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KNOWLEDGE, INTAKE, AND WILLINGNESS TO CONSUME FRUITS AND
VEGETABLES OF CHILDREN LOCATED IN A FOOD DESERT VERSUS A NON-FOOD
DESERT

A thesis submitted in partial fulfillment
of the requirements for the degree of
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by

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Abstract

The United States Department of Agriculture (USDA) defines a food desert as “urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable foods” (“Food Deserts”, 2014). The purpose of this study was to determine the differences between knowledge, intake, and willingness to consume fruits and vegetables between students going to school in a food desert and students not going to school in a food desert. This study was conducted by showing students picture cards to determine knowledge of fruits and vegetables, surveying students to determine intake of fruits and vegetables, and food sampling to determine willingness to consume fruits and vegetables. Statistically, there was very little difference between the students going to school in a food desert and non-food desert. The only difference noted was fruit consumption. This study suggests that a food desert is not a factor in knowledge, intake, and willingness to consume fruits and vegetables.

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Background

Child obesity rates are at an all-time high in the United States (17%) and in Arkansas (20%) (“Childhood overweight and obesity trends”, 2014). These values have nearly tripled in the past forty years (“Childhood overweight and obesity trends”, 2014). More troubling is that a large portion of the United States is also classified as a food desert. The United States Department of Agriculture (USDA) defines a food desert as “urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable foods” (“Food Deserts”, 2014). An area can be classified as a food desert by meeting the criteria for being a low-income community or a low-access community. A low-income community has a poverty rate of twenty percent or greater and a low-access community has at least one-third of the residents living at least one mile from a grocery store that sells fresh produce (“Food Deserts”, 2014). One way to help resolve the obesity epidemic is to enhance the public’s, specifically children’s, understanding of how to lead a healthy lifestyle. A healthy lifestyle begins during childhood and includes a basic knowledge of and willingness to consume various fruits and vegetables.

According to Rasmussen et al. (2006), socioeconomic status and culture are factors that impact childhood obesity rates. Children from lower socioeconomic status and a non-white ethnicity have higher obesity rates. A low socioeconomic status has also been associated with a lower consumption of fruits and vegetables.

This study compared children who attend school in a food desert to children who do not attend school in a food desert. Determining if there is a difference between level of knowledge about fruits and vegetables and willingness to consume various fruits and vegetables between children in these two schools, a food desert and a non-food desert, will give insight into their eating habits.

Literature Review

Food deserts are defined as geographic areas within a community that lack access to a supermarket or grocery store selling fresh products (Hubley, 2011). A food desert is the overarching concept that encompasses poverty, access to nutritious and affordable food choices, and healthy outcomes (Breyer & Voss-Andreae, 2013).

Food deserts are commonly found in areas that contain a high percentage of families living in poverty. Poverty stricken families are more likely to consume a poor diet than higher socioeconomic status families because of the price of fresh produce. The price of fruits and vegetables has been linked to increased obesity rates (Breyer & Voss-Andreae, 2013). Obesity rates are inversely related to the price of fresh fruits and vegetables. Breyer and Voss-Andreae (2013) noted that students with the highest body mass indexes (BMI) were from low socioeconomic families that could not afford fruits and vegetables. This study also found that a price reduction of fruits and vegetables of ten percent through coupons and discounts increased consumption of fruits and vegetables up to seven percent (Breyer & Voss-Andreae, 2013). Low income areas are more likely to have a small, locally owned store instead of a chain grocery store. Prices of fresh produce trend higher at the small stores where people who can least afford the increased price of fruits and vegetables live (Walker et al., 2010).

Access to nutritional foods is the first step to living a healthy lifestyle. Jiao et al. (2012) noted that transportation accessibility was the best indicator of a healthy diet. However, Fielding and Simon (2011) did not find a correlation between distance to grocery store and fruit and vegetable consumption. These researchers postulated that access to fruits and vegetables did not influence healthy eating habits as much as access to fast-food options and other unhealthy eating

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Nationally, 23.5 million people including 6.5 million children live more than a mile from a grocery store – qualifying them as living in an urban food desert (Foundations, 2012).

