

PILOT STUDY: PLANT-BASED DIETS IN SCHOOL LUNCHES

by

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## Plant-based diet choices in school lunches

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### **ABSTRACT**

Plant-based diets have seen a rise in popularity over the past decade. Despite only 5% of the United States currently identifying as vegetarian, this study was designed to explore interest in plant-based meals in school lunches in a school (Chandler Preparatory Academy) in Arizona. A 13-question survey, created using Qualtrics, was conducted online over a 9-day period asking students about their current diet, potential lunch choices, and general knowledge about climate change. The link was issued to students through Google classroom, a system utilized by the school. After 99 complete responses from students, it showed that despite their dietary choice to not be plant-based, students felt that more options should be available, and if they were given more frequently, they would be chosen by over 50% one to two days a week. Students were also willing to consider making changes to their diets if they knew it impacted climate change while recognizing it impacted climate change. This study serves as a pilot study to future studies where types of plant-based choices as school lunch options in which interest in plant-based options can be further evaluated.

*Keywords:* Plant-based diets, school lunch choices, diet choice, climate change, environment

## INTRODUCTION

A 2018 Gallup poll showed that while 70% of Americans from 18-34 were concerned about climate change, 56% of Americans 55 and older were worried (Reinhard, 2018). However, younger generations won't necessarily go the route of contacting government officials, donating to charity, or volunteer (see Figure 1), yet perhaps changes can be made that are more individual-centered. Asking individuals to make changes such as turning off lights, changing to energy-efficient appliances, and shutting off the water while brushing teeth have been shown to be environmentally friendly practices that can help mitigate climate change that many people are aware of (Denchak, 2017). Yet, another potential area that could have long-standing impacts includes changes to diets.

“What we eat and how we eat has more impact on the Earth than almost anything else” (Sage, 2012, p. 1). Statements like these have shifted the way that many people on the planet look at their food choices. Food is necessary for our survival; however, the types of foods that we eat are constantly changing as society's needs change. In the past century, we have seen more change with human's relationship to food unprecedented by almost any other time in history. The only comparable time would be the transition to farming from hunting and gathering during the Neolithic age (Sage, 2021). These changes have had both positive and negative impacts on the consumers, the farmers, corporations, and finally, and perhaps most significantly, the planet. Given current diet projections, it is possible it will become more difficult to feed the growing population around the globe, especially as many animal-based diets currently harm ecosystems, deplete water resources, and are a driving force for climate change (Frandsen, 2020).

With this in mind, it will be up to the consumer, in conjunction with farmers and corporations, to start making changes that can help positively impact the trajectory of climate change. Yet, as

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consumers asking for people to make changes can be difficult for all age brackets. However, younger generations have been shown to be more focused on climate change than older generations, so this may lead to more change from these generations. Many young people are influenced by the choices that their family and friends make, and when adolescents eat at home, they are typically following the choices that are made by those they live with. However, when adolescents/school-aged children are at school, they have the freedom to make choices as long as choices are given. Perhaps changes can start by educating younger generations on how their personal choices impact the planet and allowing them the opportunity to make personal changes. This study will analyze to what extent students are willing to integrate and choose plant-based diets for their school lunches, and to a lesser extent, would students be willing to make changes to food choices if they knew it impacted climate change?

## BACKGROUND

### 1. Plant-Based Diet Benefits

#### *1.1 Environmental benefits.*

Food is one leading cause of greenhouse gases (GHG's), contributing around 20-30%, with most of these emissions coming from animal-based protein production (Beverland, 2014). Although the U.N. estimated that livestock production accounted for 18% of the total GHG emissions globally, another report from World Watch Institute estimated the true impact to be somewhere closer to 50% of all GHG emissions. Due to the environmental impacts of meat and dairy products, it has been suggested that humans should start transitioning to a more plant-based diet, and some suggest it could be the most important issue when it comes to sustainability (Beverland, 2014; Vinnari & Vinnari, 2014). Our food system considers many stages of food production, including growing/production, processing, distribution, storage, selling, and food waste, yet consumers drive this system. This has been seen this way as the positive impact from a reduction in animal-based protein, and thus less livestock needed could have a much quicker impact on the environment than many other alternatives. Meat has been shown to be unsustainable for a variety of reasons. Fewer forests would be destroyed for needed grazing land, less water would be utilized, and GHG's would be reduced (Beverland, 2014). Animals also consume more protein than they produce, as they consume around 6kg per kg produced (Beverland, 2014). Now truly sustainable diets may vary based on the wherein the food chain that something falls, as a sustainable diet for farmers may not be the same as a sustainable diet for a consumer. The FAO defined a sustainable diet as one with low environmental impact in terms of maintaining food security and health while keeping the environment in mind and

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keeping economics and culture in mind (Sabaté & Soret, 2014). However, stigmas exist around food as it is typically seen as a social status signifier (Beverland, 2014).

For example, India is typically thought of as having a more vegetarian-focused diet, yet as times have changed, there seems to be a shift. Meat is now being seen as a status symbol, which has led to the amount of meat being consumed to increase. Meat is also seen as exotic/more diverse, while vegetarian dishes are seen as the food that can be consumed at home, so thus blander. Indians, typically of younger generations, have also been influenced by social media and videos seen on T.V./ YouTube that meat is a status symbol. Other countries have seen a rise in meat consumption, including Brazil and China (Khara & Ruby, 2019). Hong Kong citizens are experiencing similar issues even though their diet was only 22% meat; it was still deemed unsustainable (Tang & Sobko, 2019). Plant-based diets are needed for sustainability as they rely on fewer resources and are less harsh on the environment (Sabaté & Soret, 2014). With current population growth, figuring out a solution to feeding the world is also a necessary component. Compared to animals, growing plant-based protein sources (such as soy, legumes, beans) utilize far less energy, fossil fuels, land, and water. The emissions created during the farm stage from nitrous oxide and methane are significant contributors to GHG's. A bulk of these GHGs created by the agriculture section are typically produced by livestock (Sabaté & Soret, 2014). The overall reduction of GHGs from switching to a plant-based diet would reduce CO<sub>2</sub> and GHG emissions, but planetary impacts would be beneficial in other areas, such as reducing land and water use (Sabaté & Soret, 2014). Producing plant proteins typically requires less land, water, and energy, while farming vegetables, legumes, and grains create the lowest amount of carbon emissions, especially when compared to producing animal protein (Lynch, Johnston & Wharton, 2018; Beverland, 2014). This same study also showed that a more plant-based diet is

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considered one of the most effective, if not the most effective, diet in reducing GHGs (Lynch, Johnston & Wharton, 2018). Plant-based diets have also been shown to mitigate climate change, pollution and decrease species lost (Beverland, 2014).

