Analyzing the Relationship Between Familiarity and Willingness of High School Students Toward Entomophagy

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Abstract

Entomophagy—the consumption of edible insects—is getting growing global attention as an alternative protein source. Edible insects' environmental, economic, and nutritional benefits have been proven, but consumer awareness, especially among teenagers, is the challenge that entomophagy is facing to implement in a large population. Lesnik's (Lesnik, 2019) research has discovered that disgust is learned rather than experienced. The question then emerged: If students learn about edible insects, would they be willing to consume insects? Thus, my research aims to answer the question: "To what extent would more familiarity with edible insects increase the willingness of high school students to engage in entomophagy?" This question investigates whether the mindset of high school students can be reprogrammed as they are more exposed to insects. To answer the question, this research used mixed methods using correlational and thematic analysis from data collected from high school students. Findings suggest that what students learn may be more important than what they know and more exposure to edible insects significantly increased their willingness to consume insects again, which demonstrates a high potential of bringing the insect as a replacement for traditional meat products. The study's understanding also guides other researchers in further examining "disgust-based rejections" of people toward unfamiliar foods.

Key Words: entomophagy, edible insects, familiarity, willingness, insect-containing food (ICF)

I. Introduction

This section aims to provide an overview of edible insects and define their significance. To start, the practice of consuming insects, also known as entomophagy, has a long history, spanning approximately 7000 years (Ramos-Elorduy, 2009). More than 2300 insect species have been reported as edible (Tang et al., 2019) and some of the commonly consumed insects

include beetles (Coleoptera, 31%), caterpillars (Lepidoptera, 18%), bees, wasps, and ants (Hymenoptera, 14%), followed by grasshoppers, locusts, crickets (Orthoptera, 13%) (Ishara et al., 2022). Many of them are eaten worldwide by more than two billion people (Van Huis et al., 2013), especially in "tropical and subtropical regions due to the warm and moist climate" (Tang et al., 2019).

Entomophagy has recently captured growing global attention as a key to coping with some of the major food and nutritional challenges (Verbeke, 2015). The world's population is expected to reach 9.8 billion by 2050 and 11.2 billion by 2100 (United Nations, 2019), but growing competition for land, water, energy, etc., limits the ability to produce enough food for the population, and the effects of global warming are a further threat (Godfray et al., 2010). These rising concerns about an increase in demand for food from a large population require a more environmentally friendly and socially sustainable food security system.

Edible insects generally serve as a valuable source of protein, providing a range of minerals and vitamins. The average protein content in dry insect matter varies between 35% for termites and 61% for crickets and grasshoppers, and as high as 77% for some species (Lange & Nakamura, 2021). Insects provide an ideal level of amino acids, as determined by World Health Organization recommendations, which are generally 76-96% digestible (Tang et al., 2019). Since the consumption of insects contributes to fulfilling people's nutritional needs, edible insects appear as a good alternative to traditional meat products. In line with this, Lange's research noted that "an increase in the intake of protein through insect eating may significantly enhance the nutritional quality of human diets" (Lange & Nakamura, 2021). Moreover, edible insects are abundant in calcium, copper, magnesium, manganese, and zinc (Ojha et al., 2021). High levels of B-complex vitamins, such as riboflavin, pantothenic acid, and biotin, have been found consistently throughout the insects' life stages, and vitamins A, C, D, and E increase across their developmental stages (Lange & Nakamura, 2021). Overall, numerous previous studies have shown that the nutritional richness of edible insects makes them a valuable potential dietary option.

Not only are insects very rich in nutritional value, but they also have notable environmental and economic benefits compared to traditional protein products. One of the biggest advantages of entomophagy is insects' high feed conversion efficiency, which requires less feed to grow at the same rate or produce the same amount of edible portions. According to the life cycle review of edible insects, the efficiency exists because "...insects are poikilothermic (cold-blooded), meaning that their metabolism is not used to maintain their body temperature unlike homeothermic animals" (Halloran et al., 2016). While other animals generate lots of greenhouse gas (GHG) emissions because they need large amounts of space for grazing and growing grains for feed (McMichael et al., 2007), edible insects produce much less GHG. Their high feed

conversion efficiency as well as the ability to grow in small spaces thus demonstrates how environmentally friendly entomophagy is.

