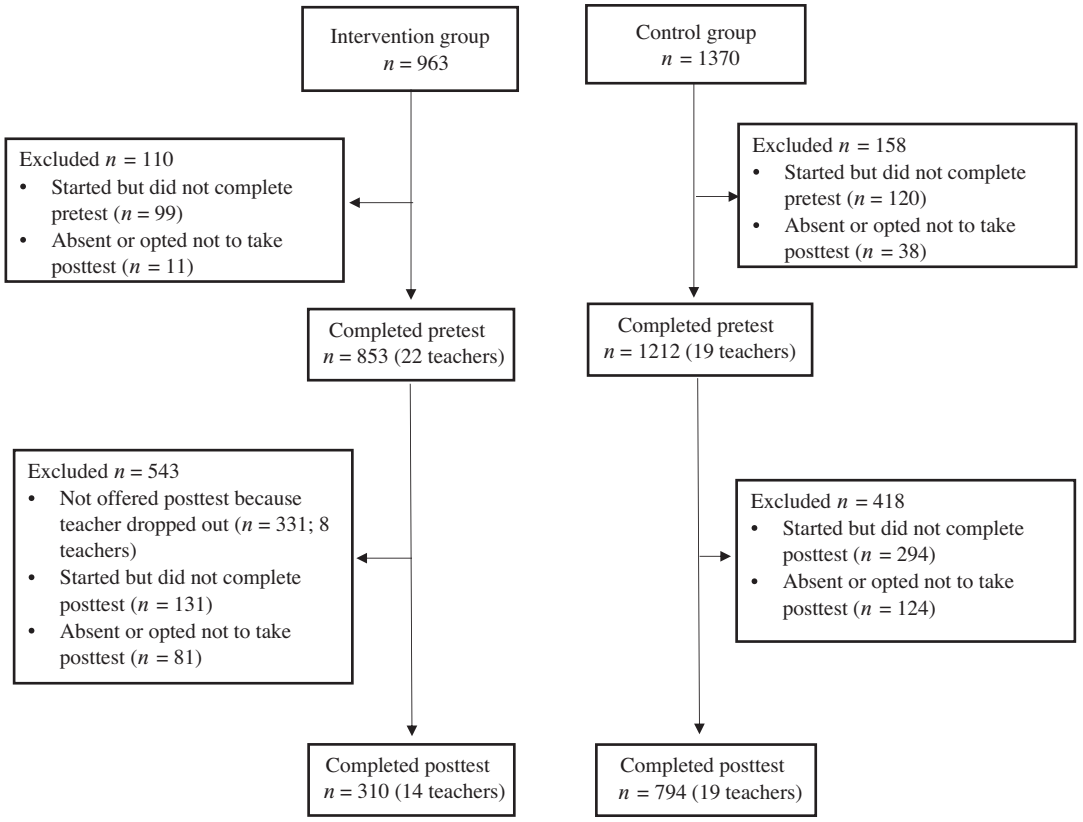

FIGURE 3 Flowchart of participants in intervention and control groups.

etary behaviors, perceptions of fruits and vegetables, and knowledge of nutrition concepts from the 2015–2020 Dietary Guidelines for Americans (12). Response choices to items included a variety of formats, i.e., multiple choice, or dichotomous scales with true/false, or yes/no (full instrument attached as **Supplemental File**). Students also completed a 37-item questionnaire on the constructs of Social Cognitive Theory as part of the posttest only. Those questions and results are beyond the scope of the current study.

Self-reported dietary behaviors.

There were 5 items about self-reported dietary behaviors. Two yes/no items addressed the daily variety of fruits and vegetables and were validated by Branscum et al. in 97 low-income 3rd to 5th grade students in Ohio. The items were: "Do you eat more than 1 kind of fruit daily?" and "Do you eat more than 1 kind of vegetable daily?" (13). There were 3 items used to estimate the dietary intake of fruits and vegetables, with units of times ate or drank 100% fruit juice, whole fruit, and vegetables (excluding French fries and chips) daily. These items were utilized from the *School Physical Activity and Nutrition Survey* for grades 8 and above that was validated by Hoelscher et al. (7) and included: "During the past 24 h (yesterday), how many times did you…" "…Drink 100% fruit juices, such as orange, apple or grape?" "…Eat fruit? (Do not count fruit juice)," and "…Eat vegetables? (Include salads and nonfried potatoes.)". Each item had 6 interval response choices that ranged from "0 times" to "5 or more times."

