Can an Educational Program on the Nutritional Benefits of Citrus Fruit Positively Influence the Nutritional Attitudes of Children?

Shari Koch¹, Sarah Lineberger², and J.M. Zajicek³

ADDITIONAL INDEX WORDS. nutrition, nutrition education, elementary schools

SUMMARY. The *Citrus Guide, Teaching Healthy Living Through Horticulture* (*Citrus Guide*) is an activity guide designed to help teachers integrate nutrition education into their classrooms. The objectives of this research project were to: 1) help teachers integrate nutrition education, specifically as it relates to citrus fruit, into their curricula by using the *Citrus Guide*; and 2) evaluate whether students developed more positive attitudes towards citrus fruit by participating in activities from the *Citrus Guide*. The nutritional attitudes of 157 second through fifth grade students were measured with a citrus fruit preference questionnaire divided into two sections: one targeting citrus fruit and the other targeting citrus snacks. After participating in the activities, no differences were detected in attitudes towards citrus fruit. However, students did have more positive attitudes towards citrus snacks after participating in the activities, with female students and younger students having the greatest improvement in citrus snack attitude scores. Also, there was a direct positive correlation between more grapefruit and oranges consumed daily and students' attitudes towards citrus fruit.

Because of increasing concerns about Americans' health, a "National Action Plan to Improve the American Diet" has been developed to achieve the goals of "Healthy People 2000: National Health Promotion and Disease Prevention Objectives" (Mullis et al., 1995). One of the main goals of Healthy People 2000 is called "5 A Day for Better Health," which encourages the consumption of five or more fruit and vegetables a day (Domel et al., 1993). Citrus is an important part of this program. Fruit such as oranges and grapefruit are available year round throughout the country and can provide many important vitamins, including vitamin C, which must be replenished daily.

Health benefits of fruit and vegetables have been widely promoted and consumption by the average American seems to be increasing. However, there are still many segments of the population that need to be reached. Currently,

children ages 6–12 years eat an average of only 2.13 fruit and vegetables a day, less than half of the recommended servings (Cullen et al., 2001).

Because children spend much of their time in the school setting, schools have an opportunity to influence nutritional attitudes and behaviors. Activities in a familiar situation may help students become more knowledgeable about fruit and vegetables, including citrus fruit. By exposing children to what citrus fruit are and by gaining experience in preparing these fruit, children's consumption of citrus fruit may increase.

There are a number of curricular techniques that can teach nutrition education, one being horticulture. A study of a horticulture gardening program for seniors found improved nutritional attitudes and consumption of fruit for those participating (Hackman and Wagner, 1990). Another study in an urban setting found that individuals who gardened ate more vegetables than those who did not (Blair et al., 1991). Therefore, horticulture may be an effective teaching tool for children to learn nutrition education, particularly the importance of eating fruit and vegetables.

The purpose of this study was to give teachers a resource to help

them integrate nutrition education, specifically related to citrus, into their curricula and measure its impact on students nutritional attitudes. The resource used was the *Citrus Guide, Teaching Healthy Living Through Horticulture* (*Citrus Guide*) (Lineberger et al., 1999). This publication is an activity guide intended to increase children's exposure to citrus and it emphasizes the importance of incorporating citrus fruit into their diet. An additional objective of this study was to evaluate whether students developed more positive attitudes about citrus after participating in this program.

Materials and methods

ACTIVITY GUIDE. The *Citrus Guide* (Lineberger et al., 1999) is designed to incorporate the use of citrus fruit into a broad range of educational disciplines. The activities in the guide are divided into six chapters. The six chapters and 24 activities include topics on: 1) the history of citrus, 2) growing citrus, 3) harvesting citrus fruit, 4) buying citrus, 5) preparing citrus and 6) nutritional values of citrus fruit. This guide can be used the entire year. Activities are intended to supplement existing curricula and do not build on each other. Their use as supplemental materials within lesson plans was at the discretion of the teachers.

SAMPLE POPULATION. This study was conducted during the spring term of the 1999–2000 school year in cooperation with six elementary schools in the lower Rio Grande Valley of Texas. The teachers of the participating classes volunteered to be a part of this study. One hundred fifty-seven second through fifth grade students completed both a pretest questionnaire prior to participating in the curriculum and a posttest questionnaire after completing the curriculum. Between testing, the children participated in activities from the *Citrus Guide* (Lineberger et al., 1999). The number of activities completed by the students was up to the discretion of the teacher.