Entomophagy also offers various opportunities to farmers and workers. Start-up for farming insects does not require lots of capital and many countries, including India and South Asia, have already started many insect farms (Tang et al., 2019). For example, Thailand is the country with the most extensive cricket farming system in the world because researchers at Khon Kaen University began to promote low-technology farming methods in response to the Asian Economic Crisis (Halloran, 2016). With a small amount of investment, edible insects would bring lots of profits, and potentially create many new jobs for unemployed people, just like people in Thailand and many other Asian countries. In addition, insect farming addresses safety concerns as studies show that no microbial contamination would occur with properly processed and stored insects while wild ones are threatened to get contaminated (van Huis et al., 2013).

II. Insect Food Avoidance in Western Countries

Despite entomologists' agreement that edible insects are nutritionally dense and can help address both global warming and famine, the question of whether people are willing to eat edible insects must be addressed. Although many organizations and food scientists are trying to promote edible insects, "…the 'ick' factor is standing in the way of an insect-inclusive diet" (Sarnoff, 2024), proposing there's a barrier to overcome before commercialization. Food that is not visually appetizing and does not taste great will remain unknown. Thus, scholars who develop food marketing strategies and behavioral economics delve more deeply into identifying consumers' opinions on entomophagy in the U.S. and the factors influencing their willingness when deciding on food.

The process of making food choices involves complicated relationships between past experiences, current trends, and future transitions. As individuals grow, there are more diverse factors that shape their decisions about what food to consume. These include biological factors (hunger and palatability), economic factors (cost, accessibility, and income), social determinants (culture, family, and peers), meal attributes (meal pattern and familiarity), and other factors such as previous experiences, beliefs, attitudes, knowledge about food, etc (Sun-Waterhouse et al., 2016). From these numerous factors that can alter consumer preferences, Woolf was able to determine "disgust-based rejection" and unfamiliarity" as the main reasons prohibiting the consumption of insect-containing foods (Woolf et al., 2019). Because Americans have passed down generation after generation the idea that insects are disgusting subjects, people have strong opinions against entomophagy even though they have not experienced anything bad from consuming edible insects (Lesnik, 2019).

To develop strategies that promote insects as a preferred food source, understanding the origins of disgust was essential. From a psychological perspective, the theory of disgust posits that disgust is a biologically rooted emotion serving as a protective mechanism against potential contaminants, but it can also be influenced by cultural and individual experiences (Rozin & Fallon, 1987). In the context of entomophagy, disgust may be heightened due to the novelty and unfamiliarity of insects as food, which aligns well with Woolf's findings.

Focusing on willingness to consume insect-containing foods (ICF), Lesnik's conclusion that "disgust is learned" (Lesnik, 2019) informed Jones's experiment on how young students under 13 negotiate new and sustainable food in school. Jones discovered five key moments where entomophagy became more acceptable to these young students. This included when the ICF was present in foods the participants regularly ate, when looking at the environmental and nutritional content of insects, when they watched and smelled the ICF in class, when they were allowed to ask questions, and finally when they were watching their peers try the products with no distaste. These findings set the foundation for my experiment.

Jones' research also made it clear that there is limited research about ways to increase the repugnance towards insects in high school students. He mentioned, "With regard to entomophagy, the literature has been dominated by adults' views…" (Jones, 2020). However, more research on the next generation is fundamental to preparing for the rise in demand for protein sources (Lesnik, 2019) caused by the growing population. Since Jones's research has proven that good educational programming for children is a viable way to work toward inhibiting disgust-based rejections for young children, I wanted to see if this also applies to high school students. Therefore, my research aims to answer the question: "To what extent would more familiarity with edible insects increase the willingness of high school students to engage in entomophagy?" This question investigates whether or not the mindset of high school students can be reprogrammed as they are more exposed to insects.

