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Kathleen Evers
University of Kentucky

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Kathleen Evers, Student

Mark Swanson, Ph.D., Committee Chair

Linda Alexander, EdD, Director of Graduate Studies

Farm to School Programs and Children's Dietary Behaviors

Capstone Project Paper

A paper submitted in partial fulfillment

of the requirements for the degree of

Master of Public Health

In the

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By: Kathleen Evers

Lexington, KY

April 20, 2015

Mark Swanson, PhD., Committee Chair

Alex Howard, PhD., Committee Member

Linda Alexander, PhD., Committee Member

Abstract

There is an increasing promotion of the importance of fruit and vegetable consumption through prevention efforts, specifically in school systems, to control and prevent childhood obesity. Farm to School (FTS) programs offer interactive hands on experiences involving fruits and vegetables. This study examines a specific FTS program including a farmer interaction, and a broccoli taste testing experience for kindergarten and fourth grade students in a rural Kentucky county. By using a digital still photography method of plate waste, the decisions of approximately 115 students to take/not take broccoli and percentage of students' consumption of broccoli was analyzed. Using chi-square and ANOVA analysis the intervention was compared to a control, while also factoring grade level (K and 4th) and time. Time included: immediately following the intervention (T1) and 2 weeks post intervention (T2). The intervention group took 10% more broccoli than control groups, and 12% of children who received the intervention ate almost the entire broccoli serving (>75%). Kindergarten and fourth grade students did not significantly differ in decision to take, but fourth graders consumed more broccoli than kindergarteners. When comparing T1 and T2 percentages, consumption drops dramatically in T2, meaning the intervention effect did not sustain. FTS has an impact on children's perceptions and actions regarding choosing and consuming vegetables, but are only part of the child's sphere of influences. Changes to children's total environments will be necessary to produce lasting change. By establishing FTS consistently in schools, Public Health can take one step further in decreasing childhood obesity.

Introduction

The current generation of children may be the first in over 100 years to live shorter and less healthy lives than their parents because of obesity related illnesses ⁽¹⁾. Dietary Guidelines for Americans, 2010, recommends that Americans aged ≥ 2 years eat more fruits and vegetables to add important nutrients that are under-consumed, reduce the risk of heart disease, stroke, and some cancers, and help manage weight ⁽³⁾. Most U.S. residents, including children, consume too few fruits and vegetables. In 2007–2010, 60% of children aged 1–18 years did not meet U.S. Department of Agriculture Food Patterns fruit intake recommendations, and 93% did not meet vegetable recommendations ^(2,4). Because of the benefits of eating fruits and vegetables and because childhood dietary patterns are associated with food patterns later in life, encouraging children to eat more fruits and vegetables is a public health priority ⁽⁴⁾.

Overweight and obesity track into adulthood and increase the risk of early-onset weight related chronic diseases. Obesity's causes are multi factorial, many of which beginning early in life ⁽⁵⁾. Once individuals become obese, it is very difficult to reverse through interventions. In this context, the role of primary prevention is critical ⁽⁶⁾.

Most interventions addressing the problem have been based on individual level behavioral changes, dietary modifications, and exercise. However, these strategies have had little impact on the growing increase of the obesity epidemic ⁽⁷⁾. Therefore, the prevention efforts are now best focused on key behaviors associated with the development of obesity, although other factors including genetics also contribute to the risk. There is modest evidence to suggest that modification of the factors such as the built environment may help to prevent the development of obesity ⁽⁶⁾.

Many programs have targeted healthier dietary behavior within the school

environment ⁽²⁾. In recent years, policymakers have recognized the important role schools can play in the effort to control and prevent childhood obesity by fostering healthy lifestyles. According to the literature, there is an encouragement for interventions to create more emphasis on diet rather than physical activity in the effort to decrease childhood obesity ⁽²⁾. Noting that accurate measurement of physical activity is complex and that comparisons between studies are difficult because of differences in designs and methods, some researchers have questioned whether it is possible to demonstrate an effect of physical activity in reducing obesity ⁽⁸⁾. It is easier to reduce energy intake by 500 to 1000 kcal (2100 – 4200 kJ)/day, than to increase energy expenditure by a similar amount, physical activity has less impact on weight loss than does dietary intervention ⁽⁸⁾.