INSTRUMENTATION. Students' nutritional attitudes regarding citrus were measured using a two-part fruit preference questionnaire which was a modified version of the fruit and vegetable questionnaire developed by Dr. T. Baranowski, Professor of Behavioral Nutrition, Baylor College of Medicine (Domel et al., 1993). The first part included a list of five commonly con-

Acknowledgements: The authors express appreciation for the financial support of the Texas Citrus Producers Board and TexaSweeT® Citrus Marketing, Inc.

¹Graduate Research Assistant.

²Texas Cooperative Extension, County Extension Agent–Horticulture, 1402 Band Road Suite 100, Rosenberg, TX 77471.

³Professor, Department of Horticultural Sciences, Texas A&M University, College Station, TX 77843-2133.

sumed citrus fruit and their by-products including oranges, grapefruits, tangerines, orange juice, and grapefruit juice (Table 1). This section of the questionnaire measured questions using a Likert-type scale (Likert, 1967). The three possible responses to each citrus and the points associated with each response included: 2 = "I like this a lot", 1 = "I like this a little", and 0 = "I do not like this". One hundred fifty seven students completed this part of the questionnaire. The second part of the questionnaire included eight snack preference questions (Table 2). Students were asked to make a choice between two snack items. One of the items included a citrus fruit and the other was a non-fruit snack eaten after school (e.g., ice cream). On the snack preference questions, a student received one point for choosing the citrus fruit snack and zero points for choosing the other option. One hundred forty-one students completed the snack portion of the questionnaire. The points within each section were summed so that each student had an overall score on each section. The fruit preference section score ranged from 0 to 10 while the snack preference section score ranged from 0 to 8. Higher scores indicated better fruit preferences/attitudes of participating children. A Cronbach's alpha reliability test indicated that for this sample and study, the reliabilities of each of the sections of the citrus fruit questionnaire resulted in coefficients of 0.68 for the fruit preference section and 0.75 for the snack preference section showing it to have an acceptable level of internal consistency (Sapp and Jensen, 1997). This is similar to the original study which had coefficients of 0.73 for the fruit portion and 0.74 for the snack portion (Domel et al., 1993).

The citrus fruit questionnaire asked for student demographic information, including gender, school, grade, ethnicity, and place of residence. In addition, this section included questions regarding the daily consumption of oranges, grapefruit, glasses of orange juice, and glasses of grapefruit juice by the student.

DATA ANALYSIS. Attitude changes were evaluated using SPSS (release 10.0 for Windows; SPSS, Chicago). Paired sample *t* tests were used to test for statistical significance between pretests and posttests. Additionally, comparisons of demographic

Table 1. Citrus fruit preference questions used in the citrus fruit questionnaire in the Rio Grande Valley of Texas to study students' attitudes towards citrus fruits.

	I like this a lot ^z	I like this a little ^y	I do not like this ^x
Orange juice	☺	☹	☹
Grapefruit juice	☺	☹	☹
Oranges	☺	☹	☹
Grapefruit	☺	☹	☹
Tangerines	☺	☹	☹

^zWorth 2 points during scoring.

^yWorth 1 point during scoring.

^xWorth 0 points during scoring.

Table 2. Snack preference questions used in the citrus fruit questionnaire in the Rio Grande Valley of Texas to study students' attitudes towards citrus fruits as a snack.

Question ^z		
1. An orange or grapefruit	or	My favorite cookie
2. Peanut butter on bread	or	An orange or grapefruit
3. An orange or grapefruit	or	My favorite ice cream
4. My favorite candy bar	or	An orange or grapefruit
5. An orange or grapefruit	or	My favorite soft drink
6. An orange or grapefruit	or	My favorite raw vegetable & dip
7. My favorite chips	or	An orange or grapefruit
8. An orange or grapefruit	or	A fried fruit pie

^zFruit choices were worth 1 point and non-fruit choices were worth 0 points during scoring.

Table 3. Paired *t* test comparisons between pretest and posttest fruit and snack preference scores for students participating in the citrus fruit questionnaire in the Rio Grande Valley of Texas.

Group and variable of interest	Cases (no.)	Mean score	SD	df	<i>t</i>	<i>P</i>
Fruit preference^z						
Pretest	157	7.31	2.32	156	-1.049	0.296
Posttest	157	7.52	1.96			
Snack preference^y						
Pretest	141	3.74	2.30	140	-4.542	0.000*
Posttest	141	4.65	2.26			

^zScores range from 0.000 to 10.000.