There is a current increase in plant-based diets in terms of popularity, yet the reasons are still undetermined; however, part of it has been linked to people having an interest in a more environmentally friendly diet. A study looking at New Zealander's dietary choices analyzed ten different dietary options, ranging from the current New Zealander's diet to a waste-free vegan. The closer diets were to vegan and waste-free vegan, the more savings and better sustainability that was observed. At the conclusion, it was determined the best diet, in terms of health benefits and sustainability, eliminated animal products entirely and was a waste-free vegan diet. This study continued to support other studies that plant-based diets helped mitigate climate change and improve health. The study concluded that in New Zealand, as it would be elsewhere, a change in eating patterns (shifting to plant-based diets) allowed for GHG emission reduction, increased health, and overall cost savings for the population (Drew, Cleghorn, Macmillan & Mizdrak, 2020).

### *1.2 Health Benefits and Potential Concerns.*

As dietary guidelines have shifted throughout the world, many countries are suggesting that environmental sustainability be part of the guidelines, yet this can have a benefit on the health of the citizens of these nations. Vegetarian/vegan/plant-based diets not only offer planetary health benefits but personal health benefits (Lynch, Johnston & Wharton, 2018). Animal-based protein diets are not necessary for optimal human health and, in fact, have shown that perhaps it is disadvantageous. It has even been recommended that purely for the health benefits, meat consumption should be cut by at least half of what is currently eaten in most



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developed worlds (Vinnari & Vinnari, 2014). Most of the time, when people choose to go vegetarian/decrease meat consumption, it is for health. An overall optimal diet is lower in calories and contains a large amount of plant products. Plant-based diets not only meet these criteria but are also typically higher in folate, fiber, and antioxidants (Beverland, 2014).

Typically, studies have shown that vegetarian and vegan populations are less likely to be obese and overweight (Magkos et al., 2020). The study does suggest it is possible that these health benefits are not completely in relation to the diet, but rather healthier overall lifestyles from the participants that focus on plant-based diets. A case study presented in a study by Tusso, Ismail, Ha, and Bartolotto showed the health improvements by a 63-year old man by shifting to a plant-based diet. He was taken off a number of medications and saw improvements in his cholesterol and blood pressure (2013). Vegetarians have also been shown to have lower incidence rates of cancer, death with ischemic heart disease, and type 2 diabetes (Magkos et al., 2020).

One of the concerns of plant-based diets is protein intake, yet multiple studies have shown that patients on a plant-based diet are not at risk for a protein deficiency, as all the essential amino acids can be obtained from plant-based foods. Some combinations such as rice and black beans have been shown to give people all the essential amino acids (Tusso, Ismail, Ha & Bartolotto, 2013). It has also been suggested that protein intakes are adjusted to account for “reduced bioavailability of plant proteins” (Magkos et al., 2020). Despite differences within the type of protein being taken in and some physiological differences, the plant-based was concluded to be on par with animal-based protein diets (Lynch, Johnston & Wharton, 2018). Another potential issue is that vegetarian/vegan diets can become high in starchy foods, refined grains, and overall higher consumptions of food (Magkos et al., 2020).

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## 2. Plant-Based Diets in Adolescents/School-Age Children

Overall, diet choices are shifting. In a 2002 survey in Canada, approximately 4% of Canadian adults were vegetarian, and in a recent Gallup poll, 5% of the United States identifies as a vegetarian (Amit, 2010; Hrynowski, 2019). However, only 2% of 6-17 year old children in the United States would identify as a vegetarian, and only 0.5% as vegan (Amit, 2010). There are many reasons adults and children may choose vegetarian diets; however, there are mixed reviews in children and adolescents if vegetarian diets are suitable. Some studies suggest that adolescents and children are more vulnerable to nutrient deficiencies (Magkos et al., 2020). The more restrictive the diet becomes, the more likely that adolescents will lack nutritional needs. However, well-balanced vegetarian diets, Lacto-vegetarian, and Lacto-ovo vegetarians are comparable to standard omnivore diets and meet all nutritional needs, and may, in fact be optimal (Amit, 2010; Beverland, 2014).

As adolescents choose a vegetarian lifestyle, although there are limited concerns for growth, there is a concern that vegetarian diets could be used to mask eating disorders. As long as it is monitored, it has been shown to even offer advantages for adolescents choosing a vegetarian diet (Amit, 2010). "There is evidence of healthier intakes of total fat, saturated fats, servings of vegetables and fruits, as well as fewer intakes of fast foods, salt, and consumption of regular soda and fruit drinks (Amit, 2010, p. 306). As with most vegetarian diets, there needs to be a review of B<sub>12</sub>, calcium, vitamin D, and iron to ensure it meets the child's nutritional needs (Amit, 2010). The Amit study concluded that vegetarian and vegan diets could meet the nutritional needs of children, of all ages, with proper monitoring.

In a similar study conducted by Dunham and Kollar, they also concluded that vegetarian diets could be healthy as long as nutritional assessment and counseling for families played a

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role in it. One of the recommendations that they made was to assess school lunch availability of vegetarian options from toddler/preschool level through adolescents (Dunham & Kollar, 2006). The same study did suggest it may be necessary to supplement nutrients through a multivitamin or single vitamin depending on the nutrient deficiency.

### **3. Plant-Based Choices for School Lunches**

Plant-based choices for lunches in a school setting may be one of the easier ways to start having people, especially adolescents, make these choices more often. However, how it is implemented and perceived will impact the success. In Finland, a school district, Helsinki School district, introduced a mandatory vegetarian day to see how it was received. At the start of the study, it was observed that there was a decrease in students choosing school lunches, and when students did choose vegetarian options, they typically took less and left more food behind (Lombardini & Lankoski, 2013). However, as the study continued students the only noticed trend was that students were taking less food. This study did acknowledge the fact that these were forced choices and that mandatory changes possibly created some of the issues. The school did introduce vegetarian alternatives every day since 2007, and the study was conducted in 2013, and it was only on the mandatory days where more resistance was found (Lombardini & Lankoski, 2013).

Another town in Europe, Ghent in northwest Belgium, introduced a similar policy by enacting “Thursday Veggie Day” (De Keyzer et al., 2012). This was enacted due to the positive benefits that can come from vegetarian diets in terms of health but also so the lunches could be more nutritious than the lunches that were typically offered. The school system offered lunches to primary schools and early childhood programs on Thursdays, and only if parents requested were these lunches changed (De Keyzer et al., 2012). When analyzing the food waste, there was

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not a statistical difference in the food waste when looking at the main course. However, there was less waste on regular days in terms of dessert and soup on regular days, yet it offered insight that offering these meals can be successful in school settings (De Keyzer et al., 2012).

Another study in Maryland introduced soy-based products into their school lunches. Soy-based choices were offered to middle school students in replacement to normal meat products (Lazor, Chapman & Levine, 2010). The study offered soy-based chicken nuggets, chicken-less slices, macaroni and cheese with soy pasta, and beef patties, although this was a narrowed “top-4” list from the first 15 soy foods that were offered. Then students were fed traditional items one week and then the soy-based alternatives the following week. The comparison was drawn between food waste between the two weeks, with the entrees being chosen at random to be weighed with condiments removed (Lazor, Chapman & Levine, 2010). Despite some issues that were run into with the study with weather conditions impacting lunch during some of the days, they found that middle school students’ consumer about equal numbers of soy-based products in comparison to traditional lunch products, and the added benefits of the soy products helps offer more support in choosing these as school lunch options (Lazor, Chapman & Levine, 2010).