Perceptions of fruits and vegetables.

There were 20 items used to measure student perceptions of fruits and vegetables. These included scales for familiarity and preferences with responses of: "I do not like this," "I like this a little," "I like this a lot," and "I do not know what this is" for a list of 37 fruits and vegetables which were coded 1 to 4, respectively (14). Familiarity was a percentage of the total number of items that the students did not choose, "I do not know what this is." Preferences for fruits and vegetables was calculated as the average of the calculated scores (1–3) for all 37 fruits and vegetables. If a student was not familiar with the fruit or vegetable, it was excluded from the preferences score.

There were 20 items (10 for fruit and 10 for vegetables) from scales created to assess fruit and vegetable neophobias, or the reluctance to eat and/or avoid novel fruits and vegetables (15). The scales were validated by Hollar et al. in 1485 3rd to 5th grade students in the Farm to School Program in California and Oregon. Affinity scores, or the willingness to try new fruits and vegetables in a variety of situations (the opposite of neophobia), were calculated and reported. The scale included 6 items to determine whether the student liked novel fruits/vegetables (3 questions for fruit and 3 questions for vegetables: "How much do you like fruit/vegetables?" "How much do you like fruit/vegetables that you have never tried before?" And "How much do you like tasting new fruit/vegetables?"). The responses were on a 4-point scale: "not at all," "not very much," "a little," and "a lot." The scale also included 12 questions on the student's willingness to try fruits/vegetables in different situations (6 questions for fruit and 6 questions for vegetables: "Will you taste a fruit/vegetable if you don't know what it is?" "Will you taste a

TABLE 1 Demographics of students that completed both the pre- and postsurveys

Item	All *n* (%)	Intervention *n* (%)	Control *n* (%)
Total students	1104 (100%)	310 (28.1%)	794 (71.9%)
Grade			
9th	336 (30.4%)	115 (37.1%)	221 (27.8%)
10th	468 (42.4%)	130 (41.9%)	338 (42.6%)
11th	169 (15.3%)	37 (11.9%)	132 (16.6%)
12th	131 (11.9%)	28 (9.0%)	103 (13.0%)
Sex			
Male	397 (35.9%)	115 (37.1%)	282 (35.5%)
Female	707 (64.1%)	195 (62.9%)	512 (64.5%)
Race			
White	896 (81.2%)	251 (81%)	645 (81.2%)
Black	66 (6.0%)	27 (8.7%)	39 (4.9%)
Asian	45 (4.1%)	6 (1.9%)	39 (4.9%)
Other[1]	98 (8.9%)	26 (8.4%)	72 (8.9%)
Strata[2]			
Rural-distant	350 (31.7%)	137 (44.2%)	213 (26.8%)
Rural-fringe	134 (12.1%)	36 (11.6%)	98 (12.3%)
Suburb-large	140 (12.7%)	21 (6.8%)	119 (15%)
Suburb-small	64 (5.8%)	21 (6.8%)	43 (5.4%)
Town-distant	198 (17.9%)	38 (12.3%)	160 (20.2%)
Town-fringe	23 (2.1%)	13 (4.2%)	10 (1.3%)
City-large	216 (19.6%)	65 (21.0%)	151 (19.0%)

[1]Other included "American Indian or Alaska Native," "Native Hawaiian or Pacific Islander," and "Other".
[2]Locale codes from the National Center for Education Statistics (nces.ed.gov).