^yScores range from 0.000 to 8.000.

*Significant at *P* ≤ 0.05.

information were accomplished using multivariate analysis of variance tests with pretests acting as covariates. To test the relationship between amount of citrus fruit consumed and attitude, Pearson's product-moment correlation was used. Each section of the citrus fruit questionnaire, including fruit preference and snack preference, were analyzed separately.

Results and discussion

FRUIT PREFERENCE SECTION. Paired *t* tests were performed to investigate variation between pretest and posttest scores on the fruit preference section of the citrus fruit questionnaire. Fruit preference scores of students did not significantly improve after participating in the program (Table 3). Both

the pretest and posttest fruit preference scores were high, indicating that students had a positive attitude towards citrus fruit before and after participating in the citrus program. The existing positive attitudes towards citrus fruit, and the fact that the students live in an area that produces large amounts of citrus which exposes children to eating citrus regularly, may help to explain the lack of improvement in the fruit preference scores.

SNACK PREFERENCE SECTION. Pretest and posttest scores for the snack preference section of the questionnaire were compared using paired *t* tests and statistically significant differences were found between the scores (Table 3). Overall, students participating in the *Citrus Guide* activities increased

their snack preference scores by 0.91 points. These results are similar to those reported by Lineberger and Zajicek (2000) where third through fifth graders improved their snack preference scores after participating in a school gardening program. Increasing fruit and vegetable consumption at snack time has been cited as an important way to improve the nutritional habits of children (Kennedy and Goldberg, 1995). Multiple analysis of variance tests were performed to investigate the variation between pretest and posttest scores on the snack preference section based on other factors including grade, gender, and ethnicity. Statistically significant differences were found in the pretest scores for the snack preference section of the questionnaire based on grade level with second graders scoring at least 1 point lower than students in the other grades (Table 4). However, by the end of the study, second graders had improved their scores sufficiently to eliminate the significant differences. Greater improvement in nutritional attitudes by students with initially lower scores has been found by previous researchers and may be due to the fact that students with lower scores have more room for improvement (Shannon and Chen, 1988). It is also important to note that nutritional habits are formed early in life and therefore targeting younger children may improve nutritional behaviors (Cullen et al., 1997). This indicates that the *Citrus Guide* had a positive effect on students with the most need for improvement.

When comparisons were made between pretest and posttest snack preference scores of boys and girls, there were no statistical differences between genders. However, a paired *t* test indicated that both boys and girls significantly improved their snack preference scores. Girls' points increased in snack preference scores by 1.1 points and boys increased by 0.74 points between pretest and posttest scores (Table 5). In other studies, differences in nutritional attitudes have been reported with girls tending to have better nutritional attitudes compared to boys (Worsley et al., 1984). This was not the case in the citrus study. Ethnicity and place of residence did not have any effect on the scores.

RELATIONSHIP BETWEEN CITRUS FRUIT CONSUMPTION AND ATTITUDE. Statistically significant correlations

Table 4. Multiple analysis of variance comparisons among pretest and posttest snack preference scores of the students participating in the citrus fruit questionnaire in the Rio Grande Valley of Texas based on grade level.

Grade	Cases (no.)	Mean score ^a	SD	df	F	P
Pretest						
2	107	3.23	2.38	3	6.054	0.001*
3	18	5.06	2.31			
4	19	4.68	2.06			
5	35	4.40	1.72			
Posttest						
2	95	4.22	2.48	3	2.368	0.073
3	14	5.29	2.39			
4	19	5.53	1.84			
5	36	4.58	1.66			

^aScores range from 0.000 to 8.000.

*Significant at $P \leq 0.05$.

Table 5. Paired *t* test comparisons between pretest and posttest snack preference scores of females and males participating in the citrus fruit questionnaire in the Rio Grande Valley of Texas.

Gender	Cases (no.)	Mean score ^a	SD	df	<i>t</i>	P
Female						
Pretest	68	3.96	2.19	67	-4.296	0.000*
Posttest	68	5.06	2.01			
Male						
Pretest	73	3.53	2.40	72	-2.408	0.019*
Posttest	73	4.27	2.43			

^aScores range from 0.000 to 8.000.

*Significant at $P \leq 0.05$.

Table 6. Pearson's correlations for the relationship between the number of grapefruit and oranges consumed in a day and the citrus fruit attitudes of students participating in the citrus fruit questionnaire in the Rio Grande Valley of Texas.