A solution to preventing childhood obesity by focusing specifically on diet is Farm to School (FTS). FTS is an increasingly popular program in school systems that provides nutrition education and exposure to locally grown foods while also supporting local farmers ⁽²⁾. FTS has been described as “a program that connects schools (K-12) and local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing agriculture, health and nutrition education opportunities, and supporting local and regional farmers,”⁽⁹⁾. In order to maximize the benefits of a farm to school program an interactive and hands on experience must occur. There is evidence that a vegetable farm field trip that offers experiential learning and vegetable-tasting opportunities may enhance students’ knowledge about growing vegetables and acceptance of vegetables ⁽¹⁰⁾. A farm field trip provides an opportunity for food-related experiential learning and an alternative to school gardens ⁽¹⁰⁾.

Researchers have had varying degrees of success in measuring cognitive learning resulting from a school field trip, but the evidence generally suggests that such trips can have a positive impact on learning of facts and concepts.

The goal of this study is to evaluate an intervention to determine whether or not an interactive Farm to School experience and interaction with a local farmer, impacts children's decision to take and consume vegetables available during school lunch. Broccoli will be utilized in the taste testing experience and its frequency of being chosen and consumption will be analyzed. This study acts as exploratory research; we are using a novel idea and method to address a significant health issue.

A major strength of Farm to School experiences is their foundation in the Socio-Ecological Model (SEM). The SEM emphasizes the interaction between, and interdependence of, factors within and across all levels of health behavior, recognizing that most public health challenges are too complex to be adequately understood and addressed from single level analysis ⁽¹⁵⁾. This study will utilize multiple levels of the SEM by changing the physical environment- granting availability and access to broccoli to the entire sample, and then also intervening at the interpersonal level for the intervention group- creating a relationship with the farmer and having a taste test experience (Figure 1). By incorporating multiple levels of the Socio-Ecological Model we will develop a better understanding of relationships between elementary aged children and their health behaviors in regards to fruit and vegetable consumption. We will be able to further describe a potential method to decreasing childhood obesity and create a springboard for further inquiry and implementation.

Methods

Intervention

In this study, the intervention consisted of an interactive farm to school experience. A local farmer, who was growing a variety of produce, including broccoli for the project, visited kindergarten and fourth grade classrooms and conducted a broccoli taste test with the students. This experience allowed students to genuinely interact with the farmer, learn more about vegetables, and taste test broccoli. The farm to school experience duration was twenty minutes. The farmer interaction was fifteen minutes long, and the taste testing took approximately five minutes. The experience took place right before the students' lunch time.

Data Collection

This study examined the effect of a farmer interaction and broccoli taste testing session on the decision to take and consume broccoli for kindergarten and fourth grade students in Lee County, Kentucky. Data was collected using a photographic method directly following the experience (T1), and then again two weeks post experience to see if the effect sustained over time (T2). To measure student selection and consumption of broccoli, digital still photography was utilized. This method allows the rapid collection of data on every lunch served and eaten with minimal disruption of the flow of cafeteria operations⁽¹²⁾. This method, based on visual observation of plate waste to calculate the amount of each item consumed, is a highly reliable and precise means of measuring consumption in the cafeteria setting⁽¹³⁾. A unique identifier number was attached to each disposable lunch tray, with a picture taken of each tray as the student exited the

serving line and again before tray disposal ⁽¹²⁾. To ensure student confidentiality and minimize disruption of cafeteria operations, tray numbers had no association with any individual student ⁽¹²⁾. Instead, the numbers only designate the grade level of the student and are used to connect the “before” and “after” pictures of each lunch tray ⁽¹²⁾. For this study, IRB approval was waived because the analysis was of publicly observable behavior.