Rasmussen et al. (2006) conducted a review of literature to identify potential determinants of fruits and vegetable intake in children and adolescents. The study concluded that the determinants were gender, age, socioeconomic status, parental fruit and vegetable intake, and what foods are available in the home (Rasmussen et al., 2006).

Simply eliminating food deserts will not make people live a healthier lifestyle. Even with the availability of fresh produce it does not mean that the public is going to partake and have healthy eating habits. People must be knowledgeable about the importance of consuming healthy foods and how to manage their own health. The public needs to be made aware of what constitutes a healthy lifestyle and how to incorporate this into their life. This transition into a healthy diet including fruit and vegetable consumption becomes a major topic for society to address. With only twelve percent of adults classified as health literate (Rodriquez, 2011), there is a need for health education programs that teach the basic skills of eating fruits and vegetables. Parents need to be educated on a healthy diet in order to reinforce this teaching to their children, when healthy eating habits are developing.

Purpose of the Study

The purpose of this study was to determine the differences between knowledge, intake, and willingness to consume fruits and vegetables in students going to school in a food desert versus a non-food desert as described in the following aims.

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Aims

Aim 1: To determine recognition rates of fruits and vegetables between third grade students going to school in a food desert compared to a control group of third grade students not going to school in a food desert. To address this aim, student surveys were conducted to gain insight to their knowledge of fruits and vegetables.

Aim 2: To determine the intake of fruits and vegetables in the groups of students. Students were surveyed to determine their consumption rates of fruits and vegetables during a given time period.

Aim 3: To determine if there was a difference between the groups in terms of their willingness to consume fruits and vegetables that would contribute to a balanced nutritious meal. In this aim, students' willingness to consume the most common fruits and vegetables consumed for their age group was determined by food sampling.

Aim 4: To determine if there was a difference between the groups in their desire to consume fruits and vegetables at home. In this aim, students' desire to consume fruits and vegetables at home was surveyed by the students listing which of the foods sampled they would consume at home, if made available.

Research Design and Methods

This study was conducted following approval by the University of Arkansas Institutional Review Board and the Springdale Independent School District.

The population for this study was third graders who completed a survey in their classroom.

To address Aim 1 and determine recognition rates of fruits and vegetables among third grade students, study participants in the two groups were surveyed to gain insight into their knowledge of fruits and vegetables. Student groups were shown thirty different fruit and vegetable picture

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cards, were asked to write whether the picture card was a fruit or vegetables, and write the name of the fruit or vegetable.

To determine the intake of fruits and vegetables proposed in Aim 2, the two student groups were surveyed on their personal consumption rates of the thirty different fruits and vegetables shown. Students were asked if they have ever consumed the fruit or vegetable. If so, they were also asked how many times they have consumed the fruit or vegetable in the past week.

To address Aim 3 and determine students' willingness to consume fruits and vegetables that would contribute to a balanced, nutritious meal, the students' willingness to consume fruits and vegetables by food sampling were measured. Students in the two groups were asked to select and consume fruits and vegetables from a sampling of six different varieties comprised of the most commonly consumed fruits and vegetables. The fruit and vegetable sampling revealed the following:

1. The number of fruits or vegetables the students consumed.
2. The frequency the fruits and vegetables were sampled.

To address Aim 4, students were asked whether or not they would consume the fruit or vegetable sampled in Aim 3 on a routine basis, if made available

Students were assigned a random case number and the data collected was stored on a password protected computer. All results are reported in the aggregate.

Sample. The sample for this study consisted of 120 third grade students. One group was comprised of students attending an elementary school located in an area classified by the USDA as a food desert. Students from an elementary school which is not located in a food desert served as the control group. All information was de-identified according to the guidelines of the Health Insurance Portability and Accountability Act (HIPPA).