Finally, a study looking at college students at the University of Cambridge analyzed vegetarian meal choices due to increased availability. The study hoped to offer some insight as to how to potentially nudge people in higher-income countries to choose more plant-based options, as it would offer not only increased personal health but planetary health as well (Garnett et al., 2019). The three cafeterias on the campus offered more vegetarian meal options and collected data in two studies (one observational and one experimental). The data was collected utilizing student I.D. purchases, as the system already collected student lunch choices when they are purchased (Garnett et al., 2019). In all three locations across both of the studies, when the

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number of vegetarian meals increased, so did the sales of vegetarian meals. One of the more interesting aspects of the study was that the increase of sales increased greatest from participants who previously in the lowest quartile of ordering vegetarian meals (Garnett et al., 2019). This not only increased the sales of vegetarian meals but decreased the sales of meat, and if meal preferences in students were set, then this most likely would not have happened. Although it seems obvious that if more options are given, sales would increase. However, in this study from 2019, this also seemed to show that this was a previously untested theory (Garnett et al., 2019). This offers valuable insight into a potential method in increasing vegetarian meal consumption in upper secondary (high), lower secondary (middle), and elementary schools.

## METHODOLOGY

Utilizing the literature reviewed for the process, it was determined that conducting a survey with students could lead to valuable information about the perspectives of plant-based diet choices in school lunches. To begin the process, an IRB was conducted to ensure that there would be minimal risk to the participants involved. First, the school's administration was contacted and asked if the study could be conducted with the students, ensuring that minimal risk would be involved and that students would not be penalized academically for not completing the survey. A letter was obtained that it was approved. This was submitted to the IRB review board along with survey questions, student and parental consent documents, and a teacher script. All documents were approved, and the survey was deemed to be minimal risk for participants. This process was slightly delayed with the revisions and work needed due to the sensitivity when working with students. Although the IRB process is already detail orientated, there is an even higher level of sensitivity when working with populations under the age of 18. Following approval, the script (see appendix) was read by the teacher to all students within their classes, informing them of the nature of the survey in its' relation to lunch choices with no other viable information given. This was to ensure that minimal risk of the students' sensitive information, mental well-being, standing in the school, and overall health was maintained. This was ensured as the survey created asked no discerning information that would be sensitive in nature was even collected. The teachers selected to distribute the survey typically taught science, while some senior (12<sup>th</sup>) teachers taught calculus, logic, and rhetoric as well as science teachers, as all students do not take science in their senior year. By only asking a select number of teachers to help read the script ensured that the script was read as few times as possible and that students were not asked multiple times to complete the survey. Outside of the initial request from the

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teacher, there was not a recruitment process, and students were able to complete the survey at their leisure within the designated window.

The survey was conducted with students, grades 6-12<sup>th</sup>, who attend Chandler Preparatory Academy. Chandler Preparatory Academy is a middle school and high school located in Chandler, Arizona, and is part of the GreatHearts Charter Network in Arizona. The demographics of the school are a majority White (56%), followed by Asian (16%), Hispanic (15%), two or more races (7%), Black (4%), Hawaiian Native/Pacific Islander (2%), and American Indian/Alaskan Native (0.3%). The gender distribution for the school is a majority female at 56% (U.S. News, 2021). The survey was published on April 15<sup>th</sup>, and data was collected until April 24<sup>th</sup>. The survey was created via Qualtrics and distributed to the entire student body at Chandler Preparatory Academy through Google Classroom. The link was created by the student investigator and given to teachers. However, the link was only given to teachers once the script for teachers was read to the students. The survey was a 13-question survey broken into three blocks: student information, lunch choices, and planetary health (see appendix for a list of questions). Student information gathered gender as well as grade level to help with result analysis. Lunch choices focused on current lunch choices meeting student needs/wants, plant-based choices within school lunch, and the number of days students would pick plant-based lunches (the primary focus of this pilot study), while the planetary health section focused on whether the participant had knowledge of climate change and its relation to food. This portion was conducted to better understand if students had a concern about climate change and if they would be willing to make changes in the future to dietary preferences if knowledge about how it impacted the planet was given. The questions written for the survey were based on questions in two prior studies, de Boer et al. and Christensen et al. Both studies had survey questions that

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either addressed the topic or the language for the chosen audience. De Boer et al. looked at how adults would make changes to their preferences if they understood the implications it had when mitigating climate change. Christensen et al. conducted a survey with middle school-aged children about climate change. These studies served as the foundation for the questions in the survey; however, few of them were taken verbatim. These questions were then modified slightly to meet the criteria for the given survey and the goals of the survey. Most questions were based on a Likert-type question with an answering scale of 1-5: 1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5= strongly agree. The only questions that fell out of this scaling range were gender (question 1), grade level (question 2), dietary preference (question 3), and if vegetarian/vegan/plant-based options were given every day...chose them (question 8).

The study looked to analyze to what extent are students willing to integrate and choose plant-based diets for their school lunches and would they make changes to food choices if they knew it impacted climate change? Based on prior research, it was hypothesized students' willingness to make plant-based lunch choices increases if plant-based options are given more frequently throughout the school week, and they would make changes if they knew food choices impacted climate change.



## RESULTS

In the total of the 716 students that are enrolled in the school, 102 completed the survey (14.4%); however, some of the responses were incomplete, leaving valid responses at 101. Once the survey was in the final block (planetary health) responses dropped to 99 (13.8%) students. Mean averages and standard deviation (to determine the strength of the response) were used to analyze the overall opinion of the students that took the survey. First, it was analyzed looking at the entire group for trends, means, and standard deviation.

The first block of the survey was composed of questions for the use of analysis. The gender split of the survey was proportional to the school's split of 56% female, as 53.9% of the survey identified as female, 42.1% identified as male, while 4 respondents preferred not to say their gender (3.9%). Students who responded included 6<sup>th</sup>-12<sup>th</sup> graders, with a majority of the responses being conducted from 9<sup>th</sup> and 10<sup>th</sup> graders, with both grades offering 24 respondents each.

In the second block, which discussed lunch choices, 101 respondents answered the 3<sup>rd</sup> question, 90 of the students identified as omnivores, with only 7 participants identifying themselves as either pescatarian, vegan or vegetarian, and 4 participants unsure of their dietary choices. This information was necessary to better analyze the data collected later in the survey. The next question looked at wanting more plant-based choices at lunch, which had a Mean of 3.27 ( $SD=1.03$ ). When analyzing that there should be as many plant-based choices and animal-based choices for school lunch, the mean was 3.91 ( $SD=.96$ ) with no one strongly disagreeing. With the student who currently answered the survey most felt that they could make choices that reflected their current dietary choices ( $M=3.96$ ;  $SD=.97$ ), yet most students felt if more choices were offered, they were close to undecided, with a slight correlation to disagreeing to make the

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choice of a vegetarian/vegan/plant-based option ( $M=2.90$ ;  $SD=1.22$ ). However, even with this information, when asked if they would choose plant-based options, the mean was 2.85, which was somewhere between 1-2 times a week ( $SD=1.39$ ).