The broccoli consumption patterns will be compared to a control group of kindergarten and fourth grade students who did not receive the broccoli taste test intervention. Kindergarten at school A served as control for the Kindergarten at school B, while 4th grade at school B served at control for 4th at school A (Figure 2). The inclusion criteria are that the participants must be a Kindergarten or fourth grade student eating the provided school lunch. The exclusion criteria include all other grades at the elementary schools and students who brought their own lunch on the day of data collection.

Measures

The data in this study will determine if the students made the choice to take broccoli from the serving line and also if they consumed the broccoli they took. Two analyses will be conducted in this study: whether broccoli was consumed, and how much was consumed. When indicating if broccoli was taken or not taken by a student the variables of yes (taken) and no (not taken) are used as measurements. When analyzing actual amount of broccoli consumed, the consumed percentages are divided into five sections using percentages in quarters of servings increments (0%-25%, 25%-50%, etc.).

Analytic Plan

Descriptive statistics will be reported in this study. This study is looking for the mean (average) of broccoli consumption for each class during the lunchtime photo analysis directly following the experience, and then two weeks after the broccoli taste testing experience. The averages of broccoli consumption will then be compared to a control to examine the effect of the broccoli taste testing session on student's decision to take broccoli when given the opportunity and their actual consumption of broccoli. The student's age/grade level will also be included in the analysis.

The first analysis will include chi-square testing that looks at students' decision to take or not take a serving of broccoli, and testing if the distribution is other than what would occur at random chance. The second analysis will be an ANOVA to evaluate the association between broccoli taste testing session, the grade level (age) of the students, and their actual broccoli consumption.

The chi square test analysis is appropriate because it involves a categorical variable (grade, time, group, etc.) and the dichotomous variable (yes/no). The ANOVA analysis is the appropriate analysis when evaluating the association between the taste test experience, grade level, and broccoli consumption because it involves a continuous outcome variable- broccoli consumption – with two categorical predictors - the first being whether they received the taste test or they were the control, the second being their grade level- kindergarten or fourth grade.

Missing data, including the before and after photographs which were not taken, those which were not clear enough to be interpreted properly, and which the servings

and amount of consumption could not be determined (Swanson, 2008), is excluded from analysis.

Results

During the photo analysis taken at T1 lunch, 114 students were present and 57 (50%) students received the intervention and 57 (50%) were members of the control group (Table 1). During the photo analysis taken at T2 lunch, 116 students were present and 54 (47%) students received the intervention and 62 (53%) were in the control group.

Of those who were in the intervention group, 46.8% took broccoli, in comparison to those in the control group, where 37% that took broccoli (Table 2a). Of those in the intervention group, 53.2% did not broccoli. Of those in control group, 63% did not take broccoli (Table 2a). At T1, 46.5% of students took broccoli, and at T2 37.1% took broccoli (Table 2a). At T1, 42.1% of kindergarteners took broccoli, and 57.9% did not. At T1, 50.9% of 4th graders of broccoli, and 49.1% did not (Table 2b). At T2, 43.5% of kindergartners took broccoli, in comparison to the 29.6% of 4th graders that took broccoli (Table 2b). At T1, of those in the intervention group, 61.4% of students took broccoli, in comparison to the 31.6% of those in the control group that took broccoli (Table 2c). At T2, of those in the intervention group, 31.5% took broccoli. At T2, of those in the intervention group, 31.5% took broccoli and 41.9% of those in the control group took broccoli (Table 2c).

Of those who consumed no broccoli at all, 65.1% received the intervention and 79.5% were members of the control group (Table 3a). Of those who consumed a quarter of a serving or less, 12.3% received the intervention and 4.3% were in the

control group. Of those who ate more than three quarters of a serving of broccoli, 12.3% received the intervention and 8.5% were in the control group. Of those that consumed no broccoli at all, 72.1% took no broccoli at T1 and 73.2% took not broccoli at T2. Of those that ate more than three quarters of a serving of broccoli, 13.5% did at T1 and 7.1% did at T2 (Table 3b). Those who ate less than a quarter, 14.5% were in the intervention group, and those who ate more than three quarters of serving of broccoli, 20.0% received the intervention (Table 3b).