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Statistical Analysis. All tests performed compared the two groups, food desert and non-food desert. A chi-squared test of independence was performed to analyze the recognition rates of fruits and vegetables. A t-test was performed to analyze the rates of consumption of fruits and vegetables.

Results

Data was collected to determine the differences between knowledge, intake, and willingness to consume fruits and vegetables in a food desert versus a non-food desert. The results for each aim are as follows.

Aim 1: A chi-square test of independence was conducted to determine if the rate of students living in a food desert that recognized or could distinguish between items being fruits or vegetables was significantly lower than the recognition rate of students living in a non-food desert. The food desert group had a recognition rate of 84.97 while the non-food desert had a recognition rate of 84.21. The recognition rates between the two groups were statistically equal, $\chi^2(1) = 0.40, p = 0.53$. A review of the recognition rates of food items shown is broken down by the two groups in Table 1. There was a difference between the two groups, food desert and non-food desert, in specific fruits and vegetables; however, overall there are no statistical differences.

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Table 1
Recognition of Food Item by Group

Item Name	Group	
	Food Desert	Non Food Desert
	Correct ID Count (%)	Correct ID Count (%)
Apple	55(100.0)	61(93.9)
Asparagus	11(20.0)	6(9.2)
Avocado	20(36.4)	32(49.2)
Banana	51(92.7)	62(95.4)
Bell Pepper	9(16.4)	13(20.0)
Broccoli	51(92.7)	51(79.7)
Cantaloupe	20(36.4)	11(16.9)
Carrot	50(90.9)	60(92.3)
Cauliflower	23(41.8)	19(29.2)
Celery	18(32.7)	15(23.1)
Corn	55(100.0)	62(95.4)
Cucumber	42(76.4)	37(56.9)
Grapes	52(94.6)	58(89.2)
Green Beans	6(10.9)	14(21.5)
Kiwi	23(41.8)	28(43.1)
Lemon	54(98.2)	56(86.2)
Lettuce	25(45.5)	22(33.9)
Mango	29(53.7)	34(52.3)
Orange	54(98.2)	60(92.3)
Peach	33(60.0)	37(56.9)
Pear	48(87.3)	50(76.9)
Pineapple	52(94.6)	56(86.2)
Potato	50(90.9)	59(90.8)
Raddish	31(56.4)	33(50.8)
Raspberry	34(61.8)	48(73.9)
Spinach	18(32.7)	21(32.3)
Squash	27(49.1)	29(44.6)
Strawberry	54(98.2)	59(90.8)
Tomato	55(100.0)	65(100.0)
Watermelon	54(98.2)	58(89.2)

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Aim 2: Comparisons between students in a food desert and students in a non-food desert were made separately for self-reported fruit and vegetable consumption over the previous week.

Independent T-Tests were conducted to compare the two groups on each of these outcomes. The results are provided in Table 2.

Table 2
1-Week Consumption of Fruits and Vegetables by Group

Food Item	Group						df	t-ratio
	Non Food Desert			Food Desert				
	N	M	SD	N	M	SD		
Fruit	65	33.9	26.8	55	19.5	15.4	104.7	3.67**
Vegetable	64	17.5	16.7	55	13.9	12.9	117	1.31

** *p-value is less than .01*

There was a clear and statistical advantage for the non-food desert group regarding fruit consumption. On average, the past week of consumption of 15 fruits was roughly 1.5 times as high for non-food desert students as it was for food desert students. Put into standardized units using Hedge's g ($g = 0.83$) and providing a comparative statement, provides a more realistic assessment. The result is that the weekly fruit consumption of the average student living in a non-food desert will exceed the weekly fruit consumption of nearly 80 percent (the area below a z-score of 0.83) of all students living in a food desert.

The same cannot be said, however, of weekly vegetable consumption comparison of the two groups. Statistically, the average student of neither group exceeds the consumption of vegetables of the other group.