fruit/vegetable if it looks strange?" "Will you taste a fruit/vegetable if you have never tasted it before?" "When you are at a friend's house, will you try a new fruit/vegetable?" "When you are at school, will you try a new fruit/vegetable?" and "When you are at home, will you try a new fruit/vegetable?"). The responses were on a 4-point scale including "definitely not," "probably not," "probably," and "definitely." A score for fruit affinity was calculated by averaging the responses of the 9 fruit questions. A score for vegetable affinity was calculated the same way. The higher the score, the more willing the student was to try new fruits/vegetables in different situations. There were an additional 2 items from the same scale used to measure the number of times the student tried a new fruit or vegetable this year. The items were: "How many times have you tried a new fruit since you were at school this year?" and "How many times have you tried a new vegetable since you were at school this year?" The response choices used a 5-point interval scale ("never," "1 time," "2 times," "3 times," and "at least 4 times").

Knowledge of nutrition concepts.

There were 9 knowledge items on concepts from the 2015–2020 Dietary Guidelines for Americans. These were developed from materials on the MyPlate website (16). Five multiple choice items and 1 true/false item were about the food groups and recommendations in MyPlate ("According to MyPlate, how much of your plate should be a combination of fruits and vegetables?" "About how much of the grains you eat should be whole grains?" "What food group are beans and peas counted in?" "Select the 5 food groups in MyPlate," "Select the 5 vegetable subgroups in the vegetable group of MyPlate," "All products made from milk are part of the Dairy Group"). One true/false item was about measuring cup-equivalents of leafy vegetables ("2 cups of raw leafy green vegetables counts as 1 cup-equivalent of vegetables"), 1 multiple choice item was about the nutrients in whole fruit compared with fruit juice ("Which of these nutrients is more abundant in whole fruit compared to fruit juice?"), and 1 item was about which foods or food ingredients should be limited or increased ("Indicate whether the 2015 Dietary Guidelines encourage us to increase or limit the following foods or food ingredients as part of a healthy eating plan: saturated fat, whole fruit, added sugars, dark green vegetables, beans and peas, sodium, red and orange vegetables, *trans* fat, fat-free and low-fat dairy food, and whole grain food." Answer choices were, "Increase," "Decrease," and "Unsure." All answers were coded 1 for right and 0 for wrong. The knowledge score was calculated as the sum of correct answers and ranged from 0 to 9.

Statistical analysis

Data were analyzed as an intention-to-treat paradigm, that is, participants were included in analysis in original groups regardless of the amount or type of treatment received (17), using hierarchical linear modeling, with random effects for subjects and schools (level 1 = time point, level 2 = student, level 3 = school) and fixed effects for treatment group, time, treatment group × time interaction, strata, sex, and grade. The group × time interactions were the effects tested to determine if the intervention group of students had significantly different responses than the control group for knowledge of nutrition concepts from the dietary guidelines, familiarity, preferences, affinity, intake of and number of times trying novel fruits and vegetables across 2 time points.

Data were also treated as a per-protocol paradigm, that is, participants were grouped by the amount of treatment they received, regardless of treatment group (17). Here, the amount of curriculum received by the students in each class was assessed and the percent of the total curriculum received was calculated as the lessons taught, or received, divided by the total number of lessons in the curriculum, based on information reported by the teachers. The amount of curriculum received was then categorized into 3 levels: none, low, and high. None were those who received no curriculum (i.e., control group, students that received the usual curriculum from 18 teachers). Low were those who received less than half (1–50%) of the curriculum (students that received less instruction on the new curriculum as reported by 7 teachers) and high were those who received more than half (51–100%) of the curriculum (students that received this level of instruction as reported by 8 teachers). None of the teachers delivered between 41 and 60% of the curriculum, so students in the low group received between 1 and 40% of the lessons in the curriculum and the high group received between 61 and 100% of the curriculum.

Hierarchical linear modeling was performed with random effects for subjects and schools (level 1 = time point, level 2 = student, level 3 = school), and fixed effects for curriculum level (none, low, high), time, curriculum level × time interaction, strata, sex, and grade. The curriculum level × time interaction was the effect tested to determine differences between groups of students for knowledge of nutrition concepts from the dietary guidelines, familiarity, preferences, affinity, intake of and number of times trying novel fruits and vegetables due to the amount of curriculum they received across 2 time points.