Furthermore, the study utilizes the mere exposure effect suggesting that repeated exposure to a stimulus increases familiarity and reduces negative reactions (Zajonc, 1968), to mitigate disgust. By integrating these frameworks, this study fills the gap between research on young children's and adults' opinions and examines how familiarity influences adolescents' willingness to consume ICF.

The two key concepts for this investigation are familiarity (the independent variable) and willingness (the dependent variable). In this study, familiarity was defined as having knowledge of entomophagy. The definition encompassed whether students understood what entomophagy was before the experiment, whether they got the presentation about ICF's environmental, economic, and nutritional benefits, the safety of edible insects, and the limitations of implementing entomophagy, and finally,

whether they had the opportunity to try ICF. While a brief presentation under 10 minutes may not provide comprehensive familiarity with entomophagy, in the field of entomophagy, the fact that it served as a priming mechanism would be considered as familiarity, as numerous other studies also use similar definitions. The short informational presentation sensitized participants to the potential benefits of entomophagy, thereby temporarily raising their awareness of the practice. Willingness, in this case, was the readiness of high school students to accept ICF and was measured by how likely they were to try edible insects again if they had another opportunity.

III. Methods

A mixed method was used to address the research question. Firstly, a true experimental design using correlational analysis was performed. Then, qualitative data using thematic analysis was done to enhance the understanding of the correlational analysis. True experimental design is a quantitative research method focusing on why various phenomena occur. The present study will measure if random manipulation of the independent variable (informational presentation about entomophagy), is related to the dependent variables (students' future willingness). Because this study aims to examine the relationship between overall familiarity and future willingness, correlational analysis was most suitable and aligned with the purpose of the research. Finding relationships between uncontrollable variables consisting of pre-knowledge and tasting cricket-powder-based cookies, not only exploring the effect of an informational presentation, fulfills the research goal. Qualitative data from open-ended survey questions complemented the numerical statistics by identifying common themes and providing context for the quantitative findings.

Most of the foundational research for my study involved meta-analysis and survey research, due to the lack of regulations on ICF and the difficulty of gathering participants because of their initial revulsion towards insects. Despite those methods being most common in the entomophagy research field, I chose real-experimental and qualitative analysis methods to execute the real-life strategy for implementing entomophagy in participants based on past discoveries and to understand why they did change or did not change their opinions. This would broaden the understanding of the consumers' viewpoint in the research field.

3.2 Hypothesis

Before collecting data, I hypothesized three variables that would positively influence students' attitudes derived from conclusions from prior research. The first one is that if students had pre-knowledge about entomophagy, then they would have a higher willingness to try edible insects again in the future than those who did not have any knowledge before the experiment. This hypothesis was made as Woolf's study discovered that "Willingness

to consume ICF was highly dependent on participants' familiarity with entomophagy ($p < 0.001$)" (Woolf et al., 2019). Secondly, if a presentation were given to students, then they would have a higher willingness to try edible insects again in the future than those who did not receive a presentation. This assumption was made, as the research was done with students ranging in age from 7 to 14 years old, who had an increase in choosing edible insects for lunch at school after a workshop learning about edible insects and trying ICF (Jones, 2020). Another research study by Gmuer discussed that products containing processed insect ingredients and a familiar appearance contributed to the positive evaluation of ICF (Gmuer et al., 2016). Thus, the last hypothesis was made that, if students tasted cricket-powder-based cookies, then they would be more willing to try edible insects again in the future than those who did not taste the cookies.

3.3 Participants

Participants included 59 students (31 male, 27 female, 1 non-binary) aged from 15-18 from Timberline High School. Given that the gap discovered in my study was limited research on teenagers' perspectives towards edible insects, and that the high school was the most accessible place for me to experiment, the study focused on investigating teenagers' perception of edible insects. Before the research, the project was introduced and consent forms adapted from Hampshire College (Appendix A) were distributed. The purpose of this was to share the expectations required to participate in the study at the start of each class period. The consent forms were sent to 10 different classes at Timberline High School, to which teachers were willing to devote some of their class time. Students were informed that by volunteering to participate in the experiment, they agreed to provide demographic information anonymously, including their age and gender, and that they had a choice to consume cricket-power-based cookies with nutritional information about the food. After a week, 59 students consented to participate.

