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Sierra Gregory
University of Arkansas, Fayetteville

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Evaluating the Effect of Garden-Based Education on Young Learners' Preferences for and Willingness to Try Healthy Food

Sierra Gregory

University of Arkansas

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Abstract

Childhood obesity in American children has tripled in the last 20 years, and 85% of current healthcare spending is linked to diet-related diseases. The consumption of highly processed foods is linked to these trends and makes up more than half of an average American youths' diet. Reducing the consumption of highly processed foods in children's diets can be addressed, in part, by addressing childhood neophobia (willingness to try new foods) associated with whole foods like fruits and vegetables. Influence over behavioral areas such as nutrition and in early childhood is essential to long-term sustained health, and garden-based interventions shows promise for improving childhood nutrition and health outcomes. This study has two main objectives: 1) to create and deliver a curriculum lesson for students to learn about making healthier food choices and 2) to evaluate the effectiveness of the lesson to (a) increase willingness to try fresh fruits and vegetables and (b) measure food neophobia in students. The key curriculum concepts focused on identifying the differences between unprocessed and highly processed foods, reducing consumption of heavily processed foods, and how healthy food choices affect the body and the planet. Data was gathered in pre-lesson, short-term post-lesson, and long-term post lesson surveys for one hundred and twenty-five fourth grade students from Happy Hollow and Butterfield Elementary schools in the Fayetteville Public School Districts. One-way analysis of variance (ANOVA) was used to determine whether the difference between means of the independent groups were statistically significant. Means were compared between male and female genders and between the Pre, Post1, and Post2 survey. Our findings were that Food Neophobia Scale Questions (FNS) were significantly different in the short-term post. Students generally scored lower on the FNS scale questions in the short and long-term post programming. These results suggest immediate and sustained impacts of the intervention on

students' food neophobia. The curriculum's experiential component, where students interact with food ingredients to complete a recipe and then taste the final products, significantly increased students' preference for sweet potatoes, a healthy, minimally processed food present as the main ingredient in the recipe used for the curriculum. This change in willingness to try roasted sweet potatoes was significant in the short-term comparison results but the effect was reduced over time (though not back to baseline levels). These results imply that a single experience may not be enough to expect long term behavioral change. Overall, the study's findings affirm the efficacy of the garden-based curriculum in mitigating food neophobia and promoting a preference for minimally processed foods among children. The key findings were the reduction in food neophobia, enhancement of healthy food preferences, and sustainability of changes. The results underscore the need for ongoing research into the scalability of garden-based intervention curriculum.

Introduction

Over the past 20 years, childhood obesity has tripled largely due to the American youth diet being more than half of all calories consumed from highly processed foods. "Ultra-processed foods" contain ingredients that are rarely found in food prepared at home because of industrial methods in production (Wang et al., 2021). Preservatives, high fructose corn syrup, artificial flavoring agents, chemical alterations, and high-pressure shaping help to put food on the shelf that is appealing to kids' tastes and preferences. Previous research has linked ultra-processed foods directly to weight gain and diet related diseases like fatty liver disease and type 2 diabetes (Monteiro et al., 2013). According to the USDA, "85 percent of current healthcare spending is related to management of diet-related chronic disease" (USDA, 2022, p. 1). Elementary aged children may not have the cooking efficacy needed to prepare home cooked meals and make sure they are receiving adequate nutrition, and if no adult is present to prepare those meals for them then nutrition deficiencies can be present. The USDA defines food insecurity as lack of access to enough food to provide adequate nutrition, and has been associated with "negative health, social, and academic outcomes" in developing children (USDA, p. 1, 2017). Nutritional security builds on this definition of food insecurity, but places emphasis on the coexistence of diet-related diseases and food insecurity.

Children in Arkansas face the challenges of food insecurity at "30% in rural areas, and 26.3% in urban areas" (Miller, p.1, 2019). These Arkansas food insecurity rates are significantly higher than that of the national average of 10.1% and are much higher than food insecurity rates among adults in Arkansas at about 17% (USDA, 2021). Achieving nutritional security focuses on accessibility and affordability of foods that promote well-being, prevent disease, and even treat disease especially in underserved population demographics including minority and low-income households. The USDA’s approach to relieving nutritional insecurity across the country is grounded in research and evaluation to guide the policies that are written and the funding that goes into nutritional assistance programs. Research and evaluation of strategies to alleviate nutrition and food insecurity, particularly in states with higher food insecurity rates, such as Arkansas, is crucial to furthering the collective understanding of how to approach these issues.

Influence over behavioral areas such as nutrition and physical activity in early childhood is essential to long-term sustained health, and garden-based interventions show promise for improving childhood nutrition. Skelton (2020) suggested “garden-based interventions, which typically include hands-on learning with fruits and vegetables, nutrition education about food origins and systems, and production of fresh produce, have been associated with improved child health outcomes”. Previous literature on the subject focuses mainly on the impact garden-based interventions can have related to the health factor of increased consumption of fruits and vegetables. However, there is a lack of research on how garden-based curriculum can impact the decrease in consumption of highly processed foods.

The goal of this study is to measure the effect of a garden-based healthy foods lesson on children’s healthy food choices. Specifically, the changes in student preferences and willingness to try healthy foods (with specific emphasis placed on minimally processed foods) will be measured. The key lesson concepts focused on identifying the differences between unprocessed and highly processed foods, reducing consumption of heavily processed foods, and how healthy food choices affect the body and the planet. The evaluation component of the study measured the effectiveness of the lesson to: (1) increase students' willingness to try fresh fruits and vegetables; and (2) measure changes in student preference for healthy foods and “ultra-processed” foods. The following describes the specific research objectives of the study.

- Develop a garden-based lesson focusing on the nutritional benefits of healthy (minimally processed) foods and the consequences of ultra-processed (highly processed) foods.
- Evaluate the effectiveness of the garden-based lesson on a student's willingness to try new healthy foods.
- Evaluate the effectiveness of a garden-based lesson on a student's preference for healthy foods (minimally processed foods) over ultra-processed foods.