Moving into the final block on planetary health, when asked if food choices impacted climate change, there was a strong agreement that there is a correlation ( $M=3.94$ ;  $SD=.97$ ). Students also had a strong understanding of climate change ( $M=4.26$ ;  $SD=0.77$ ) and that the actions of individuals can positively impact ( $M=4.29$ ;  $SD=0.83$ ). Finally, when asking students if they would make different food choices if they knew it impacted climate change and overall, the students agreed, with a mean of 3.67 and standard deviation of 1.01. This information can be seen on Table 1 (see Tables), excluding questions 1, 2, 3 & 8. These questions were excluded due to either the nature of the question not having a mean or the differentiating scale used.

Table 2 (see Tables) does include question 8, but it should be noted the mean has a different range and it is not a Likert-scale question. Question 8 addressed the number of days in a school week that students would choose plant-based choices at lunch, with 1=Never through 6=Five days. The analysis then continued to look at individual groups such as male, female, prefer not to say (gender question) and individual grade levels. Utilizing these breakdowns, each individual question was able to be better analyzed, and individual means were utilized, offering more valuable insight.

Looking first overall at gender, for students who preferred not to answer their gender, they averaged the highest mean scores for almost every question, except for question 6. However, it should be noted question 6 asked students if they felt their dietary choices were being represented, so a lower mean score would indicate their choices were not being represented. It should also be noted that there were only 4 students who preferred not to answer

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their gender. Students who identified as female were the next highest demographic in terms of mean averages, yet this demographic had 55 respondents.

Looking next at grade level when analyzing the 4<sup>th</sup> question in the survey, the highest mean scores were present in 6<sup>th</sup>/10<sup>th</sup>, 12<sup>th</sup>, and finally 11<sup>th</sup> with the highest, and the lowest mean ( $M= 2.92$ ) coming from the freshman class. All individual grade levels did feel that plant-based options should be equal to animal-based, however, 6<sup>th</sup> graders averaged the highest mean (4.38), with 7<sup>th</sup> graders trailing closely behind (4.33). Question 6 asked students if their choices were being represented, and 6<sup>th</sup> graders had the lowest mean at 3.38. Looking at question 7, 7<sup>th</sup> grade was most likely to make plant-based choices at school lunch if they were offered more frequently with a mean of 3.25. Finally in this block, 7<sup>th</sup>-grade students ( $M=3.50$ ) and 11<sup>th</sup> grade students ( $M= 3.20$ ) were most likely to choose plant-based options, averaging somewhere between 2-3 days a week if they were offered every day of the school week.

Looking at the final block on planetary health, first by gender (Table 3). Students who didn't disclose a gender averaged the highest means for questions 9, 10, 11, and 13. With question 11, which asked about climate change concern, all four of the students responded with strongly agree (5.00). Students who identified as female averaged highest for question 12, which was that the actions of individuals can positively impact climate change.

Analyzing the final block by grade (Table 3), 8<sup>th</sup> graders had the strongest awareness that food impacted climate change ( $M=4.36$ ), while 6<sup>th</sup> grade was the most unaware ( $M=3.00$ ). 6<sup>th</sup> graders were also most uncertain about the term climate change, while 8<sup>th</sup> grade was almost certain ( $M=4.55$ ). 6<sup>th</sup> grade was the lowest mean again, this time when asked about concern for climate change (question 11), as well as feeling that the actions of individuals could impact climate change (question 12), while 8<sup>th</sup> grade was the highest mean for both questions. Finally,

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the last question addressed willingness to make a change to diet if they knew it impacted climate change. 6<sup>th</sup> grade was the lowest with a mean of 3.00, while 7<sup>th</sup> grade had the highest mean at 4.27.

Links to all reports that were analyzed can be found in the appendix, including the full report and breakdown reports by grade and gender.

## DISCUSSION

### 1. Discussion

This study helped provide insight into the future trajectory of this study, and it offered support in terms of the hypotheses proposed. First, it was hypothesized that students would be willing to increase the number of times they chose plant-based options if they were offered more frequently. When analyzing the data, the average data was slightly skewed to the side of disagreeing with choosing more plant-based options; however, given the fact that most of the survey was completed by omnivores, this is not entirely shocking. What did offer promise was the fact that even though students completing were mostly omnivores, was that when asked the number of days they would choose plant-based options, the study did average a 2.85, which puts the average between 1 and 2 days a week. As it stands, this information seems conflicting; however, it does offer valuable insight. Similar to the University of Cambridge study showed, just having the options available can increase the number of times it is chosen. This may then offer a potential option of how to best introduce these choices; simply make them available to students during the day. So, although the question asking about choosing plant-based choices did not support the hypothesis, the fact that many of them were willing to choose plant-based options 1-2 times a week showed that this a potential area where students are willing to give these choices a try and supported the hypothesis.

Overall, the data showed that students felt that more plant-based options should be offered, and even though the bulk of the students are omnivores, they felt that an equal number of plant-based options should be present to animal-based options. This willingness to see these options present during the school day may also lend itself to having students open their willingness to plant-based options. If they are more readily available, that continues to support

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the potential behind a similar University of Cambridge study in a secondary school setting, and hopefully, an observation that students choose the vegetarian options more often.

In terms of the second hypothesis that was looked at in the study that students would be more willing to make changes to their diets if they impacted climate change, more data supporting the hypothesis was found within the survey. Looking at the final question of the survey (Fig.4), all means except for the 6<sup>th</sup> graders (which was 3.00) skewed toward the positive sides (agree/strongly agree), offering support of the hypothesis. This does open the survey to more questions but also supports the argument that students, and the younger generation, are willing to make individual changes for the betterment of the planet. Something as simple as making slight adjustments to their diet is a simple way for students to start making changes. A promising aspect of the study was looking at the positive correlation that students had when thinking about if they would make changes to their dietary preferences if they knew the impact that it had on climate change (Fig.2). Many students are aware that their diet has on climate change (Fig. 3), and they believed that individuals could have a positive impact on climate change.

Middle school students (6<sup>th</sup>-8<sup>th</sup>) were more likely to be undecided on many of the choices. This could likely be determined by the fact they are less aware of their dietary preferences, or they haven't decided how they feel about making their own choices with food. Typically, at that age, many students are at the whim of their parents/guardians' food choices and what they are provided. If they are typically provided choices, they will most likely pick, even at school, choices that their parents have provided them. Of the 33 middle school students that completed the survey, most of them were omnivores. Yet, it was interesting to observe that the sole vegan, one of the pescatarians, and three of the vegetarians were all in middle school. Considering that

## Plant-based diet choices in school lunches

the average population is only 5% vegetarian and 0.5% vegan, of the students who took the survey in middle school, 10% were vegetarian, and 3% were vegan. This could have impacted the reason they took the survey because they may have been more likely to want to make sure that their choices were noted. 6<sup>th</sup> graders were also the most uncertain group when it came to climate change, yet it is interesting to observe that 8<sup>th</sup> graders were the most confident. This could be from the curriculum offered in 7<sup>th</sup> and 8<sup>th</sup> grade at Chandler Preparatory Academy. In 7<sup>th</sup> grade, students take life science, where students spend time looking at their diet as well as the environment, while in 8<sup>th</sup> grade student's study Earth Science and climate change is a part of the curriculum. This would offer an argument toward them not only gaining some knowledge through education but that the more educated on issues that students become, the more likely they are to make changes. 7<sup>th</sup> grade also noted the highest number of days that students would choose plant-based lunches, looking at 2-3 times a week. This can continue to stem back to the curriculum they receive in their 7<sup>th</sup>-grade year.