Discussion

The goal of this study was to evaluate an intervention to determine whether or not a vegetable (broccoli) taste testing experience impacts children's decision to take vegetables available during school lunch and their actual consumption of vegetables in comparison to a control. Results indicated that differences in decision to take/not take broccoli and amount of broccoli consumed existed between the intervention and control groups. The results also indicated differences between decisions to take/not take when comparing T1 and T2, as well as when comparing grade levels. Decision to take/not take and amount of consumption did not follow a consistent pattern, but yielded valuable findings that are useful in addressing children's dietary behaviors.

Taste Testing Experience Comparisons (Broccoli Taken and Consumption)- Intervention and Control Group

The results of this study indicate intervention group taking 9.8% more broccoli than the control groups. The broccoli taste testing experience enhanced their familiarity with broccoli since they have had exposure to the vegetable and already know what it tastes like. When analyzing amount of broccoli consumed, 12.3% of the children that received the intervention ate almost their entire serving of broccoli. Another result that is

most interesting is that 12.3% of those who received the intervention are eating less than a quarter of serving. Less than a quarter of serving of consumption may seem disappointing, but it is a positive finding. The intervention group may not be eating their entire broccoli serving, but at least they are trying in comparison to the control, where only 4.3% are trying. The striking finding of this study is the students' willingness to try broccoli. Almost half of the intervention group is at least trying a quarter of a serving. 45% of students in the intervention group are trying broccoli, in comparison to the 10% of students in the control.

Grade Level Comparisons – K and 4

The differences in decision to take/not take broccoli and amount of consumption when looking at age may be a result of maturity and interest in vegetables and farm to school experiences. There is a slight difference in frequency of broccoli taken when comparing the kindergarteners and fourth graders. The study shows the fourth graders taking 50.9% broccoli at T1, but then 29.6% broccoli at T2. Kindergarteners took 42.1% of broccoli at T1 and 43.5% of broccoli at T2. This may be a result of fourth graders being more open to try new things (T1), but interestingly more kindergarteners than 4th graders took broccoli at T2. This result may be a result of kindergarteners seeing the older students taking broccoli.

Consumption of broccoli is significant when comparing kindergartens to fourth graders. 17.8% of fourth graders that consumed broccoli ate almost their entire serving ($p = .006$), in comparison to the 3.4% of kindergarteners that ate almost their entire serving. This result may be attributed to the greater maturity of fourth graders in comparison to kindergarteners. They are not only more willing to try new things, but will

also eat more food in general. Kindergarteners simply do not eat as much due to their physical size and development intellectually.

Time Comparisons (Broccoli Taken and Consumption)- T1 and T2

A major aspect of this study is the comparison of broccoli taken/not taken and consumption at T1 to T2. The reasoning for this assessment was to see if the intervention did have an effect, and if it did, did it sustain over time? The most significant finding of this aspect of the study is when looking at broccoli consumed and time. At T1 of those who ate almost an entire serving of broccoli 20% of the consumers received the intervention, in comparison to the control of 7.1%. When comparing T1 and T2 percentages, consumption drops dramatically in T2, meaning the effect of the intervention did not sustain. The unexpected finding in the increase in the fourth grade controls is difficult to explain and may be the result of random variation in behavior. For example, the time lapse between T1 and T2 may have been an opportunity for the intervention and control groups to interact, the kitchen staff may have been more encouraging, or the “cool kids” may have more interest in broccoli. This finding supports the notion of having multiple and consistent Farm to School experiences in order to increase exposure and acceptance of vegetables.