3.4 Experimental Design

Within the 10 classes, I randomly selected 5 classes to be assigned to the control group, while the remaining 5 classes were assigned to the experimental group. Cluster randomization was used due to practical constraints, as it was important not to take up too much of the teachers' class time. This approach allowed students to remain in their existing classes, which prevented individual randomization. However, the results are still comparable because the classes are similar in terms of demographics and academic level. To ensure randomness, I assigned a number to each class and used a random number generator to randomize the class assignments. In the control group, students did not receive any informational presentation about entomophagy and were given two chocolate chip cookies at the start of the experiment. One was made with half EXO pure cricket powder and half flour, while the other was made

with all flour. The cookies were made out of cricket powder because crickets were the most accessible and cheap insect species I could purchase from U.S. online stores. The rest of the ingredients were kept the same in both cookie doughs. That way, participants could compare the tastes of the two cookies, using the all-flour cookie as a reference. As Jones mentioned, using foods that participants are familiar with helps establish positive viewpoints. Since cookies are popular and easy to make, cookies were given in the experiment. The recipes and ingredients for the cookies can be found in Appendix B. In comparison, the experimental group listened to a 7 to 8-minute presentation (Appendix C) and had the opportunity to taste the same cookies afterward. Those who were not willing to taste the cookies waited until everyone else had finished trying them. The presence of the presentation in the control versus experimental group was crucial, as it allowed me to compare the differences in responses between the two groups and understand how educational interventions affect students' willingness to consume edible insects.

After the tasting session, all participants completed an online survey (Appendix D) with 18 questions, including demographic information, pre-knowledge of entomophagy (yes/no), willingness to consume ICF (5-point Likert scale), and open-ended questions about their perceptions. The survey took approximately 5 minutes to complete. The Likert scale provides five possible answers to questions that allow respondents to indicate their strength of agreement or feeling. This is beneficial because the data can be analyzed relatively easily. Since many researchers in my field used this to measure participants' attitudes, I decided to include this in my survey as well. Also, open-ended questions allowed me to gain some qualitative data considering the Likert scale only provides numerical statistics. The responses allowed surveys to be analyzed objectively, rather than interpreting the results myself.

3.5 Analysis

Correlational data analysis using Independent Samples t-tests and Two-way Analysis of Variance was performed to analyze the relationship between independent variables on a dependent variable once the survey responses were submitted. This statistical analysis was frequently used in the research in my field. The Independent Sample t-Test is a type of parametric test that compares the mean of two independent groups to understand whether there is statistical evidence that the associated population means are different. If the p-value derived from the test is less than the alpha level of 0.05 (5%), then it signifies that there are statistical differences between the means of two separate groups, which are the control group and the experimental group in this study, and that the relationship between the independent variable and dependent variable is not caused by variability. If the derived p-value is greater than 0.05, then it reveals that the difference between the mean of the two groups is not statistically significant.

The t-Test was visualized in Violin plots. Violin plots show how a data set varies along one variable by combining a boxplot with a probability density function (PDF). A wider density function indicates that the value occurs more frequently than the narrower density function. This is useful for visualizing the Likert scale's multiple distributions at once for comparing one group to another.

While the Independent Sample t-Test only considered one independent variable, the Two-way Analysis of Variance test (ANOVA) determined the differences in the effects of two independent variables on a dependent variable. A Two-way ANOVA test is a type of quantitative analysis used when a dependent variable is affected by multiple independent variables at the same time. These two types of tests were appropriate in demonstrating the relationship between Timberline high school students' familiarity with the concept of entomophagy and their future willingness to try ICF if they had another opportunity because it provides statistical evidence to support the difference in the control group and the experimental group.

To understand the overarching patterns in the students' responses, a thematic analysis was conducted. This allowed me to connect the data produced from Independent Sample t-Tests and Two-way ANOVA tests to the individual's responses. The recurring themes derived from the open-ended questions furthered the understanding of the relationships between students' familiarity with entomophagy and future willingness to consume ICF.