High school students (9<sup>th</sup>-12<sup>th</sup>) all skewed on the agreeing side with questions when it came to issues involving climate change, yet there seemed to be few trends that emerged from within the population other than they understood climate change, agreed it was a problem, felt individuals could enact change and that overall, they were willing to make changes to their diet if it helped mitigate climate change. The only pattern that emerged was that 11<sup>th</sup> grade proved to have the strongest opinions toward these questions, averaging the highest means skewing toward agreeance; however it is not entirely clear why. The curriculum within the 9<sup>th</sup> and 10<sup>th</sup> grade year includes aspects of ecology, nutrition, and ocean acidification. Yet to ensure this information had no influence on the survey, most of this information was not taught until after the survey concluded. However, it would have allowed for a logical conclusion if they had more positively

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skewed data, yet this was not the case. The only topic taught was ecology, yet little information is presented about climate change in this unit. High school students, on average, were more willing to make plant-based choices at lunch, which suggests that as students get older they are willing to try more foods/diets outside of their comfort zone. They are also more likely to be influenced by social media and peers, so if diets are promoted by either of these outlets, this may impact their decisions as well.

Most of the students within the study were also omnivores, so even though most students have their dietary preferences observed, they still felt that more plant-based options were necessary and that they even might choose them one to two days a week. With the current literature discussed, it could have been because they were looking for either environmentally friendly options or rather just healthier choices, which plant-based diets are typically associated with.

A promising aspect of the study was looking at the positive correlation that students had when thinking about if they would make changes to their dietary preferences if they knew the impact that it had on climate change (Fig. 2). Many students are aware that their diet has on climate change (Fig. 3), and they believed that individuals could have a positive impact on climate change. Taking all this information into account, it would be interesting to see how students would react with more knowledge being given and if they would be more willing to make changes. This suggests potential recommendations toward educational programs geared toward climate change and diet could be helpful.

## **2. Limitations and Recommendations**

Although the study offered many useful pieces of data, there were limitations involved with the study. First, the school does not follow the typical national school lunch program but



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instead uses outside vendors. Now, although the school still has dietary guidelines to follow, it does not compare to many other school's lunch programs. This could lead to a differentiation in the data that is collected and may change results in the future. It is recommended that future studies not only include schools within the GreatHearts system but expand to other public high schools in the area. In particular, the survey should run in schools that utilize the National School Lunch program. The survey should also look to different socioeconomic statistics (i.e., Title I schools, and private schools that ask for tuition upon entrance). This would allow for even more differentiation in the information and allow for more depth in analysis with the data.

Another limitation to the survey was that only 99 students completed the survey, which is only 13.8% of the population. Although this is not sufficient data in aspects, it cannot properly represent most of the school's population, even when the demographics of gender aligned closely with the overall school's population. In order to better address this, the window should be open for longer. It was the intention of the student investigator to run the survey for a longer period of time to help increase the number of responses, however with the delays in the IRB process and the limitation of when the paper was due, the window needed to be shortened. In the future, the student investigator would address these issues much earlier, and this would allow for a greater window of time to collect data.

One of the biggest issues with the survey was that it didn't ask about why they would make changes. This data is sufficient in the types of questions that were asked, but it doesn't get to the root cause as to why students would choose more plant-based options during their day. It can be inferred that students would choose for either the major reasons of health or environment, but which influence is most important is still undetermined. There are a few potential recommendations to address these problems. First, the survey could be conducted in person and

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conducted with an interview follow-up with groups of students that wanted to speak to the matter. The survey could also have more questions addressing specifically why changes were made (i.e., drop-down menu or ranking questions for why they are changing) or areas for written responses from the participants. It is recommended that the survey have adjustments made and then reissued to either support or oppose the current results from the survey.

Another limitation to the survey was that potentially the student's that answered the questions wanted to participate because they felt their lunch choices were not being met. Although the data strongly supported that students felt their dietary needs were being met, the teacher script discussed that it asked about lunch choices. Students could have thought it had to do with changing the menu of the current options available (i.e., the vendors) or, more specifically, what the vendors offer. More information was not given to students to ensure that there was not a bias created by the student investigator with the script that led students to answer a certain way, but there may need to be revisions to the script in the future to not only address different schools but address what the true purpose in the survey is.

Finally, the survey did not ask any questions about what students currently ate for lunch. Although the data showed that 89.1% of the students currently are omnivores, there were no questions about what they eat. It is assumed that meat is most likely part of their lunch daily, but this cannot be confirmed. Without that information, the students choosing to eat plant-based options 1 to 2 times a week may be no different than their current eating habits. It is recommended that this be the first section of the survey in the future, following the demographic questions, about current eating habits. This would allow for a more in-depth analysis and more insight into potential changes students are willing to make.

### CONCLUSION

The survey and the literature review provided a baseline study for information on a topic that currently lacks substantial research, from what was observed by the student investigator. The two hypotheses addressed were given valuable information, and the survey seemed to support the hypotheses there is room to grow. With the recommendations listed above, as well as more studies conducted, this study serves as a pilot study in which the student investigator hopes to build on. Research has shown and backed by the survey that there is a need to start making changes to lunch programs across the United States. Small changes and nudging younger generations toward these changes could lead to a potentially substantial impact on mitigating climate change. This could not only offer health benefits to students within the building by having more plant-based choices, but if schools across the United States started to nudge students, we could see dietary shifts in student's lifetime eating habits. These lifestyle changes could lead to benefits for the entire nation in terms of health care but also offer a jumping-off point to start reducing the impact that the agricultural sector has on greenhouse gases. Students believe that individuals can have an impact on climate change, and small changes to diets and offerings in schools is just one small area in which to begin.