Limitations

Even though the findings of this study are beneficial to preventive methods in decreasing childhood obesity, several limitations did occur. The small sample size and time frame limits the conclusions that can be drawn. The sample size is only 112 students at T1 and 116 students at T2. The sample size at T2 is also larger than T1, meaning that a couple students were absent from the intervention at T1. The study also

did not allow researchers to match the individual children over time due to the anonymity of the identification numbers, and we were unable to determine if the same children or different children were taking and consuming broccoli at T2. The time frame between T1 and T2 is also very small and it only provides a small snapshot into the lunchroom experience for those 2 weeks. This does not allow for any causal conclusion. Also the participants in this study are from a very particular region of the country with rural landscapes and low resources. Due to the sample size and its characteristics the results cannot be generalized to other kindergarteners and fourth graders across the country. This study was also unable to compare taking and consuming of another consistent food served at lunch. This does not allow research into changes in taking and consumption of other foods offered on the same days.

There are also limitations with methodology. The photographic method fails to account for any sharing or trading of food items that may occur during the lunch period, which can cause either underestimation or overestimation of consumption behavior. Another limitation in this study is the lack of knowledge of the specific influencer of the intervention on student's decision to take/not take and their consumption. It is unknown if the interaction with the farmer, or the actual taste testing that creates the more influential impact the students' behaviors. Further research and qualitative methods can explore this concept and tease out the factors of influence.

Implications

Farm to school programs, such as this broccoli taste testing intervention have an impact on children's perceptions and actions regarding choosing and consuming vegetables. In a similar study conducted by Bontrager-Yoder et al., the observed

influences of a farm to school experience were small. It is likely that longer times are required for farm to school programs' maximal effects, because habits take time to establish ⁽⁵⁾. As such, continuing farm to school throughout school systems is supported by these positive findings ⁽⁵⁾. The effects of the broccoli taste testing intervention are evident, specifically in fourth grade students, and if farm to school experiences occur more frequently effects may sustain. However, farm to school programs are only part of the child's sphere of influences rather than a simple answer to a major public health problem ⁽⁵⁾. More extensive changes to children's total environments, both physical and social, will be necessary to create meaningful shifts in the prevalence of overweight and obesity ⁽⁵⁾. This suggests the importance of utilizing the Socio-Ecological Model when designing and implementing intervention programs.

This study implemented an environmental and interpersonal change. Adding an additional aspect and addressing the individual's perception and attitudes of vegetables may bring further success. By implementing farm to school programs consistently in schools at multiple levels of the Socio-Ecological Model, public health can take one step further in decreasing childhood obesity and prevent children from becoming obese adults and avoid the chronic health conditions associated with obesity in adulthood.

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Figure 1: Socio-Ecological Model and Farm to School Intervention Element