3.6 Limitations

The study used a small population of 59 participants only from Timberline High School. This could indicate that the results may only apply to this population or others with similar locations or demographics since the sample size is insufficient to represent the overall high school student population. Although control groups and experimental groups were chosen randomly from 10 different classes, the repetition of the experiment throughout the day means that there is a likelihood that students have already heard about the experiment from other participants. In addition, consent forms are required for an ethical experiment due to the nature of the research. This implies that the participants were more interested in the topic than the overall population because they were already informed that they would be tasting cricket powder-based cookies while filling out the consent forms.

Several limitations exist for the method itself. The correlational analysis does not suggest causation but rather provides that if two variables are correlated, which means the result does not show if controlled variables caused the change or no change in students' willingness value. While some qualitative data were gathered through open-ended questions, depth of understanding is lacking because only generalized questions were asked about students' knowledge and opinions

on entomophagy, not individuals' personal stories regarding edible insects that might have shifted their viewpoints. Moreover, it is difficult to ensure conclusive results from the data because the accuracy of the survey responses relies on the honesty and the interpretation of the participants. Even though the Likert scale provides the full range of answer choices, participants might feel that their responses are not completely aligned with it. All of these limitations addressed could impact the results.

IV. Results

All 59 participants submitted their responses. Most of the participants were over 18 because it was easier for them to sign the consent forms, as they did not need parental consent forms in addition. The age distributions were the following: 2 students (3.4%) were the age of 15, 11 students (18.6%) were the age of 16, 12 students (30.3%) were the age of 17, and 34 students (57.6%) were the age of 18. Gender was more balanced than age as 31 students indicated themselves as male and 27 students indicated themselves as female, with one person who did not prefer to indicate their gender. 30 students were in the experimental group and 29 students were in the control group.