Aim 3: The third assessment was of willingness to eat fruits and vegetables determined by food sampling. The average number of fruits and vegetables that students from the food desert were

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willing to consume ($M = 4.98$, $SD = 1.38$) was statistically equal to the average number of fruits and vegetables that students from the non-food desert were willing to consume ($M = 4.78$, $SD = 1.23$), $t(118) = 0.89$. Thus, students from both groups, on average, were willing to consume approximately five out of the six food items they sampled. The fruits and vegetables the students sampled are provided in Table 3.

Table 3
Fruits and Vegetables Sampled

Item Name	Group	
	Food Desert	Non Food Desert
	Sampled (%)	Sampled (%)
Apple	43(78.2)	55(84.6)
Banana	49(89.1)	53(81.5)
Orange	50(90.9)	54(83.1)
Corn	46(83.6)	55(84.6)
Lettuce	46(83.6)	49(75.4)
Tomato	39(70.9)	33(50.8)

Aim 4: The final assessment to determine the students' desire to consume the fruits and vegetables consumed at home. The fruits and vegetables the students desired to consume at home if made available are listed in Table 4.

Table 4
Fruits and Vegetable Desired to Consume at Home

Item Name	Group	
	Food Desert	Non-Food Desert
	Consume at Home (%)	Consume at Home (%)
Apple	42(76.4)	48(73.8)
Banana	44(80.0)	47(72.3)
Orange	41(74.5)	50(76.9)
Corn	36(65.5)	48(73.8)
Lettuce	26(47.2)	30(46.2)
Tomato	19(34.5)	23(35.4)

Limitations

This study was performed by surveying third graders at two different elementary schools. Each class contained approximately fifteen to twenty students. The students were sitting in close proximity to each other and could visualize each other's answers. One student required an aide and said their answers aloud and the aide wrote them down. The students sitting in the same section could hear this student's answers. The students were instructed to remain quiet during the duration of the survey but would say the answers to some of the fruits and vegetables aloud. Each of these limitations were expected and controlled for to the best of the ability of the researcher.

Discussion

Aim 1: Students in both the food desert and non-food desert could classify an equal number of foods as a fruit or vegetable. There was a difference between the two groups on identifying specific fruits and vegetables but overall there was no difference between the two groups.

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Aim 2: Weekly fruit consumption in the non-food desert was higher than that of the non-food desert. The students were surveyed on the amount of times they had eaten the fruit or vegetable in the past week. This value might have a statistical difference because the students wrote the number of fruits or vegetable they had consumed in the past week instead of the number of times they had consumed that fruit or vegetable in the past week. There was no difference in vegetable consumption for the two groups.

Aim 3: The students from both groups, the food desert and non-food desert, consumed, on average, five of the six fruits and vegetables provided. The students were willing to sample the foods provided in this setting. This can be attributed to the novelty of the situation in being provided foods to sample in the school setting.

Aim 4: The students from both groups, the food desert and non-food desert, were less willing to consume the fruits and vegetables at home than they were to sample them at school. The fruits and vegetables provided were the three most commonly eaten fruits in the United States and three of the five most commonly eaten vegetables in the United States.

Conclusion

This study shows that there is very little difference in knowledge, intake, and willingness to consume fruits and vegetables in students going to school in a food desert versus students going to school in a non-food desert. The recognition and intake rates were low in both the food desert and non-food desert. These values suggest that a food desert is not a factor in children's knowledge, intake, and willingness to consume fruits and vegetables. Even though a food desert is not a factor, the recognition and intake rates of fruits and vegetables were unacceptably low. These rates need to be increased to encourage healthy eating habits in children. Healthy eating habits begin during childhood, so this time is critical to encourage fruit and vegetable

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consumption and other healthy eating habits. Further interventions need to be done to determine the reasoning behind students' low recognition and consumption rates of fruits and vegetables.

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