Background and Literature Review

Overview

Childhood obesity, food and nutrition insecurity, and diet quality have been linked to negative impacts on children's academic performance, social and psychological outcomes, harmful eating patterns later in life such as eating disorders, development of chronic diseases, and long-term morbidity rates across all factors. According to the USDA (n.d.), around 85% of current healthcare costs are spent on management of diet-related chronic diseases. This can be largely attributed to the Standard American Diet (SAD) being defined by over consumption of calories from refined fats, carbohydrates, sodium, and added sugars while lacking essential nutrients and minerals from fruits, vegetables, and whole grains (Grotto, 2010). Children's diets are impacted by a variety of factors. For the purpose of this study, special focus has been placed on food neophobia, consumption of overprocessed foods, and in turn the lack of consumption of whole foods like fruits and vegetables. Negative factors of this poor diet quality may not be shared equally because of the disproportionate risk of diet-related diseases on low-income and underserved groups like non-white black, indigenous, and pacific islander demographics (Willis & Fitzpatrick, 2020). However, there is evidence that garden-based interventions accompanied by nutritional education components can effectively improve childhood health-related factors like openness to trying fruits and vegetables and decreasing consumption of processed foods (Skelton, 2020)

Defining Terms

For the purpose of this study, food neophobia refers to reluctance to eat and try new food, which can impede fruit and vegetable preference and consumption among children and contribute to the development of unhealthful food habits (Chan, 2022). Food neophobia’s impact on fruit and vegetable consumption can also lead to increased intake of ultra-processed foods. Ultra-processed products are made to be extremely appetizing, shelf-stable, and easy to prepare and consume. These types of products often promote overconsumption and the displacement of home-cooked meals and whole foods. Nutritional content of ultra-processed foods is characterized by energy density; a high glycemic load; low dietary fiber, micronutrients, and phytochemicals; and high in unhealthy types of dietary fat, free sugars, and sodium (Monteiro et al., 2013). The economic and marketable advantages of ultra-processed foods ultimately lead to a diet inconsistent with the United States dietary guidelines. According to Grotto, 2010, “Today’s Western diet or Standard American Diet generally refers to a total diet pattern (with multicultural variations) that includes excess consumption of calories from refined carbohydrates, fatty meats, and added fats and that lacks many nutrients found in whole grains, fruits, and vegetables.” To combat these issues focus should be placed on the growing consumption of ultra-processed foods.

The Link Between Ultra-Processed Foods and Public Health

Since the 1980’s, the global food system has seen a huge increase in the production of ultra-processed foods. The increased production of these foods was met with substantial increase in consumption over the last two decades, “from 1999 to 2018, the estimated percentage of total energy from consumption of ultra-processed foods increased from 61.4% to 67.0%, whereas the percentage of total energy from consumption of unprocessed or minimally processed foods decreased from 28.8% to 23.5%” (Wang et al., 2021). Ultra-processed foods are often marketed to children and compose the majority of youths’ diets in the United States (US). Globally, trends in consumption display an inverse relationship between a country's gross national income and sales of processed frozen foods, snacks, and canned beverages. The largest average annuals sales growth rate of processed products came from frozen ready-to-heat-and-eat foods in both low-, middle-, and high-income countries (Monteiro et al., 2013). Since the 1950’s, calorie consumption has increased by roughly 761 kcals with added fats and sugars making up the largest portion of that calorie increase (Grotto, 2010). The growing displacement of nutrient dense foods with excess calories from fats and sugars has increased the risk of heart disease, diabetes mellitus, cancers, obesity, and other inflammatory and metabolic conditions (Grotto, 2010). To combat the growing displacement of calories from whole foods, focus can be placed increasing children’s willingness to try fruits and vegetables.

Neophobia’s Impact on Diet Quality in Children

Willingness to try new foods can greatly impact dietary variety and quality. Children can be classified as neophobic, average, and neophilic based on their aversion to or likelihood of trying new foods (Falciglia, 2000). The main factors associated with neophobic children are parental influences on eating habits, innate preference for sweet and savory flavors, sensory issues in children and the sensory experience associated with eating, childhood anxiety, and the presence of parental pressure or encouragement during mealtime (Torres et al., 2020). Neophobic children score lower on The Health Eating Index because of higher intake of saturated fats and less food variety than non-neophobic kids (Falciglia, 2000). Food neophobia can be treated through repeated exposure and encouragement to try new foods from various sources including parental intervention, school intervention, and community intervention through garden-based, nutrition, and culinary education and interventions (Falciglia, 2000).

Garden-Based Intervention's Impact on Diet-Related Behaviors

Garden-based interventions have shown a strong positive correlation with improving children's food neophobia, fruit and vegetable intake, and unprocessed foods intake in a cost-effective way (Chan, 2022) The impact can vary based on programming type and length; and by environmental factors such as parental involvement and age of children. Multidisciplinary approaches including aspects of nutrition and culinary education have been most successful in positively impacting diet related factors (Skelton, 2020). Attitudes towards fruits and vegetables can shift through increased preference for and willingness to try fruits and vegetables. Garden-based interventions can also decrease food neophobia and consumption of highly processed foods (Skelton, 2020). These types of interventions are especially relevant to improving the dietary quality of underserved populations.

The Inequity of Poor Diet-Quality and Nutrition Insecurity in America

Food and nutrition insecurity has been shown to disproportionately impacts underserved populations of non-White, Black, Pacific Islander, Indigenous, and immigrant populations. Black and Mexican American youths showed a significantly larger increase in estimated percentage of energy from consumption of ultra-processed foods than that of their non-Hispanic White youth counterparts from 1999 to 2018 (Wang et al., 2021). Black women in America face maternal morbidity rates among the highest in the developed world (USDA, 2022). Indigenous people living in rural reservation and urban populations face food security barriers such as dietary transition, lack of access to traditional foods, the costs associated with commercial foods available, and livelihood change (Skinner, 2016). In Northwest Arkansas where this study took place, the largest Marshallese Pacific Islander population of anywhere in the continental United States exists. The odds of food insecurity for Marshallese youth in this area are 62.2% higher than Black youths, and 66% higher than White and Latinx students (Willis & Fitzpatrick, 2020). Health disparities exist because of long-standing policies and structural racism that have increased disease risk and reduced opportunities for healthy lifestyles among certain populations (USDA, 2022). Nutrition and diet-related issues can have far reaching impacts when it comes to systematic oppression of marginalized groups. As previously mentioned, nutritional insecurity can be associated with decreased academic performance as well as financial stress. These factors translate to societal impacts like lower productivity, weakened military readiness, widening health disparities and skyrocketing healthcare costs (USDA, 2022). Research-based solutions are needed to address these health disparities across the country, especially within the next generation of children in these marginalized groups.

The average American scores 59 out of 100 on the Healthy Eating Index (which indicates that on average, American diets do not meet the federal dietary recommendations (USDA, 2022). This can be attributed to factors like the global dominance of ultra-processed foods, the displacement of whole foods like fruits and vegetables, and lack of access to healthy foods and nutrition education among marginalized groups. Implementation of nutritional, culinary, and garden-based education has been successful in increasing children’s willingness to try fruits and vegetables and decreasing consumption of ultra-processed foods. Prioritizing the health of future generations can mean helping children form healthy habits through reinforcement in areas like gardening, cooking, and nutritional awareness.