Statistical analysis for hypothesis tests was conducted using IBM SPSS 25 and the SAS system for Windows 9.4.

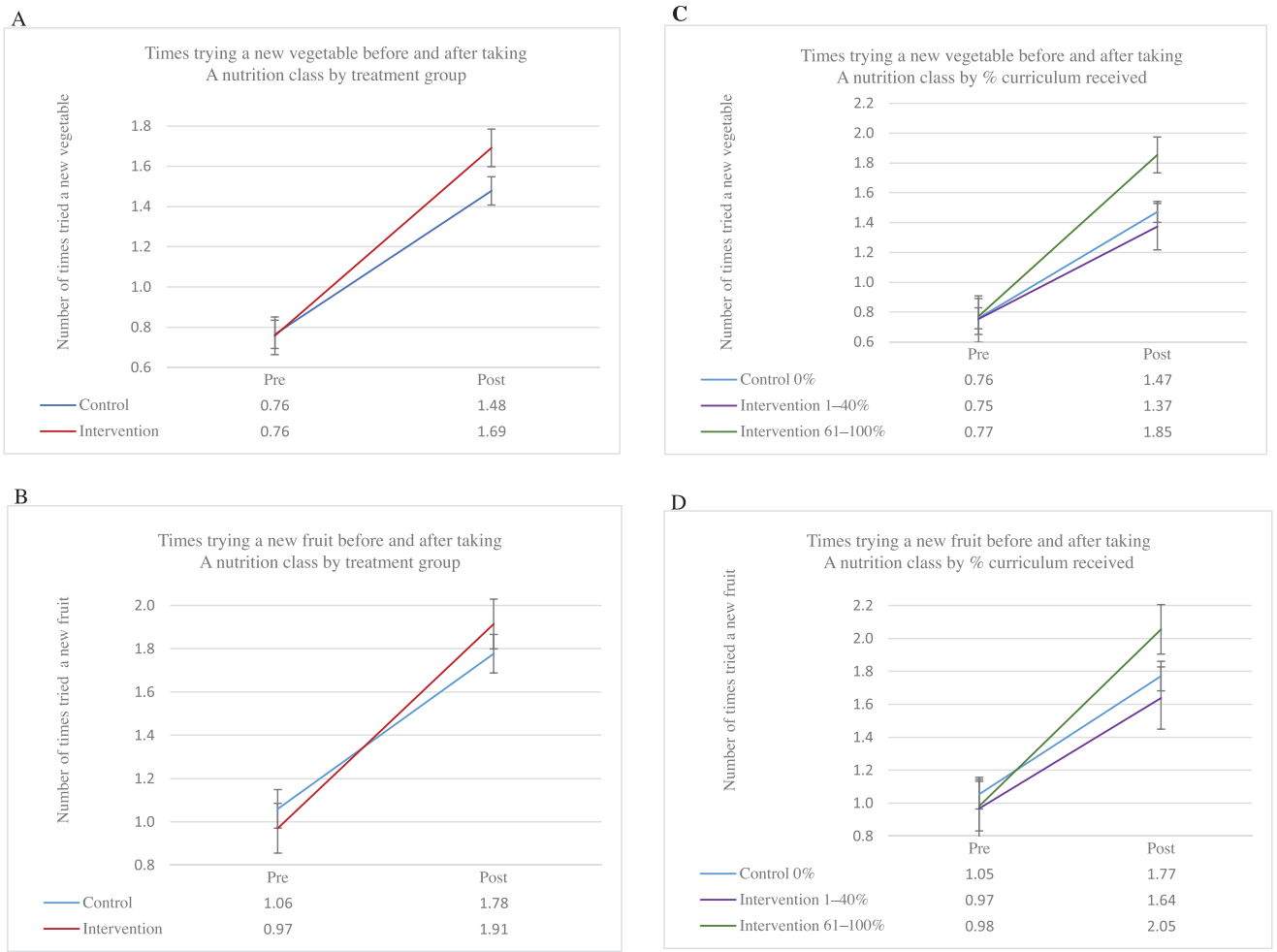

FIGURE 4 Significant outcomes by treatment group and by amount of curriculum received.