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**APPENDIX****Survey Questions**

## 1. Gender?

- Male
- Female
- Prefer not to answer

## 2. Grade Level

- 6
- 7
- 8
- 9
- 10
- 11
- 12

## 3. Are you:

1. Vegetarian (Eat dairy, eggs, and plants, no meat)
2. Vegan (Eat no animal-based products (eggs, milk, cheese, fish, meat); eat only plant-based)
3. Pescatarian (Eat dairy, eggs, fish and plants, no meat)
4. Omnivore (Eat both animal and plant products)
5. Unsure

## 4. I want more vegetarian/vegan/plant-based options at lunch.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly Agree

## 5. It is important to have as many plant-based choices as there are animal-based choices for school lunch.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly agree

## 6. I can make a choice for school lunch that reflects my dietary needs/choices.

1. Strongly disagree
2. Disagree
3. Undecided
4. Agree
5. Strongly agree

## 7. I would choose vegetarian/vegan/plant-based options more often if they were consistently provided at lunch

1. Strongly disagree
2. Disagree

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3. Undecided
  4. Agree
  5. Strongly Agree
8. If vegetarian/vegan/plant-based options were given every day for school lunch how many days a week would you choose them?
1. Never
  2. One day a week
  3. Two days a week
  4. Three days a week
  5. Four days a week
  6. Five days a week
9. My food choices can impact climate change.
1. Strongly disagree
  2. Disagree
  3. Undecided
  4. Agree
  5. Strongly Agree
10. I understand what it means when people say “climate change.”
1. Strongly disagree
  2. Disagree
  3. Undecided
  4. Agree
  5. Strongly Agree
11. I am concerned about climate change.
1. Strongly disagree
  2. Disagree
  3. Undecided
  4. Agree
  5. Strongly Agree
12. The actions of individuals can make a positive difference in climate change.
1. Strongly disagree
  2. Disagree
  3. Undecided
  4. Agree
  5. Strongly Agree
13. I would make different food choices if I knew it impacted climate change.
1. Strongly disagree
  2. Disagree
  3. Undecided
  4. Agree
  5. Strongly Agree



## **Teacher Script**

Hello Students,

Ms. Caporali is asking that you complete a survey for her graduate school program. Ms. Caporali has been studying at Johns Hopkins for the past few years and is completing her final capstone project. For her study she is asking that you complete a survey about your lunch choices. This survey is completely optional and not completing it will have no impact on your grades or standing here at the school. It would be appreciated by her, as the more data she can collect, the better her analysis can be. This survey will only take at a maximum, 15 minutes to complete. This survey will be completed entirely online, and the link will be posted in our google classroom. If you or your parents have any questions, please reach out to Ms. Caporali.

## **Link to Full Report**

<https://ql.tc/pnE135>

**Access Code:** MCapPlant2021

## **Links to Breakdown Reports**

**Access Code to all Reports:** MCapPlant2021

**Male:** <https://ql.tc/e3zYGh>

**Female:** <https://ql.tc/L6L4eO>

**Prefer Not to Say:** <https://ql.tc/7P4anm>

**6<sup>th</sup> Grade:** <https://ql.tc/WYT82r>

**7<sup>th</sup> Grade:** <https://ql.tc/m2czyZ>

**8<sup>th</sup> Grade:** <https://ql.tc/sOfeHK>

**9<sup>th</sup> Grade:** <https://ql.tc/P5kHcl>

**10<sup>th</sup> Grade:** <https://ql.tc/hEdquJ>

**11<sup>th</sup> Grade:** <https://ql.tc/H7g7Te>

**12<sup>th</sup> Grade:** <https://ql.tc/9zglOO>

**Consent Form****JOHNS HOPKINS UNIVERSITY  
HOMEWOOD INSTITUTIONAL REVIEW BOARD (HIRB)****PARENTAL PERMISSION RESEARCH FORM**

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**Study Title:** Plant-Based Diet Choices in School Lunches

**Application No.:** HIRB00012549

**Principal Investigator:** Dr. Daniel Zachary, JHU professor, [d.s.zachary@jhu.edu](mailto:d.s.zachary@jhu.edu)

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You are being asked to allow your child to join a research study. Participation in this study is voluntary. If you allow your child to join the study, you can change your mind later.

If you are a parent or legal guardian of a child who may take part in this study, your permission is required for your child to participate. The assent (agreement) of your child may also be required. When we say “you” in this consent form, we mean you and your child.

**1. Research Summary (Key Information):**

The information in this section is intended to be an introduction to the study only. Complete details of the study are listed in the sections below. If you are considering participation in the study, the entire document should be discussed with you before you make your final decision. You can ask questions about the study now and at any time in the future. The purpose of this study is to determine school aged children’s willingness and interest in plant-based meals being offered during their school lunches.

**2. Why is this research being done?**

I am inviting your child's participation, which will involve completing a short survey that should take no more than 15 minutes. Your child's participation in this study is voluntary. If you choose not to have your child participate or to withdraw your child from the study at any time, there will be no penalty (it will not affect your child's grade, treatment/care, etc). Likewise, if your child chooses not to participate or to withdraw from the study at any time, there will be no penalty. The results of the research study may be published, but your child's name will not be used, nor will it be collected. Children enrolled at Chandler Preparatory Academy are allowed to participate. We anticipate that about 700 children will take part in this study.

**3. What will happen if you allow your child to join this study?**

If you agree to allow your child to be in this study, we will ask you to allow your child to do the following things:

- Your student will complete a quick survey regarding school lunch choices. Students will also be asked their grade level and gender.
  - o This is to allow further analysis of student willingness/desire to eat plant-based lunches

**How long will your child be in the study?**

Your child will be in this study for approximately 15 minutes to complete a short survey about school lunch choices.

**4. What are the risks or discomforts of the study?**

There is minimal risk in completing this survey. Your child may get tired or bored when answering survey questions online. Your child may find it tiring or boring if s/he is asked to complete questionnaires. Your child does not have to answer any question s/he does not want to answer.

**5. Are there benefits to your child from being in the study?**

Your child may or may not benefit from being in this study. This study may benefit society if the results lead to a better understanding of student interest in plant-based meal choices being offered during school lunch.

**6. What are your options if you do not want your child to be in the study?**

Your child's participation in this study is entirely voluntary. You do not have to allow your child to join this study. If your child does not participate, there are no penalties, and your child will not lose any benefits to which s/he would otherwise be entitled.

**7. Will it cost you anything to allow your child to be in this study?**

*No*

**8. Will you or your child be paid if you allow your child to join this study?**

*No.*

**9. How will the confidentiality of your child's data be protected?**

Any study records that identify your child will be kept confidential to the extent possible by law, although this study requires no personal information other than gender and grade level. The records from your child's participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the National Institutes of Health and the Office for Human

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Research Protections. (All of these people are required to keep your child's identity confidential.) Otherwise, records that identify your child will be available only to people working on the study, unless you give permission for other people to see the records.

### 10. **What does a conflict of interest mean to participants in this study?**

In some situations, the results of this study may lead to a financial gain for the researcher and/or Johns Hopkins University. This financial interest has been reviewed in keeping with Johns Hopkins' policies. It has been approved with certain conditions, which are intended to guard against bias in how the study is conducted, how the results are analyzed, and how participants are protected. You may call the Office of Policy Coordination 410-361-8667 for more information. The Office of Policy Coordination reviews financial interests of researchers and/or Johns Hopkins.

### 11. **What other things should you know about this research study?**

#### **What is the Institutional Review Board (IRB) and how does it protect you?**

This study has been reviewed by an Institutional Review Board (IRB), a group of people that reviews human research studies. The IRB can help you if you have questions about your child's rights as a research participant or if you have other questions, concerns or complaints about this research study. You may contact the IRB at 410-516-6580 or [hirb@jhu.edu](mailto:hirb@jhu.edu).