Methodology

Introduction to Methodology

This section describes the collaborative efforts, curriculum development, sampling, and analytical approaches used to evaluate the impact of a garden-based curriculum on children's food choices. For our study, a lesson plan was developed as part of a United States Department of Agriculture (USDA), National Institute of Food and Agriculture (NIFA), Capacity Building Grant (USDA Award 2021-38821-34712). The University of Arkansas – Pine Bluff (UAPB) is the lead institution on the project and the University of Arkansas – Fayetteville (UAF) worked with and continues to work with Apple Seeds, Inc. (Apple Seeds), a local project partner, to carry out the deliverables on the UAF subaward grant. Apple Seeds is a garden-based education non-profit located in Fayetteville, Arkansas with established programming spanning from kindergarten to high school aged children. The lesson plan developed for this study was integrated with the existing garden-based education curriculum developed by Apple Seeds in collaboration with Apple Seeds programming directors. The lesson plan was designed to be approximately 75 minutes in length, with access to a garden and teaching kitchen.

Curriculum Development and Rigor

Curriculum was developed based on K-12 Next Generation National Science Standards (NGSS, n.d.) and key components from Apple Seeds Growing My Plate and Farm Lab (Apple Seeds, 2023) programming curriculum. Development took place after roughly one year of persistent observation and prolonged engagement assisting in teaching of Apple Seeds programming and curriculum across all grade-levels (kindergarten through twelfth grade) and curriculum types. The curriculum was reviewed by two science curriculum professionals from Fayetteville and Springdale school districts, as well as 4th grade teachers whose students would later be participants in the study. Pilot testing of the curriculum took place with students from two schools to determine the best plan for curriculum delivery during the evaluation period. The lesson portion of the curriculum included a nutrition component seen in, food pathway component, and plant adaptations component. The following NGSS standards were included in the lessons: 4-PS3.D Energy in Chemical Processes and Everyday Life, 4-ESS3.A Natural Resources Energy, and 4-PS3.A Definitions of Energy (NGSS, n.d.). Following the lesson students participated in gardening, cooking, and tasting experiential components. Gardening component: harvesting, washing, and weighing produce pictured in Figure 1 (Appendix 1). Cooking experiential component: knife skills and following a recipe to prepare foods harvested from the garden in Figure 2 (Appendix 1). Tasting component: raw garden vegetable taste-test paired with a cooked taste-test following recipe completion in Figure 3 (Appendix 1).

Population and Sampling

Focusing on 4th grade students within the Fayetteville Public Schools, the study was conducted in two schools, Happy Hollow and Butterfield, selected based on prior engagement with Apple Seeds' programs. Although these schools may not fully represent the district's diverse demographics, they offered a suitable starting point for evaluating the curriculum's impact. Approximately one-hundred twenty-five students participated, with the selection process influenced by logistical constraints such as timing, weather conditions, and parental consent (Pilner, 1994). The parent or guardian consent form used is included in Appendix 4.

Evaluation Instrumentation

Students included in the evaluation completed the pre-programming surveys, short-term post, and long-term post surveys and participated in the programming after returning parental consent forms for evaluation. Pre- and post-surveys were designed to assess changes in food preferences for whole (fruits and vegetables) and highly processed foods, and to determine each student’s food neophobia. The surveys were developed to be in printed booklet format. Food Neophobia Score (FNS) items were developed based on a previously tested FNS scale for elementary aged children (Pilner, 1994) which included 10 true or false questions about student’s feelings towards trying new foods. Values of 2 indicated a high level of food neophobia and 1 indicated a low level, and scores were based on positive or negative feelings towards trying new foods. Ten willingness to try survey items included five paired comparisons of a relatively healthy (minimally processed food) compared to a similar relatively unhealthy (highly processed) food. These items used a 5-point Likert scale (Park and Cook, 2019) 1 being “I do not want to eat it” and 5 being “I would love to eat it”, students were asked to rank how likely they were to eat each food. These questions also included visual aids and descriptions of each food for clarity. Unprocessed foods were chosen based off seasonal availability, income accessibility, and locality. Processed foods were chosen for similarity to the unprocessed foods selected as paired comparisons. Roasted sweet potatoes were included as the healthy food present in the experiential component of curriculum, and french fries were chosen as the unhealthy food paired comparison counterpart. Other healthy foods present in the survey items but not included in the lesson were: baked kale chips, yogurt and fresh fruit, fresh vegetables and dip, and roasted chickpeas, other unhealthy food options included: cheese flavored snacks, cereal with marshmallows, a highly processed crackers, cheese and ham snack, and potato chips. A copy of the full survey can be found in Appendix 3.

Data Collection and Analysis

Before collecting data, human subjects' approval was sought from the University of Arkansas Institutional Review Board (2311502628). The curriculum was delivered over the course of two months along with assistance from Apple Seeds program directors and undergraduate students working on the grant project. Data was collected immediately before (Pre) and then immediately following the curriculum delivery (Post1) using paper surveys. Another longer-term post survey (Post2) was implemented in school classrooms approximately two months after programming. Data was sorted to only include students who were present for the Pre, Post1, and Post2 surveys and had signed consent forms. Because not all students completed all questions across the three surveys, the observations data in our tables and figures will not always be equal.

Statistical Analysis

Statistical analyses were performed using STATA software, version 14. One-way analysis of variance (ANOVA) was used to determine whether the difference between means of the independent groups were statistically significant. Means were compared between male and female genders and between the Pre, Post1, and Post2 survey. The standard deviation was also estimated and reported with the means. The standard deviation is the measure of variation given the expected impact of a variable on the means and looks to see the dispersion of data from the mean. ANOVA was used to examine differences in responses across gender and survey periods, assessing the curriculum's effect on students' food preferences and neophobia levels. This approach facilitated a detailed understanding of the intervention's impact, guiding future improvements (Hess & Hess, 2017). These values are vital for understanding the variation in our data, which is crucial for subsequent statistical analysis. Statistical Evidence that means were significantly different was measured at the one percent level ($p<0.01$).

Results and Findings

This section presents the outcomes of implementing a garden-based curriculum, focusing on changes in food neophobia scores and preferences for minimally processed foods among 4th grade students from Happy Hollow and Butterfield Elementary Schools. In Figure 1, average FNS score questions are compared pre- and short-term post-programming (Post1). All FNS questions Neophobia (NF) except NF8 were significantly different in the short-term post. Students generally scored lower on the FNS scale questions post programming. These changes suggest the immediate effectiveness of the garden-based curriculum in reducing food neophobia. Notably, NF8 did not show significant variation, likely due to specific wording issues that may have confused the respondents (Pilner, 1994).

Figure 2 should the results of the long-term post-programming survey (Post2) and shows that the reduction in food neophobia scores persisted in the long-term follow-up for all but one of the FNS questions. These results suggest sustained impacts of the intervention on students' food neophobia. As in the short-term results, NF8 displayed an unusual pattern, which underscores the need for careful question phrasing in future assessments (Pilner, 1994).