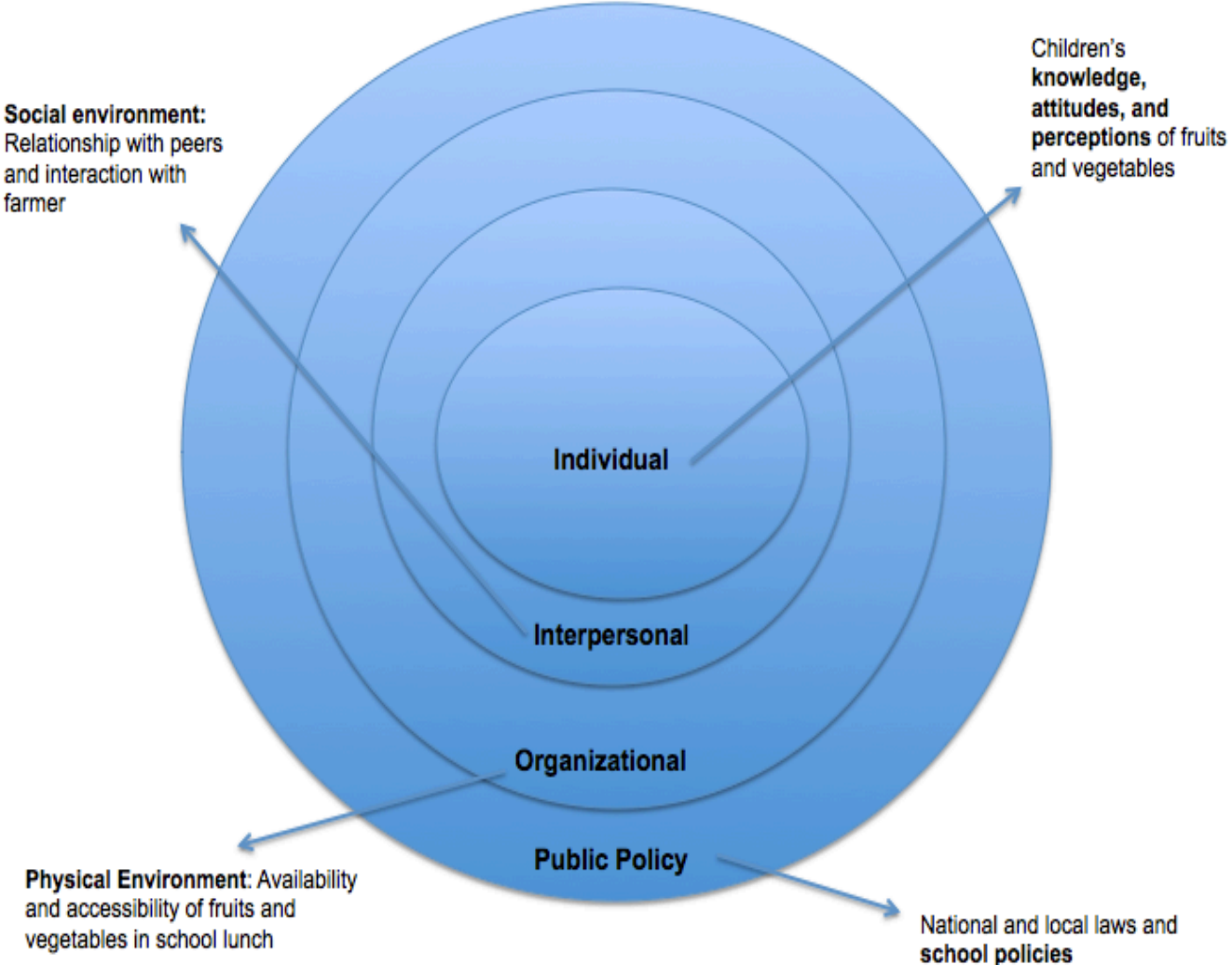


Figure 2: Description of the intervention/control groups		
	School A	School B
Kindergarten	Control	Intervention
4th grade	Intervention	Control

Table 1. Description of sample at Time 1(immediately following intervention) and Time 2 (two weeks post intervention). N= 230		
	Time 1 (N= 114)	Time 2 (N= 116)
	n (%)	n (%)
Grade		
Kindergarten	57(50%)	62(53%)
Fourth grade	57(50%)	54(47%)
Broccoli Taste Test		
Intervention	57(50%)	54(47%)
Control	57(50%)	62(53%)

Table 2a. Frequency of Broccoli Taken, by key variables.		
	Broccoli Taken	
	Yes	No
School		
A	40.8%	59.2%
B	43.0%	57.0%
Broccoli Taste Test		
Intervention Group	46.8%	53.2%
Control Group	37.0%	63.0%
Grade		
Kindergarten	42.9%	57.1%
Fourth Grade	40.5%	59.5%
Time		
(1) Immediately following intervention	46.5%	53.5%
(2) 2 weeks post intervention	37.1%	62.9%

Table 2b. Broccoli taken by grade and time N= 214			
	Broccoli Taken		
	Yes	No	
Time 1			
Kindergarten	42.1%	57.9%	
4 th grade	50.9%	49.1%	
Time 2			<i>p = 0.129</i>
Kindergarten	43.5%	56.5%	
4 th grade	29.6%	70.4%	