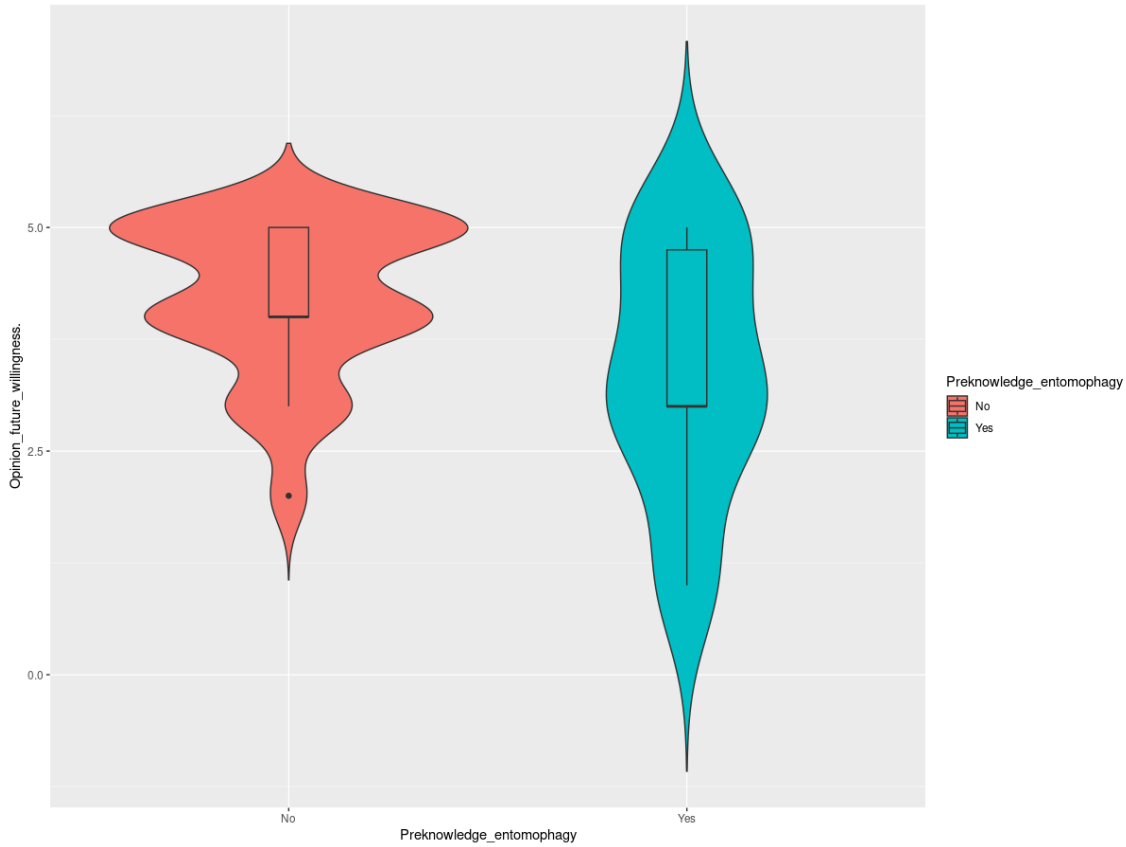

FIGURE 1. Violin Plot of Future Willingness to Consume ICF by Pre-Knowledge of Entomophagy

Pre-knowledge	Min	Q1	Median	Q3	Max	Mean	SD	n
No	2	4	4	5.00	5	4.200	0.868	45
Yes	1	3	3	4.75	5	3.357	1.392	14

TABLE 1. Descriptive Statistics of Pre-knowledge

An independent sample t-test was conducted to compare the mean future willingness to consume ICF scores between students with no pre-knowledge of entomophagy and those with pre-knowledge. The data is visually represented in Figure 1. The y-axis of the graph displays students' opinions on future willingness (ranging from 1 = very unlikely, 5 = very likely), and the x-axis displays two different groups on pre-knowledge. A willingness score of 5 appeared more frequently than any other value in

the no-pre-knowledge group as shown in red (Figure 1). Further interpretation of the data is provided in Table 1. Subsequently, the results showed a statistically significant difference between the two groups ($t(57) = 2.73$, $p = 0.048$, $\alpha = 0.05$). Given that the p-value is less than α, it provides the evidence to reject the null hypothesis in favor of the alternative hypothesis. In the case of the test, the null hypothesis was that the mean future willingness score for the group with no pre-knowledge of entomophagy would be equal to the mean future willingness score for the group with pre-knowledge of entomophagy, and the alternative hypothesis was that there would be a difference in these two mean values. In particular, participants who had pre-knowledge resulted in a mean value of 3.357 (SD = 1.392), while those who did not have any knowledge resulted in a mean value of 4.2 (SD = 0.868). The p-value suggests that the difference in these two sample means of 0.843 is unlikely due to random chance. The 95% confidence interval for the difference in means ranged from 0.225 to 1.461, further supporting this conclusion.

The data signifies that people are more likely to consume edible insects again in the future if they do not have any existing knowledge about entomophagy, which rejects my first hypothesis. Contrary to Woolf et al. (2019) finding that consumers were significantly more willing to consume ICF if they had heard of ICF at least once in their life than those who had never heard of the concept, my result showed that consumers who had heard of entomophagy had a lower mean willingness score. Although my initial hypothesis was rejected, the result is reasonable because prior knowledge of entomophagy does not guarantee positive perceptions and may not eliminate feelings of repugnance toward insects. The idea aligns with Woolf et al.'s study, which noted that familiarity alone does not reduce disgust-based rejection and that the factors influencing willingness scores vary depending on cultural identities. The demographic differences between my participants and those in Woolf's study could have contributed to the discrepancies in our findings. Moreover, the results suggest that prior knowledge might reinforce negative stereotypes unless paired with positive educational interventions, as cultural and psychological barriers like disgust can persist even with knowledge about entomophagy. Consistent with Woolf's suggestion that education can enhance consumers' willingness to eat insect-containing foods, and Jones' study, which found that children's educational workshops lead to a higher chance of being willing to consider insects as a lunch option, the impact of providing information sessions and the interplay between education and prior knowledge will be examined in the following two results.