Figure 4

Average Food Neophobia Scale Scores Pre and Post1 Programming

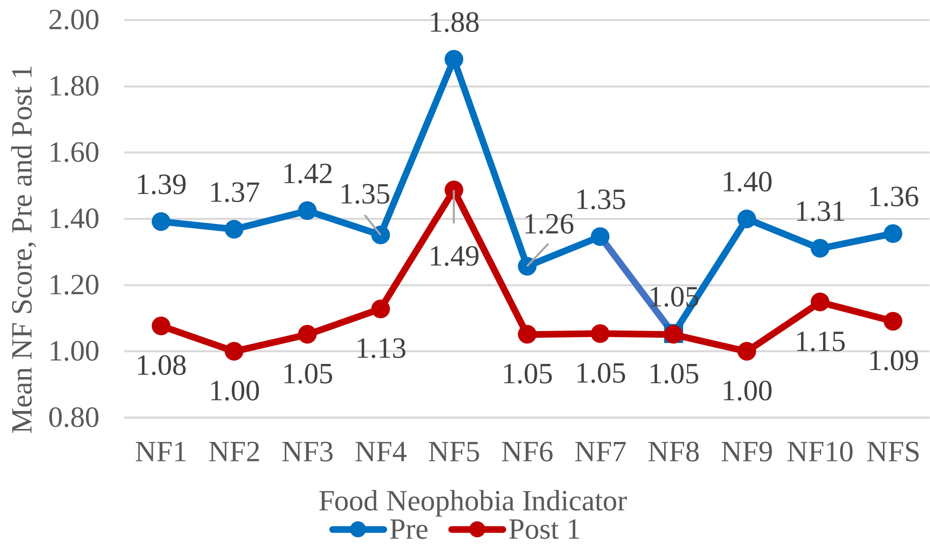
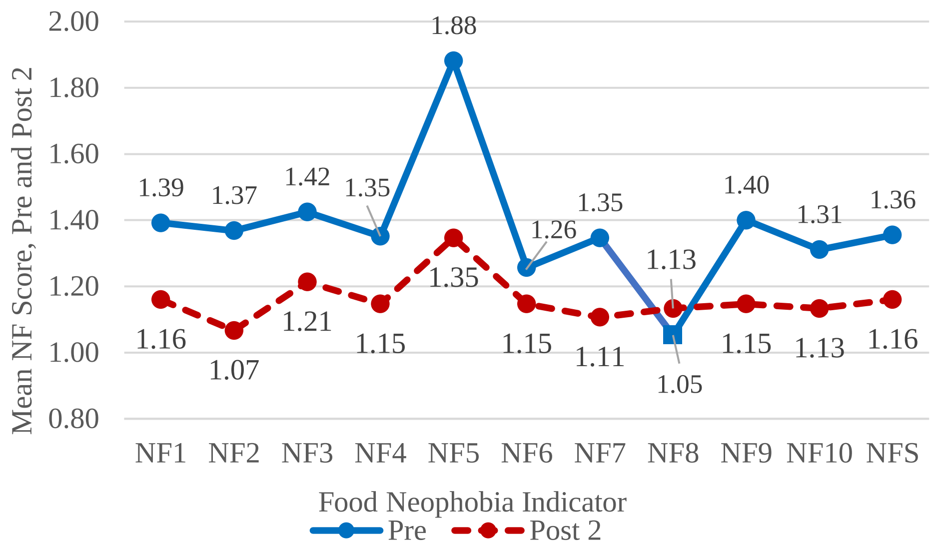


Figure 5

Average Food Neophobia Scale Scores Pre and Post 2 Programming



Moving on to the food preference pairwise comparisons, interpreting the results becomes more challenging. The results shown in Table 1 demonstrate that the curriculum's experiential component, where students interact with food ingredients to complete a recipe and then taste the final products, significantly increased students' preference for sweet potatoes, a healthy, minimally processed food. The recipe used in this study included sweet potatoes as the main ingredient. This change in willingness to try roasted sweet potatoes was significant in the Post1 comparison results (p=0.003) but the effect was reduced over time (though not back to baseline levels) in the Post2 results, were we found that when compared to the Pre scores, there was no significant difference found (p=0.648). These results imply that a single experience may not be enough to expect long term behavioral change, as suggested by prior literature (Park and Cook, 2019). The willingness to try results appear to be heavily influenced by direct experience with new foods in order to prompt a significant behavior change in the short-run. We cannot speculate as to how many direct experiences students may need in order to make these changes more permanent, but we did observe that one experience was not adequate in our sample. Additional data tables can be found in Appendix 2.

Table 1

Summary of Paired Comparison Results - Pre, Post1 and Post2 Programming

		Sample	**Male**	**Female**		**Sample**		**Male**		**Female**	
	Var.	Mean	Mean	Mean	Var.	Mean Diff.	P-value	Mean Diff.	P-value	Mean Diff.	P-value
Baked Kale Chips (A1)	Pre	2.6	2.9	2.3	Post 1	0.0	0.876	-0.2	0.680	-0.1	0.801
					Post 2	-0.1	0.709	0.2	0.827	***-0.1***	***0.028***
French Fries (E2)	Pre	4.4	4.6	4.2	Post 1	***-0.3***	***0.029***	-0.3	0.048	-0.2	0.386
					Post 2	0.3	0.117	***0.5***	***0.001***	-0.1	0.815
Yogurt and Fresh Fruit (B1)	Pre	4.1	4.3	4.1	Post 1	-0.2	0.332	-0.2	0.551	-0.1	0.746
					Post 2	-0.1	0.740	0.1	0.513	-0.1	0.864
Cheese Flavored Snack (D2)	Pre	4.0	3.9	4.0	Post 1	-0.2	0.384	-0.1	0.705	-0.2	0.576
					Post 2	0.4	0.040	***0.4***	***0.004***	0.2	0.700
Fresh Pico de Gallo (C1)	Pre	2.5	2.5	2.6	Post 1	-0.4	0.086	-0.1	0.715	-0.3	0.352
					Post 2	-0.2	0.454	-0.1	0.349	0.0	0.775
Cereal with Marshmallows (B2)	Pre	3.9	4.1	3.8	Post 1	-0.1	0.794	0.0	0.988	-0.1	0.828
					Post 2	0.4	0.076	0.5	0.050	0.1	0.952
Roasted chickpeas (D1)	Pre	2.9	3.2	2.6	Post 1	-0.3	0.175	-0.3	0.452	-0.2	0.532
					Post 2	0.1	0.606	0.4	0.070	0.2	0.005
Crackers, Cheese, and Ham Snack (C2)	Pre	3.4	3.5	3.5	Post 1	0.2	0.426	-0.1	0.721	0.2	0.543
					Post 2	0.3	0.176	0.4	0.619	0.2	0.932
Roasted Sweet Potatoes (E1)	Pre	2.7	2.8	2.8	Post 1	***-1.1***	***0.000***	***-1.0***	***0.010***	***-1.2***	***0.003***
					Post 2	-0.4	0.152	***-0.3***	***0.002***	-0.1	0.648
Potato Chips (A2)	Pre	4.5	4.7	4.3	Post 1	0.0	1.000	0.0	0.956	-0.1	0.788
					Post 2	***0.6***	***0.001***	***0.8***	***0.001***	0.1	0.662