Results

There were 22 teachers in the intervention group that received training in how to teach the new curriculum and offered the pretest to their 963 students. There were 19 teachers in the control group who offered the pretest to their 1370 students. After exclusions due to incomplete data, student absences, students opting to not take the survey, and teacher dropouts, 310 students in the classes of 14 teachers from the intervention group and 794 students in the classes of 19 teachers in the control group completed both the pre- and posttests and were included in the analysis (**Figure 3**).

Table 1 shows the demographics of students that completed both the pre- and postsurveys. Overall, 10th graders comprised the largest group of students followed by 9th graders. There were more girls than boys with 707 (64.1%) and 397 (35.9%), respectively. The majority of students self-identified as white (81.2%).

There was a higher increase in the number of times students in the intervention group tried a new vegetable ($P = 0.022$) and fruit ($P = 0.027$) (**Figure 4**A and 4B, respectively) than that of students in the control group (**Table 2**).

This effect was amplified when the intervention students were split into 3 groups describing the amount of curriculum received. There was a difference in the number of times students reported that they tried new fruits and vegetables among the level of curriculum they received (group × time interaction $P = 0.002$ for vegetables and $P = 0.009$ for fruit) (Figure 4C and 4D, respectively). The students in the category who received the most lessons from the new curriculum increased more in the number of times they reported that they tried new vegetables ($P = 0.001$) and fruit ($P = 0.003$) than those that received none of the new curriculum (controls, $P = 0.002$ for vegetables and $P = 0.003$ for fruit) and those who received a lower amount (1–40%) of the curriculum ($P = 0.007$ for vegetables and $P = 0.029$ for fruit).

There were no significant differences between treatment groups or curriculum levels for familiarity or preferences of fruit and vegetables, affinity toward fruit or vegetables, daily intake of fruit, whole fruit, or vegetables, or knowledge of the 2015–2020 Dietary Guidelines for Americans. There were also no significant differences between students in different strata based on geographic location of the school and school size.

TABLE 2 Changes in students' responses over time by treatment group

Item	All Pre n = 1721 Mean ± SE	All Post n = 1104 Mean ± SE[1]	Intervention Pre n = 522 Mean ± SE	Intervention Post n = 310 Mean ± SE[2]	Control Pre n = 1199 Mean ± SE	Control Post n = 794 Mean ± SE[3]	P[4]
Familiarity with fruit and vegetables (%)	91.24 ± 0.43	93.28 ± 0.48***	91.68 ± 0.65	93.49 ± 0.74**	90.8 ± 0.53	93.06 ± 0.56***	0.541
Preferences for fruit and vegetables[5]	2.02 ± 0.02	2.02 ± 0.02	2.01 ± 0.02	2.02 ± 0.03	2.02 ± 0.02	2.02 ± 0.02	0.341
Affinity toward vegetables[6]	2.64 ± 0.03	2.62 ± 0.03	2.64 ± 0.05	2.62 ± 0.05	2.64 ± 0.04	2.62 ± 0.05	0.864
Affinity toward fruit[6]	3.22 ± 0.03	3.18 ± 0.03*	3.18 ± 0.04	3.16 ± 0.04	3.26 ± 0.03	3.21 ± 0.03*	0.504
Tried new vegetable this year (times)	0.76 ± 0.05	1.58 ± 0.06***	0.76 ± 0.08	1.69 ± 0.09***	0.76 ± 0.07	1.48 ± 0.07***	0.022*
Tried new fruit this year (times)	1.01 ± 0.07	1.85 ± 0.08***	0.97 ± 0.10	1.91 ± 0.12***	1.06 ± 0.09	1.78 ± 0.09***	0.028*
Fruit intake[7] (times/day)	3.27 ± 0.10	3.59 ± 0.11***	3.14 ± 0.15	3.50 ± 0.17**	3.40 ± 0.13	3.68 ± 0.13***	0.627
Whole fruit intake (times/day)	2.10 ± 0.07	2.20 ± 0.07	2.02 ± 0.10	2.13 ± 0.11	2.16 ± 0.08	2.26 ± 0.09	0.871
Vegetable intake (times/day)	1.84 ± 0.06	2.06 ± 0.07***	1.83 ± 0.09	2.04 ± 0.11*	1.84 ± 0.08	2.08 ± 0.08***	0.776
Knowledge of Dietary Guidelines[8]	3.19 ± 0.10	3.68 ± 0.11***	3.21 ± 0.15	3.75 ± 0.16***	3.18 ± 0.13	3.61 ± 0.13***	0.312