#### **What should you do if you have questions about the study?**

Contact the principal investigator, *Dr. Daniel Zachary* at [d.s.zachary@jhu.edu](mailto:d.s.zachary@jhu.edu). If you cannot reach the principal investigator or wish to talk to someone else, call the IRB office at 410-516-5680.

You can ask questions about this research study now or at any time during the study, by talking to the researcher(s) working with you or by calling Michele Caporali at (480)855-5410 ext. 5420.

If you have questions about your child's rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (410) 516-6580.

#### **What should you do if your child is harmed by taking part in this study?**

If you feel that your child has been harmed in any way by participating in this study, please call Michele Caporali, Student Investigator at (480) 855-5410. Please also notify the Homewood Institutional Review Board at Johns Hopkins University at (410) 516-6580.

### 12. **Assent Statement**

This research study has been explained to my child in my presence in language my child can understand. He/she has been encouraged to ask questions about the study now and at any time in the future.

Plant-based diet choices in school lunches

**13. What does your signature on this consent form mean?**

Your signature on this form means that: You understand the information given to you in this form, you accept the provisions in the form, and you agree to allow your child to join the study. You and your child will not give up any legal rights by signing this consent form.

**WE WILL GIVE YOU A COPY OF THIS SIGNED AND DATED  
CONSENT FORM**

---

Signature of Parent / Guardian  
Date/Time

(Print Name)

**For CHILD PARTICIPANT**

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Signature of Child Participant (optional unless IRB required)  
Date/Time

(Print Name)

**NOTE: A COPY OF THE SIGNED, DATED CONSENT FORM MUST BE KEPT BY THE PRINCIPAL INVESTIGATOR; A COPY MUST BE GIVEN TO THE PARTICIPANT.**

## Plant-based diet choices in school lunches

TABLES

Question*	Mean	SD
4	3.27	1.03
5	3.91	0.96
6	3.96	0.97
7	2.90	1.22
9	3.94	0.97
10	4.26	0.77
11	4.12	0.90
12	4.29	0.83
13	3.67	1.01
*Omitted 1, 2, 3 & 8 as they are not Likert-style		

Table 1: Survey Data: Mean and standard deviation of the whole group

Grade Level or Gender Breakdown	# of respondents	Q4 (Mean and SD)	Q5 (Mean and SD)	Q6 (Mean and SD)	Q7 (Mean and SD)	Q8 (Mean and SD)*
6th	9	M=3.38; SD= 0.99	M=4.38; SD= 0.70	M=3.38; SD= 1.49	M=2.63; SD= 1.41	M= 2.25; SD= 1.56
7th	12	M=3.17; SD= 1.14	M= 4.33; SD= 0.62	M=4.00; SD= 0.91	M=3.25; SD= 1.30	M= 3.50; SD= 1.44
8th	11	M=3.18; SD= 0.94	M= 3.91; SD= 0.67	M=4.27; SD= 0.62	M=2.73; SD= 1.05	M= 2.45; SD= 0.89
9th	24	M=2.92; SD= 1.04	M= 3.58; SD= 1.00	M=3.75; SD= 0.92	M=2.58; SD= 1.11	M= 2.71; SD= 1.31
10th	24	M=3.38; SD= 0.90	M= 3.79; SD= 1.04	M=4.08; SD= 0.95	M=3.21; SD= 1.19	M= 2.83; SD= 1.34
11th	15	M=3.60; SD= 1.02	M= 4.07; SD= 1.00	M=4.20; SD= 0.54	M=2.87; SD= 1.15	M= 3.20; SD= 1.51
12th	7	M=3.57; SD= 1.05	M= 3.86; SD= 0.99	M= 3.86; SD= 1.25	M=3.00; SD= 1.31	M= 2.86; SD= 1.25
Female	55	M=3.45; SD= 1.08	M=4.22; SD= 0.82	M=3.87; SD= 1.01	M=3.18; SD= 1.15	M=3.00; SD= 1.28
Male	42	M=2.95; SD= 0.90	M=3.45; SD= 0.96	M=4.14; SD= 0.83	M=2.48; SD= 1.22	M=2.62; SD= 1.51
Prefer not to say	4	M=4.00; SD= 0.71	M=4.50; SD= 0.50	M=3.25; SD= 1.09	M=3.50; SD= 0.87	M=3.25; SD= 1.09

Table 2: Survey Data: Block 2 (Lunch Choices)- Broken down by grade level and gender choice.

\*Note question 8 is not Likert-scale but rather 6 points (1=Never; 6=Five Days a Week)

## Plant-based diet choices in school lunches

<b>Grade Level or Gender Breakdown</b>	<b># of respondents</b>	<b>Q9 (Mean and SD)</b>	<b>Q10 (Mean and SD)</b>	<b>Q11 (Mean and SD)</b>	<b>Q12 (Mean and SD)</b>	<b>Q13 (Mean and SD)</b>
<b>6th</b>	9	M=3.00; SD= 0.93	M=2.71; SD= 1.16	M=3.00; SD= 0.53	M=3.29; SD= 0.45	M=3.00; SD= 0.53
<b>7th</b>	12	M=4.00; SD= 0.95	M= 4.55; SD= 0.66	M=4.36; SD= 0.98	M=4.36; SD= 0.77	M=4.27; SD= 0.75
<b>8th</b>	11	M=4.36; SD= 0.77	M= 4.73; SD= 0.45	M=4.73; SD= 0.45	M=4.73; SD= 0.45	M=4.09; SD= 0.51
<b>9th</b>	24	M=3.79; SD= 0.96	M= 4.13; SD= 0.60	M=3.88; SD= 0.88	M=4.29; SD= 0.68	M=3.54; SD= 1.04
<b>10th</b>	24	M=4.13; SD= 0.98	M= 4.38; SD= 0.48	M=3.92; SD= 0.86	M=4.38; SD= 0.75	M=3.46; SD= 1.19
<b>11th</b>	15	M=4.27; SD= 0.85	M= 4.47; SD= 0.50	M=4.67; SD= 0.60	M=4.47; SD= 0.81	M=3.87; SD= 0.81
<b>12th</b>	7	M= 3.29; SD= 1.16	M= 4.29; SD= 0.70	M= 4.29; SD= 0.70	M= 3.86; SD= 1.36	M= 3.43; SD= 1.05
<b>Female</b>	55	M=3.94; SD= 1.04	M=4.17; SD= 0.86	M=4.09; SD= 0.92	M=4.40; SD= 0.76	M=3.77; SD= 1.00
<b>Male</b>	42	M=3.95; SD= 0.79	M=4.33; SD= 0.64	M=4.07; SD= 0.88	M=4.19; SD= 0.91	M=3.48; SD= 1.01
<b>Prefer not to say</b>	4	M=3.75; SD= 1.64	M=4.75; SD= 0.43	M=5.00; SD= 0.00	M=4.00; SD= 0.71	M=4.25; SD= 0.43

Table 3: Survey Data: Block 3 (Planetary Health)- Broken down by grade level and gender choice.

Figures



Figure 1: Ballew, M., Marlon, J., Rosenthal, S., Gustafson, A., Kotcher, J., Maibach, E., & Leiserowitz, A. (2019).