Note: based on one-way ANOVA, $p < 0.01$

*See specific Food Preference survey items in Appendix 3

Conclusions

Overall Conclusions

The study's findings affirm the efficacy of a garden-based curriculum in mitigating food neophobia and promoting a preference for minimally processed foods among children. The key insights and implications of this study are as follows:

1. Reduction in Food Neophobia: The curriculum substantially lowered students' reluctance to try new foods, an important step toward diversifying their diet with healthier options. This outcome is crucial for encouraging dietary variety and increasing intake of fruits and vegetables among elementary-aged children (Falciglia, 2000; Pilner, 1994).
2. Enhancement of Healthy Food Preferences: Direct engagement with healthy food options, such as sweet potatoes, significantly influenced students' preferences. This finding supports the notion that hands-on food experiences are vital in shaping positive dietary habits and preferences (Park and Cook, 2019).
3. Sustainability of Changes: While the positive changes in food preferences showed some decline in the long-term post-programming phase, the sustained preference for healthier options indicates the lasting impact of the curriculum. This suggests that reinforcement and continuous engagement with healthy foods could further solidify these preferences.

The results underscore the need for ongoing research into the scalability of garden-based curricula and their long-term effects on children's dietary habits. Future studies should explore the effectiveness of such interventions across different settings and demographics to broaden the scope of these findings. Based on the study's outcomes, there is a clear case for integrating garden-based learning and nutrition education into school curricula as a strategy to combat childhood obesity and improve public health.

Recommendations

This study was limited in scope, but recommendations may be made concerning future research objectives and questions. A long-term study is needed to evaluate sustained behavior changes in food neophobia and food preferences. Students should be tracked across time over a several year period with recurring garden intervention and exposure to new foods. For instance, surveying students each year post Apple Seeds programming from kindergarten to 5th grade. An experimental control group evaluation with no exposure to our programming would be valuable to compare our results to, and determine any possible biases associated with evaluation. Our study's sample of students was limited to two schools in the Fayetteville school district resulting in limited socio-economic demographics of students. Future studies could include a more diverse sample from multiple schools in multiple school districts with different demographics. For example, Springdale Public Schools could be included in the sample as well since Apple Seeds has partner schools frequently receiving programming in the Springdale District. Overall, this study had limited resources due to timing and logistical constraints, but if Apple Seeds were to work with more undergraduate or graduate students in the future there is potential for expanded studies, or continuations of this study.

Final Acknowledgements

This study would not have been attainable without the valued assistance of our project partner Apple Seeds Organization in Northwest Arkansas and funding from the USDA, NIFA subaward grant (USDA Award 2021-38821-34712). Apple Seeds program directors and educator assistance, access to the teaching farm, and supplemental materials all played an integral role. A special thanks to Ryan Patterson, Shanleigh Powell, and Dominique Rosario for aiding with curriculum implementation, logistics, feedback, and overall development. Assistance from University interns under the USDA, NIFA subaward grant including Alex Pittman, Eileen Masterson, Kyla Clouthier, and Katherine Goodrich also played an important role in programming implementation and documentation. We extend our gratitude to all parties involved in making our curriculum and evaluation possible.

Appendices

Appendix 1 – Curriculum Component Visuals

Figure 1

Gardening Component

Figure 2

Culinary Component

Figure 3

Tasting Component

Appendix 2 – Additional Data Tables of Results

Table 2

Food Neophobia Responses Pre and Post1

	Var.	Mean	Std. Dev.	Freq.	F-stat	p-value
NF1	Pre	1.4	0.492	74	24.38	***0.000***
	Post	1.1	0.268	78		
NF2_r	Pre	1.4	0.486	76	44.91	***0.000***
	Post	1.0	0.000	78		
NF3_r	Pre	1.4	0.498	73	36.21	***0.000***
	Post	1.1	0.222	78		
NF4	Pre	1.4	0.481	74	11.09	***0.001***
	Post	1.1	0.336	78		
NF5_r	Pre	1.9	0.325	76	32.99	***0.000***
	Post	1.5	0.503	76		
NF6_r	Pre	1.3	0.440	74	13.42	***0.000***
	Post	1.1	0.222	78		
NF7	Pre	1.3	0.479	75	22.99	***0.000***
	Post	1.1	0.226	75		
NF8	Pre	1.1	0.225	76	0.00	0.970
	Post	1.1	0.222	78		
NF9_r	Pre	1.4	0.497	74	55.49	***0.000***
	Post	1.0	0.000	78		
NF10	Pre	1.3	0.466	74	5.63	***0.019***
	Post	1.1	0.358	74		
NFS	Pre	13.6	2.094	76	93.02	***0.000***
	Post	10.9	1.197	78		

Note: based on one-way ANOVA, $p<0.01$

*See specific NF items in Appendix 3

Table 3

Food Neophobia Responses Pre and Post 2

	Var.	Mean	Std. Dev.	Freq.	F-stat	p-value
NF1	Pre	1.4	0.492	74	10.62	***0.001***
	Post	1.2	0.369	75		
NF2_r	Pre	1.4	0.486	76	22.91	***0.000***
	Post	1.1	0.251	75		
NF3_r	Pre	1.4	0.498	73	7.93	***0.006***
	Post	1.2	0.412	75		
NF4	Pre	1.4	0.481	74	8.74	***0.004***
	Post	1.1	0.356	75		
NF5_r	Pre	1.9	0.325	76	64.58	***0.000***
	Post	1.3	0.479	75		
NF6_r	Pre	1.3	0.440	74	2.82	***0.095***
	Post	1.1	0.356	75		
NF7	Pre	1.3	0.479	75	13.25	***0.000***
	Post	1.1	0.311	75		
NF8	Pre	1.1	0.225	76	2.94	0.088
	Post	1.1	0.342	75		
NF9_r	Pre	1.4	0.497	74	14.81	***0.000***
	Post	1.1	0.356	75		
NF10	Pre	1.3	0.466	74	7.03	***0.009***
	Post	1.1	0.342	75		
NFS	Pre	13.6	2.094	76	38.93	***0.000***
	Post	11.6	1.732	75		