* $P < 0.050$; ** $P < 0.010$; *** $P < 0.001$.

[1] Asterisks (*) in this column indicate significant differences pre to post for all students, regardless of treatment group.

[2] Asterisks (*) in this column indicate significant differences pre to post for students in the intervention group only.

[3] Asterisks (*) in this column indicate significant differences pre to post for students in the control group only.

[4] P value is for time × treatment interactions. It is the changes in intervention from pre to post compared with the changes in control pre to post.

[5] Scores ranged from 1 to 3. Measure is average of scores for 37 fruits and vegetables, with a higher score indicating greater preferences.

[6] Scores ranged from 1 to 4 with a higher score indicating more affinity, or willingness to try new fruits and vegetables in different situations.

[7] Fruit intake is a combination of the number of times a student reported drinking 100% fruit juice and eating whole fruit.

[8] Scale is from 0 to 9. Score is the sum of correct responses for 9 knowledge items.

Overall (regardless of treatment group), familiarity with fruits and vegetables ($P < 0.001$), intake of fruit ($P < 0.001$), intake of whole fruit ($P = 0.57$; not significant), intake of vegetables ($P < 0.001$), and knowledge of the dietary guidelines ($P < 0.001$) increased from pretest to posttest. Table 2 shows the changes over time for all outcome measures.

In total, girls had higher scores compared with boys for familiarity with fruits and vegetables ($P < 0.001$), preferences of fruits and vegetables ($P < 0.001$), affinity toward fruit ($P = 0.057$; not significant), affinity toward vegetables ($P = 0.002$), and knowledge of the Dietary Guidelines ($P < 0.001$). However, boys tried more new vegetables ($P = 0.004$) and new fruits ($P = 0.008$). Boys also reported higher daily intakes of fruits ($P < 0.001$) compared with girls; however, that effect was attenuated when fruit juice was not included in the analysis. There were no differences between genders for intake of whole fruit or vegetables.

Discussion

The 310 students who were in the classes of the 14 teachers who received training in the new curriculum entitled *Forecasting Your Future: Nutrition Matters*, reported more significant increases in the amount of fruits and vegetables that they tried compared with the 794 students in the control group. The students who received $>\frac{1}{2}$ of the curriculum reported trying more fruits and vegetables than both the control group and the students in the intervention group that received $<\frac{1}{2}$ of the curriculum. This indicates that when teachers used a majority of the curriculum, the students were likely to try more new fruits and vegetables. Exposure to novel fruits and vegetables at this stage is important because it could affect whether or not they will be willing to try the food again and ultimately affect their health in the long-term. This is in line with previous research that has shown that repeated exposure increased preferences for and consumption of fruits and vegetables in children (18–22). Wardle et al. (21) found that students who were exposed to and offered red bell peppers 8 times in a school-based program significantly increased their preferences for red peppers compared with both control and reward groups. Additionally, a recent study by Ehrenberg et al. (22) found that applying repeated exposures incorporating hands-on cooking increased children's preferences for what were initially their least liked fruits and vegetables.