Posttest attitude score	Grapefruit consumed (no.)	Oranges consumed (no.)
<i>r</i>	0.157	0.169
<i>p</i>	0.024*	0.015*
<i>n</i>	207	206

*Significant at $P \leq 0.05$.

were found between citrus fruit intake and combined posttest attitude scores, the sum of both the preference and the snack sections of the posttest questionnaire for both grapefruit and oranges (Tables 6). The number of grapefruit a student consumed a day was significantly correlated with posttest attitude scores. These scores were positively correlated indicating that, in general, the more grapefruit a student consumed in a day, the more positive they felt towards citrus fruit (Table 7). Positive correlations were also recorded for oranges indicating that, in general, the more oranges a student consumed

Table 7. The relationship of the number of grapefruits and oranges consumed in a day and the citrus fruit attitudes posttest scores of students participating in the citrus fruit questionnaire in the Rio Grande Valley of Texas.

Fruit consumed (no.)	Mean score ^a	SD
Grapefruit		
0	9.06	5.39
1	10.23	5.09
2	11.45	3.83
>2	11.03	5.66
Oranges		
0	9.95	5.07
1	8.52	5.53
2	10.06	4.82
>2	11.51	5.24

^aScores range from 0.00 to 18.00.

in a day, the more positive they felt towards citrus fruit (Table 7).

The integration of activities from the *Citrus Guide* (Lineberger et al., 1999) appeared to have an impact on snack attitude preference scores of students that participated in these activities increasing their preference for citrus fruit snacks over non-fruit snacks

by the end of the program. In addition, the positive correlations found between the number of grapefruit and oranges eaten by students and their citrus fruit attitudes helps to reinforce the fact that the better attitudes students have towards fruit and vegetables, the higher their consumption of these foods. Increasing fruit and vegetable consumption as snacks has been cited as an important way to improve the nutritional habits of children (Kennedy and Goldberg, 1995), and improving fruit and vegetable snack attitudes is an important step in that direction.

Literature cited

- Blair, D., C.C. Giesecke, and S. Sherman. 1991. Dietary, social and economic evaluation of the Philadelphia Urban Gardening Project. *J. Nutr. Educ.* 23:161–167.
- Cullen, K.W., L.K. Bartholomew, and G.S. Parcel. 1997. Girl Scouting: An effective channel for nutrition education. *J. Nutr. Educ.* 29:86–91.
- Cullen, K.W., T. Baranowski, L. Rittenberry, C. Cosart, D. Hebert, and C. de Moor. 2001. Child-reported family and peer influences on fruit, juice and vegetable consumption: Reliability and validity of measures. *Health Educ. Res.* 16:187–200.
- Domel, S.B, T. Baranowski, H. Davis, S.B. Leonard, P. Riley, and J. Baranowski. 1993. Measuring fruit and vegetable preferences among 4th- and 5th-grade students. *Preventive Medicine* 22:866–879.
- Hackman, R.M. and E.L. Wagner. 1990. The senior gardening and nutrition project: development and transport of a dietary behavior change and health promotion program. *J. Nutr. Educ.* 22:262–270.
- Kennedy, E. and J. Goldberg. 1995. What are American children eating? Implications for public policy. *Nutr. Rev.* 53:111–126.
- Likert, R. 1967. The method of constructing an attitude scale. In: M. Fishbein (ed.). *Readings in attitude theory and measurement*. Wiley, New York.
- Lineberger, S., S. Grahmann, and J.M. Zajicek. 1999. Citrus guide, teaching healthy living through horticulture. Texas Coop. Ext., College Station.
- Lineberger, S. and J. Zajicek. 2000. School gardens: Can a hands-on teaching tool affect students attitudes and behaviors regarding fruit and vegetables. *HortTechnology* 10:593–597.
- Mullis, R.M., A. Owen, and L. Blaskovich. 1995. National action conference on healthy eating for children: A policy dialogue. *J. Nutr. Educ.* 27(5):222–224.
- Sapp, S.G. and H.H. Jensen. 1997. Reliability and validity of nutrition knowledge and diet-health awareness tests developed from the 1989–1991 diet and health knowledge surveys. *J. Nutr. Educ.* 29:63–72.
- Shannon, B. and A.N. Chen. 1988. A three-year school-based nutrition education study. *J. Nutr. Educ.* 20:114–124.
- Worsley, A., P. Baghurst, A.J. Worsley, W. Coonan, and M. Peters. 1984. Australian ten-year-olds' perceptions of food: I. Sex differences. *Ecol. Food Nutr.* 15:231–246.