Note: based on one-way ANOVA, $p<0.01$

Table 4

Food Neophobia Responses overall by gender, Pre and Post1

	Var.	Mean	Std.	Freq.	F-stat	p-value
NF1	M	1.2	0.421	75	0.00	1.000
	F	1.2	0.421	75		
NF2_r	M	1.2	0.388	77	0.01	0.939
	F	1.2	0.392	75		
NF3_r	M	1.2	0.430	75	0.30	0.587
	F	1.2	0.405	74		
NF4	M	1.3	0.445	75	0.58	0.448
	F	1.2	0.412	75		
NF5_r	M	1.7	0.475	75	0.28	0.600
	F	1.7	0.458	75		
NF6_r	M	1.2	0.417	77	5.68	0.018
	F	1.1	0.277	73		
NF7	M	1.2	0.426	77	1.45	0.230
	F	1.2	0.364	71		
NF8	M	1.0	0.195	77	0.58	0.448
	F	1.1	0.251	75		
NF9_r	M	1.3	0.438	75	2.68	0.104
	F	1.1	0.356	75		
NF10	M	1.4	0.484	72	16.27	***0.000***
	F	1.1	0.295	74		
NFS	M	12.4	2.302	77	1.83	0.178
	F	12.0	1.948	75		

Note: based on one-way ANOVA, $p<0.01$

* See specific NF items in Appendix 3

Table 5

Food Neophobia Scores Responses overall by gender, Pre and Post 2

	Var.	Mean	Std.	Freq.	F-stat	p-value
NF1	M	1.3	0.439	78	0.16	0.691
	F	1.3	0.455	70		
NF2_r	M	1.2	0.420	80	0.02	0.876
	F	1.2	0.413	70		
NF3_r	M	1.3	0.470	78	0.04	0.834
	F	1.3	0.464	69		
NF4	M	1.3	0.439	78	0.04	0.851
	F	1.2	0.432	70		
NF5_r	M	1.6	0.497	80	1.06	0.306
	F	1.7	0.478	70		
NF6_r	M	1.2	0.428	80	1.30	0.256
	F	1.2	0.371	68		
EvNF7	M	1.3	0.436	80	0.81	0.370
	F	1.2	0.394	69		
NF8	M	1.1	0.318	80	0.74	0.392
	F	1.1	0.259	70		
NF9_r	M	1.3	0.470	78	1.55	0.215
	F	1.2	0.423	70		
NF10	M	1.3	0.463	79	7.98	***0.005***
	F	1.1	0.323	69		
NFS	M	12.7	2.240	80	0.87	0.353
	F	12.4	2.024	70		

Note: based on one-way ANOVA, $p<0.01$

*See specific NF items in Appendix 3.

Table 6

Food Preference Responses Pre and Post1

	Var.	Mean	Std. Dev.	Freq.	F-stat	p-value
kal	Pre	2.6	1.403	74	0.02	0.876
	Post	2.6	1.368	73		
fri	Pre	4.4	0.867	76	4.86	***0.029***
	Post	4.7	0.716	75		
yog	Pre	4.1	1.254	75	0.95	0.332
	Post	4.3	1.172	73		
chz	Pre	4.0	1.270	76	0.76	0.384
	Post	4.1	1.174	74		
pic	Pre	2.5	1.357	74	3.00	0.086
	Post	2.9	1.489	74		
cer	Pre	3.9	1.209	74	0.07	0.794
	Post	4.0	1.298	74		
chk	Pre	2.9	1.329	73	1.86	0.175
	Post	3.2	1.462	73		
lun	Pre	3.4	1.451	73	0.64	0.426
	Post	3.2	1.601	72		
yam	Pre	2.7	1.474	74	24.27	***0.000***
	Post	3.9	1.289	74		
chp	Pre	4.5	0.815	74	0.00	1.000
	Post	4.5	0.954	74		

Note: based on one-way ANOVA, $p<0.01$

*See specific Food Preference items in Appendix 3

Table 7

Food Preference Responses, Males only Pre and Post1

	Var.	Mean	Std.	Freq.	F-stat	p-value
kal	Pre	2.9	1.552	71	0.17	0.680
	Post	3.0	1.605	71		
fri	Pre	4.6	0.621	73	4.11	***0.048***
	Post	4.9	0.424	72		
yog	Pre	4.3	1.143	73	0.36	0.551
	Post	4.4	1.086	72		
chz	Pre	3.9	1.373	71	0.14	0.705
	Post	4.0	1.344	71		
pic	Pre	2.5	1.503	71	0.13	0.715
	Post	2.7	1.544	71		
cer	Pre	4.1	1.252	71	0.00	0.988
	Post	4.1	1.357	71		
chk	Pre	3.2	1.497	71	0.58	0.452
	Post	3.5	1.578	70		
lun	Pre	3.5	1.550	71	0.13	0.721
	Post	3.7	1.569	70		
yam	Pre	2.8	1.521	71	7.24	***0.010***
	Post	3.8	1.302	71		
chp	Pre	4.7	0.670	71	0.00	0.956
	Post	4.7	0.877	71		

Note: based on one-way ANOVA, $p<0.01$

*See specific Food Preference items in Appendix 3

Table 8

Food Preference Responses, Female only, Pre and Post1

Var.		Mean	Std.	Freq.	F-stat	p-value
kal	Pre	2.3	1.228	74	0.06	0.801
	Post	2.4	1.227	74		
fri	Pre	4.2	1.114	75	0.76	***0.386***
	Post	4.4	0.985	74		
yog	Pre	4.1	1.215	73	0.11	0.746
	Post	4.2	1.249	73		
chz	Pre	4.0	1.254	75	0.32	0.576
	Post	4.2	1.071	74		
pic	Pre	2.6	1.374	75	0.88	0.352
	Post	3.0	1.426	73		
cer	Pre	3.8	1.167	75	0.05	0.828
	Post	3.9	1.235	73		
chk	Pre	2.6	1.224	73	0.40	0.532
	Post	2.9	1.325	73		
lun	Pre	3.5	1.401	72	0.38	0.543
	Post	3.2	1.528	72		
yam	Pre	2.8	1.612	75	9.48	***0.003***
	Post	4.0	1.267	72		
chp	Pre	4.3	0.967	75	0.07	0.788
	Post	4.4	0.979	72		