The curriculum was informed by Social Cognitive Theory. There is conflicting evidence as to whether interventions that are guided by theory are more successful than those that do not have a theoretical foundation. Some studies support this conclusion (23, 24), whereas other reviews have shown no difference in success between interventions that were and were not informed by theory (25, 26). A reason for this discrepancy could be a lack of consistent reporting about how theory was used in the intervention. The current study aimed to be transparent about how theory was utilized in the creation of the curriculum. Students who received the curriculum did try more new fruits and vegetables, indicating that the lessons in Unit 3 (Figure 1) that focused on preparing fruits and vegetables were successful in that regard. Future studies could include questions on both the pre- and posttests regarding the theoretical constructs. There is a need for more validated scales in this area for adolescent dietary behavior.

Students in Family and Consumer Sciences classes, regardless of treatment group, had significant increases in familiarity with fruits and vegetables, daily intake of fruits and vegetables, and knowledge of the 2015–2020 Dietary Guidelines for Americans. These results are consistent with previous studies of nutrition education. A meta-analysis by Dudley et al. (27) compared 49 school-based nutrition education programs in primary schools and found that hands-on learning strategies, such as cooking, had the greatest impact on reducing food intake, increasing nutritional knowledge, and fruit and vegetable preferences or consumption. Jarpe-Ratner et al. (28) showed that a program including experiential nutrition and cooking education led by chef-instructors increased nutrition knowledge of, exposure to, and consumption of fruits and vegetables in elementary and middle school children. Learning to cook in adolescence can also have long-term implications; Utter et al. (29) found that young adults who said that they could cook very adequately reported preparing meals with fruits and vegetables more frequently 10 y later.

Many interventions related to nutrition education are conducted in elementary and middle schools. This study showed that classes that include nutrition concepts and hands-on cooking experiences are beneficial for students and should be encouraged at the high school level. Collaborating with instructors who already teach nutrition shows promise for future studies.

There were significant differences between the results of the boys and girls enrolled in nutrition classes. Girls were more familiar with and reported having higher preferences of fruits and vegetables, had higher nutrition knowledge scores, and reported being more willing to try fruits and vegetables, yet boys reported actually trying significantly more new fruits and vegetables and had higher intakes of fruit than girls. It is possible that the girls had already tried the fruits and vegetables that the boys reported trying for the first time. The difference in daily intake of fruit was due to boys reporting drinking more 100% fruit juice and was attenuated when only looking at the intake of whole fruit. Since the Dietary Guidelines suggest shifting to whole fruit over fruit juice, this is an area that should be focused on in future curricula. Several limitations apply to this study. The data relied entirely on self-reports from both teachers and students, which could be subject to bias. For example, students could have answered in a way that they thought was expected of them. Additionally, the interval between baseline and posttest was narrow, students completed surveys at the beginning and end of the semester. The students' preferences for fruits and vegetables did not significantly change over this 4-mo period, yet they reported trying more fruits and vegetables. Therefore, a longer follow-up period would allow better understanding of the long-term effectiveness of the intervention.

Another limitation was that only 8 of the 14 teachers in the intervention group taught more than half of the curriculum. Five teachers indicated they dropped out of the study because they did not use the curriculum. It is not known why they did not use it. Several teachers that used the curriculum said the material was difficult for their students, whereas others said that the curriculum was too easy for their students and they needed more in-depth lessons. Creating different levels of the curriculum could make it more adaptable to individual teacher needs. Also, some teachers said that they had difficulty implementing the curriculum right away due to school policy regarding planning and budgeting. The training took place in April 2018 and the teachers were asked to use the curriculum starting August 2018. Some schools required information on curriculum and budget in advance of the period these teachers had following the training. Finally, planning to teach a new curriculum can be time intensive. The teachers indicated that they may be able to teach more of the curriculum after they have more time to become familiar with it. Once teachers have some experience teaching the new curriculum, it is possible that more student outcomes may improve.

Overall, the new curriculum, *Forecasting Your Future: Nutrition Matters,* that includes messages from the 2015–2020 Dietary Guidelines for Americans has promise for increasing exposure to new fruits and vegetables for students. Further research is needed to determine the long-term effects of receiving nutrition curricula in high school on students' health outcomes.

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