Plant-based diet choices in school lunches

**Q13 - I would make different food choices if I knew it impacted climate change.**

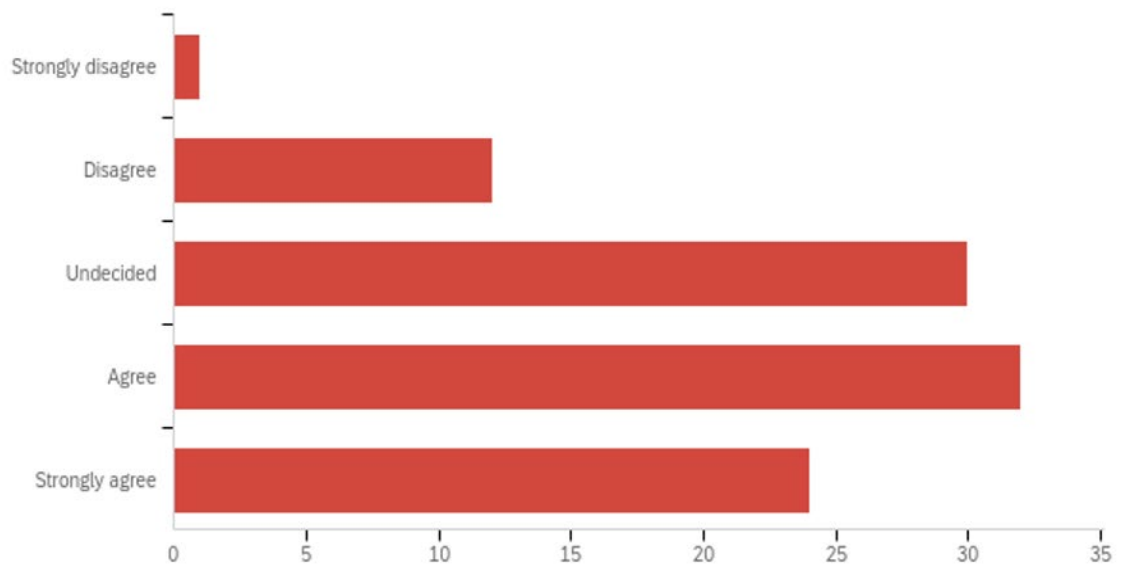


Figure 2: Survey data collected on making different food choices if known impact on climate change

**Q9 - My food choices can impact climate change**

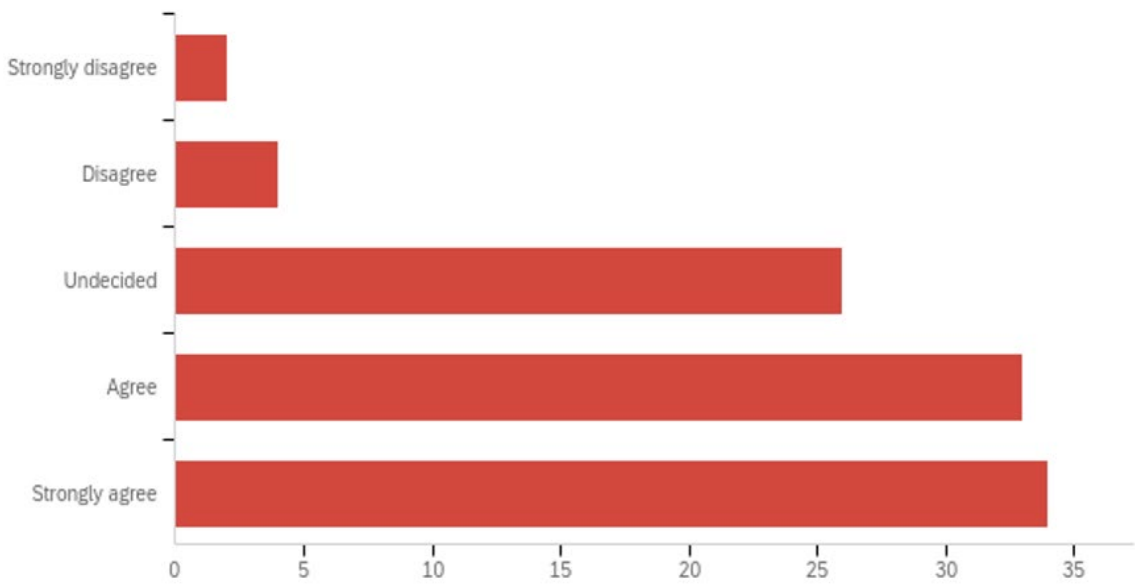


Figure 3: Survey data collected on knowing food impacts climate change

## Plant-based diet choices in school lunches

**Q8 - If vegetarian/vegan/plant-based options were given every day for school lunch how many days a week would you choose them?**

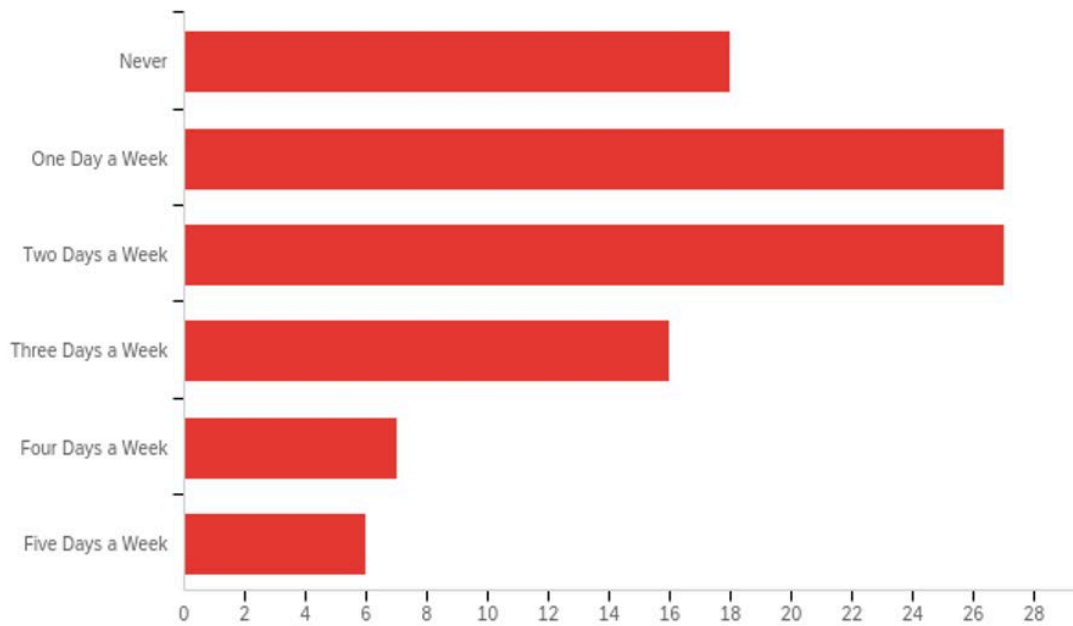


Figure 4: Survey data collected for all students on days a week they would choose vegetarian/vegan/plant-based choices.