Note: based on one-way ANOVA, $p<0.01$

*See specific Food Preference items in Appendix 3

Table 9

Food Preference Responses overall, Pre and Post 2

	Var.	Mean	Std. Dev.	Freq.	F-stat	p-value
kal	Pre	2.6	1.403	74	0.14	0.709
	Post	2.7	1.375	75		
fri	Pre	4.4	0.867	76	2.49	0.117
	Post	4.1	1.131	74		
yog	Pre	4.1	1.254	75	0.11	0.740
	Post	4.2	1.197	75		
chz	Pre	4.0	1.270	76	4.31	***0.040***
	Post	3.5	1.367	74		
pic	Pre	2.5	1.357	74	0.56	0.454
	Post	2.6	1.484	74		
cer	Pre	3.9	1.209	74	3.19	0.076
	Post	3.5	1.395	73		
chk	Pre	2.9	1.329	73	0.27	0.606
	Post	2.8	1.420	75		
lun	Pre	3.4	1.451	73	1.85	0.176
	Post	3.1	1.487	74		
yam	Pre	2.7	1.474	74	2.07	0.152
	Post	3.1	1.604	75		
chp	Pre	4.5	0.815	74	12.77	***0.001***
	Post	3.9	1.216	74		

Note: based on one-way ANOVA, $p<0.01$

*See specific Food Preference items in Appendix 3

Table 10

Food Preference Responses, Males only, Pre and Post2

	Var.	Mean	Std. Dev.	Freq.	F-stat	p-value
kal	Pre	2.6	1.368	75	0.05	0.827
	Post	2.7	1.375	74		
fri	Pre	4.7	0.716	73	12.37	***0.001***
	Post	4.1	1.131	75		
yog	Pre	4.3	1.172	74	0.43	0.513
	Post	4.2	1.197	74		
chz	Pre	4.1	1.174	74	8.80	0.004
	Post	3.5	1.367	74		
pic	Pre	2.9	1.489	74	0.88	0.349
	Post	2.6	1.484	73		
cer	Pre	4.0	1.298	73	3.90	***0.050***
	Post	3.5	1.395	75		
chk	Pre	3.2	1.462	72	3.33	0.070
	Post	2.8	1.420	74		
lun	Pre	3.2	1.601	74	0.25	0.619
	Post	3.1	1.487	75		
yam	Pre	2.8	1.289	74	10.09	***0.002***
	Post	3.1	1.604	74		
chp	Pre	4.5	0.954	78	11.45	***0.001***
	Post	3.9	1.216	70		

Note: based on one-way ANOVA, $p<0.01$

*See specific Food Preference items in Appendix 3

Table 11

Food Preference Responses, Female only, Pre and Post2

	Var.	Mean	Std. Dev.	Freq.	F-stat	p-value
kal	Pre	2.9	1.456	78	4.90	0.028
	Post	2.4	1.256	70		
fri	Pre	4.3	0.947	80	0.05	0.815
	Post	4.3	1.093	69		
yog	Pre	4.1	1.267	80	0.03	0.864
	Post	4.2	1.158	69		
chz	Pre	3.7	1.324	80	0.15	0.700
	Post	3.8	1.346	69		
pic	Pre	2.5	1.420	77	0.08	0.775
	Post	2.6	1.439	70		
cer	Pre	3.7	1.351	77	0.00	0.952
	Post	3.8	1.288	69		
chk	Pre	3.1	1.361	78	8.18	***0.005***
	Post	2.5	1.324	69		
lun	Pre	3.2	1.505	78	0.01	0.932
	Post	3.3	1.452	68		
yam	Pre	3.0	1.503	78	0.21	0.648
	Post	2.9	1.609	70		
chp	Pre	4.2	1.140	78	0.19	0.662
	Post	4.2	1.002	69		

Note: based on one-way ANOVA, $p<0.01$

*See specific Food Preference items in Appendix 3

Appendix 3 – Survey Instrument

[note: students will only participate with a consent form signed by their parent/guardian]

Introductory Questions:

1. Which option describes you best?
   A. Boy B. Girl C. I prefer not to respond
2. What age are you?
   _______ years
3. If you were to rate how hungry you are right now with 1 being not hungry at all to 7 being very hungry, how would you rate yourself (please circle)?

   Not Hungry at All 1 2 3 4 5 6 7 Very Hungry

Willingness to Try 10-Items (NF items):

Please read each of the following statements and circle the answer that is true or not true about you. Please answer honestly, there are no right or wrong answers.

1. I like the taste of new foods.
   True Not True
2. I am sad when someone asks me to try a new food.
   True Not True
3. I don't think new foods taste good.
   True Not True
4. I don't feel angry when I am asked to try new foods.
   True Not True
5. I don't know if I will like new foods.
   True Not True
6. I don't feel happy when I am asked to try new foods.
   True Not True
7. I think I like to try new foods.
   True Not True
8. I don't feel scared when I'm asked to try new foods.
   True Not True
9. I don't like to try new foods.
   True Not True
10. I do not think that new foods taste bad.
    True Not True

<u>Food Preferences (Paired Comparisons):</u>

Please rate how much you would like to eat the following foods. Use a scale of 1 to 5, where 1 means you do not want to eat the food and 5 means you would love to eat the food.

Baked Kale Chips (A1, kal)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

French Fries (E2, fri)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Yogurt and Fresh Fruit (B1, yog)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Cheese Flavored Snack (D2, chz)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Fresh Pico de Gallo (C1, pic)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Cereal with Marshmallows (B2, cer)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Roasted chickpeas (D1, chk)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Crackers, Cheese, and Ham Snack (C2, lun)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Roasted Sweet Potatoes (E1, yam)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Potato chips (A2, chp)

(I do not want to eat it) 1 2 3 4 5 (I would love to eat it)

Appendix 4 – Parent/Guardian Consent Form

Statement of Informed Consent for Parents/Guardians of Minors

Garden-Based Nutritional Lesson and Survey

KEY INFORMATION:

- Your child is being asked to be in a research study to demonstrate the effect of a garden-based healthy foods lesson on children's healthy food choices. As with all research studies, participation is voluntary.
- The purpose of this study is to measure the changes in student preferences and willingness to try healthy foods. Key lesson concepts include the importance of eating more fruits and vegetables and less highly processed foods after receiving a short in-classroom garden-based lesson curriculum.
- Approximately 300-500 students will take part in this study. The results will be used for an honors undergraduate thesis in the Dale Bumpers School of Agricultural and Life Sciences at the University of Arkansas (UA). This is part of an ongoing capacity building grant through the United States Department of Agriculture, National Institute of Food and Agriculture. The UA is working with Apple Seeds, Inc. on the grant.
- If you give permission for your child to take part in this study, it will take about one hour and twenty minutes of their time, in total. They will take a pre-survey before the lesson, then participate in one forty-five minute lesson, and about three weeks later, a post-survey will be given. Your child's survey responses will remain anonymous, and no follow up will be conducted once pre- and post-surveys are completed.
- If you do not give permission for your child to participate in the study, your child can still participate in the lesson and activity, but not be included in the survey activities.
- Your child will be given a lesson and participate in a gardening activity accompanied by a complimentary culinary activity (as is typical of Apple Seeds programming). This will occur at the AppleSeeds teaching kitchen located at Gully Park in Fayetteville Arkansas.
- This study has no more than minimal risk. Minimal risks may include discomfort in trying new foods, restlessness during the lesson, or other normal classroom related risks.
- Your child may benefit by receiving a fun lesson that is different from their normal class schedule and will be provided with a healthy snack. They may also potentially feel more excited about making healthier food choices outside of the classroom!