Table 2c. Broccoli taken by intervention and time			
	Broccoli Taken		
	Yes	No	
Time 1			<i>p = 0.003</i>
Intervention	61.4%	38.6%	
Control	31.6%	68.4%	
Time 2			
Intervention	31.5%	68.5%	
Control	41.9%	58.1%	

Table 2d. At T1, broccoli taken by intervention and grade			
	Broccoli Taken		
	Yes	No	
Kindergarten			<i>p = > 0.05</i>
Intervention	53.8%	46.2%	
Control	32.3%	67.7%	
4th Grade			<i>p = 0.008</i>
Intervention	67.7%	32.3%	
Control	30.8%	69.2%	

Table 2e. At T2, broccoli taken by intervention and grade			
	Broccoli Taken		
	Yes	No	
Kindergarten			<i>p = > 0.05</i>
Intervention	45.8%	54.2%	
Control	42.1%	57.9%	
4th Grade			<i>p = 0.083</i>
Intervention	20.0%	80.0%	
Control	41.7%	58.3%	

Table 3a. Amount of Broccoli Consumed, by key variables.						
	Percentage of 1 serving consumed					
	0%	1%-25%	26%-50%	51%-75%	>75%	
Broccoli Taste Test						<i>p = >.05</i>
Intervention	65.1%	12.3%	4.7%	5.7%	12.3%	
Control	79.5%	4.3%	3.4%	4.3%	8.5%	
Time						<i>p = >.05</i>
(1) Immediately following intervention	72.1%	7.2%	1.8%	5.4%	13.5%	
(2) 2 weeks post intervention	73.2%	8.9%	6.3%	4.5%	7.1%	
Grade						<i>p = 0.006</i>
Kindergarten	75.9%	11.2%	4.3%	5.2%	3.4%	
4 th grade	69.2%	4.7%	3.7%	4.7%	17.8%	

Table 3b. Broccoli consumed and time (immediately following vs. two weeks post)						
	Percentage of 1 serving of broccoli consumed					
	0%	1%-25%	26%-50%	51%-75%	>75%	
Time 1						<i>p=.001</i>
Intervention	54.5%	14.5%	3.6%	7.3%	20.0%	
Control	89.3%	0.0%	0.0%	3.6%	7.1%	
Time 2						<i>p= >.05</i>
Intervention	76.5%	9.8%	5.9%	3.9%	3.9%	
Control	70.5%	8.2%	6.6%	4.9%	9.8%	

Table 3c. At T1, broccoli consumed by grade and intervention						
	Percentage of 1 serving of broccoli consumed					
	0%	1%-25%	26%-50%	51%-75%	>75%	
Kindergarten						<i>p=.053</i>
Intervention	61.5%	15.4%	3.8%	7.7%	11.5%	
Control	93.3%	0.0%	0.0%	3.3%	3.3%	
4th Grade						<i>p= .055</i>
Intervention	48.3%	13.8%	3.4%	6.9%	27.6%	
Control	84.6%	0.0%	0.0%	3.8%	11.5%	

Table 3d. At T2, broccoli consumed by grade and intervention						
	Percentage of 1 serving of broccoli consumed					
	0%	1%-25%	26%-50%	51%-75%	>75%	
Kindergarten						<i>p= > .05</i>
Intervention	65.2%	17.4%	8.7%	8.7%	0.0%	
Control	78.4%	13.5%	5.4%	2.7%	0.0%	
4th Grade						<i>p= > .05</i>
Intervention	85.7%	3.6%	3.6%	0.0%	7.1%	
Control	58.3%	0.0%	8.3%	8.3%	25.0%	

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Biographical Sketch

Kathleen Marie Evers

Case Western Reserve University, Bachelor of Arts.

University of Kentucky College of Public Health, Research Assistant.

8325 Sheed Road
Cincinnati, OH 45247

513-460-6182

kevers829@gmail.com