Participation in this study is voluntary. If you decide to have your child participate, they are free to skip any question that is asked. They may also withdraw from this study at any time without penalty.

CONTACTS AND QUESTIONS:

If you have any questions about this survey itself, please contact Dr. Nathan Kemper by email or phone at nkemper@uark.edu or 479-575-2697. You may also contact the UA Research Compliance office listed below if you have questions about your rights as a participant, or to discuss any concerns about, or problems with the research: Iroshi (Ro) Windwalker IRB Coordinator, 105 MLKG Building, Fayetteville, AR 72701, Ph. 479-575-2208. If you have any questions about the program or Apple Seeds, please contact Ryan Patterson by email or phone at ryan@appleseedsnwa.org or 479-966-9206.

STATEMENT OF CONSENT:

I am 18 years of age or older. I have read and understood the above information. I give consent for my child to participate in the study.

Printed Name: ____

Signature: ____ Date: __________________

Student Consent: I have discussed this study with my parent/guardian, and I agree to participate. I understand that even if they agree, it's okay if I choose not to participate or change my mind about participating later.

Signature: ____ Date: __________________

References

Apple Seeds. (2023). *Farm lab*. Retrieved March 1, 2023, from https://appleseedsnwa.org/farmlab

Arkansas English Language Arts (ELA) Standards. (2022). *Grade 2 - Arkansas*. Arkansas Gov. Retrieved March 5, 2023, from https://dese.ade.arkansas.gov/Files/20201209104333_SecondGradeELA.pdf

Chan, C. L., Tan, P. Y. & Gong, Y. Y. (2022). Evaluating the impacts of school garden-based programs on diet and nutrition-related knowledge, attitudes and practices among the school children: A systematic review. *BMC Public Health*, *22*, 1251 (2022). https://doi.org/10.1186/s12889-022-13587-x

De Oliveira Torres, T., Gomes, D. R., & Mattos, M. P. (2020, November 6). *Factors associated with food neophobia in children: Systematic review*. Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo. Retrieved March 30, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7649857/#:~:text=The%20main%20factors%20associated%20with,or%20affection%20at%20mealtime%2C%20childhood

Falciglia, G. A., Couch, S. C., Gribble, L. S., Pabst, S. M., & Frank, R. (2000). Food neophobia in childhood affects dietary variety. *Journal of Academic Medicine Dietetics Association 2000*;100(12):1474–81. https://doi.org/10.1016/S0002-8223(00)00412-0

Grotto, D., Zied, E. (2010). The Standard American Diet and its relationship to the health status of Americans. *Nutrition in Clinical Practice*, *25*(6), 603-612. https://doi.org/10.1177/0884533610386234

Hess, A. S., & Hess, J. R. (2017). Understanding tests of the association of categorical variables: the Pearson chi-square test and Fisher's exact test. Transfusion (Philadelphia, Pa.), 57(4), 877–879. https://doi.org/10.1111/trf.14057

Loewen, R., Pliner, P. (2000). The food situations questionnaire: A measure of children's willingness to try novel foods in stimulating and non-stimulating situations. *Appetite*, *35*(3), 239-250. https://doi.org/10.1006/appe.2000.0353

Mathews, D. R., Kunicki, Z. J., Colby, S. E., Franzen-Castle, L., Kattelmann, K. K., Olfert, M. D., & White, A. A. (2019). Development and testing of program evaluation instruments for the *iCook 4-H* curriculum. *Journal of Nutrition Education and Behavior*, *51*(3), S60-S68. https://doi.org/10.1016/j.jneb.2018.11.006

Miller, W., & Knapp, T. (2019). *Rural profile of Arkansas 2019: Social and economic trends affecting rural Arkansas.* Arkansas Division of Agriculture. https://www.uaex.uada.edu/business-communities/ced-blog/posts/2019/March/2019-rural-profile-of-arkansas-shows-need-for-infrastructure-improvements-statewide.aspx

Monteiro, C.A., Moubarac, J.-.-C., Cannon, G., Ng, S.W. and Popkin, B. (2013). Ultra-processed products: Global dominance. *Obesity Reviews*, *14*(S2) 21-28. https://doi.org/10.1111/obr.12107.

Next Generation Science Standards. (n.d.). *Read the standards (4th grade).* https://www.nextgenscience.org/search-standards?keys=&tid%5B%5D=104

Pliner, P. (1994). Development of measures of food neophobia in children. *Appetite*, *23*(2), 147–163. https://doi.org/10.1006/appe.1994.1043

Rioux, C., Lafraire, J., & Picard, D. (2016). Food neophobia and pickiness in young children. How to measure it? *Menu: Journal of Food and Hospitality Research*, *5*. https://core.ac.uk/download/pdf/157602134.pdf

Skelton, K. R., Lowe, C., Zaltz, D. A., Benjamin-Neelon, S. E. (2020). Garden-based interventions and early childhood health: An umbrella review. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(121).

Skinner, K., Pratley, E., & Burnett, K. (2016). Eating in the City: A review of the literature on food insecurity and indigenous people living in urban spaces. *Societies*, *6*(2), 7. https://doi.org/10.3390/soc6020007

Trakman, G. L., Forsyth, A., Hoye, R., Belski, R., (2017). Developing and validating a nutrition knowledge questionnaire: key methods and considerations. *Public health nutrition*, *20*(15), 2670–2679. https://doi.org/10.1017/S1368980017001471

U.S. Department of Agriculture. (2021.) *Household food security in the United States in 2021*. Retrieved January 16, 2023, from https://www.ers.usda.gov/webdocs/publications/104656/err-309_summary.pdf?v=220.7

USDA. (2022). USDA Announces Actions on Nutrition Security. Usda.gov. Retrieved 2023, from https://www.usda.gov/sites/default/files/documents/usda-actions-nutrition-security.pdf

Wang, L., Martínez Steele, E., Du, M., Pomeranz, J. L., O'Connor, L. E., Herrick, K. A., Luo, H., Zhang, X., Mozaffarian, D., & Zhang, F. F. (2021). Trends in consumption of ultra-processed foods among US youths aged 2-19 Years, 1999-2018. *JAMA*, *326*(6), 519–530. https://doi.org/10.1001/jama.2021.10238

Willis, D., & Fitzpatrick, K. (2020). Adolescent food insecurity: The special case of Marshallese youth in North-West Arkansas, USA. *Public Health Nutrition*, *23*(3), 544-553. doi:10.1017/S1368980019002647