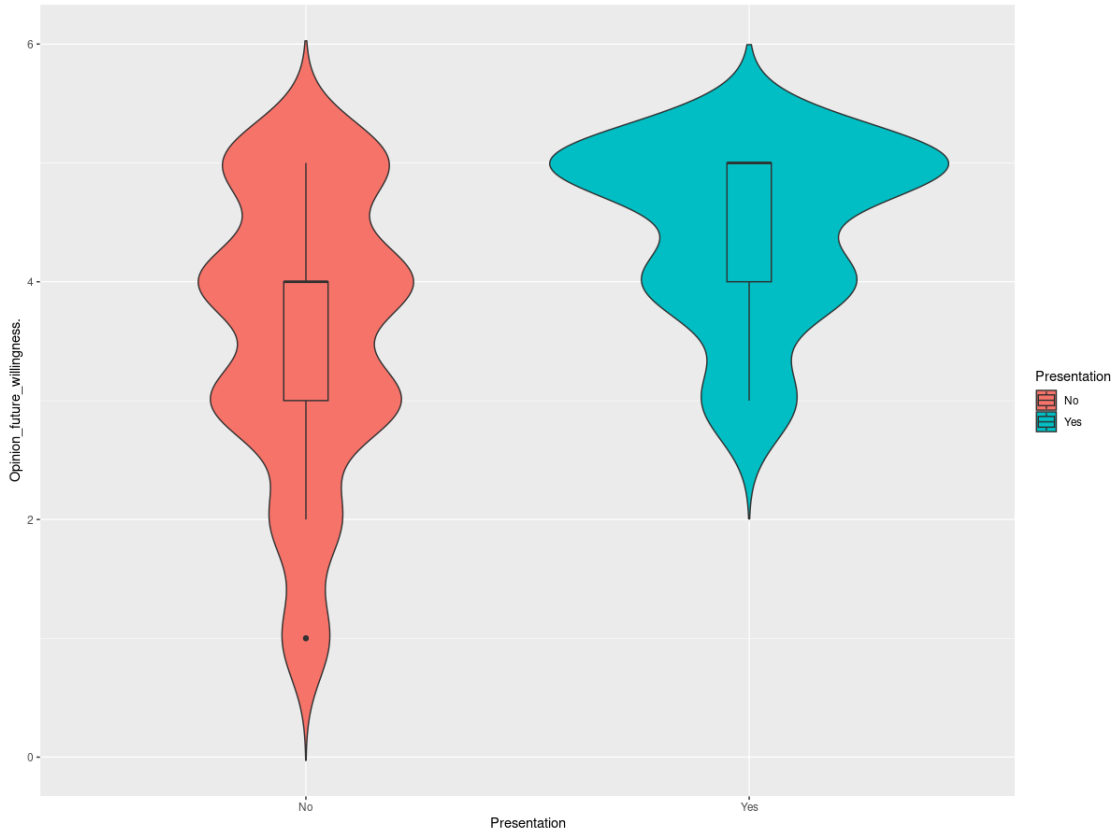

FIGURE 2. Violin Plot of Future Willingness to Consume ICF by Informational Presentation

Presentation	Min	Q1	Median	Q3	Max	Mean	SD	n
No	1	3	4	4	5	3.551	1.182	29
Yes	3	4	5	5	5	4.433	0.727	30

TABLE 2. Descriptive Statistics of Presentation

A second independent samples t-test was conducted to determine if there was any difference in the willingness score between the presentation group (experimental group) and the no-presentation group (control group), represented as a violin plot (Figure 2). The results revealed a statistically significant difference between the two groups ($t(57) = -3.47$, $p = 0.001$, $\alpha = 0.05$). The finding shows that the presentation variable was more statistically significant than the pre-knowledge variable because the p-value is much smaller. The outcome also supports the second hypothesis, suggesting that more awareness and education regarding

entomophagy leads to a higher desire to consume edible insects. In more detail, the group that received the presentation had a higher willingness score, with a mean value of 4.43 (SD = 0.73), compared to the group that did not, which had a mean value of 3.55 (SD = 1.18) (Table 2). The 95% confidence interval for the difference in means ranged from -1.392 to -0.372, further supporting the significance of this finding, as the difference is unlikely to result from random chance.

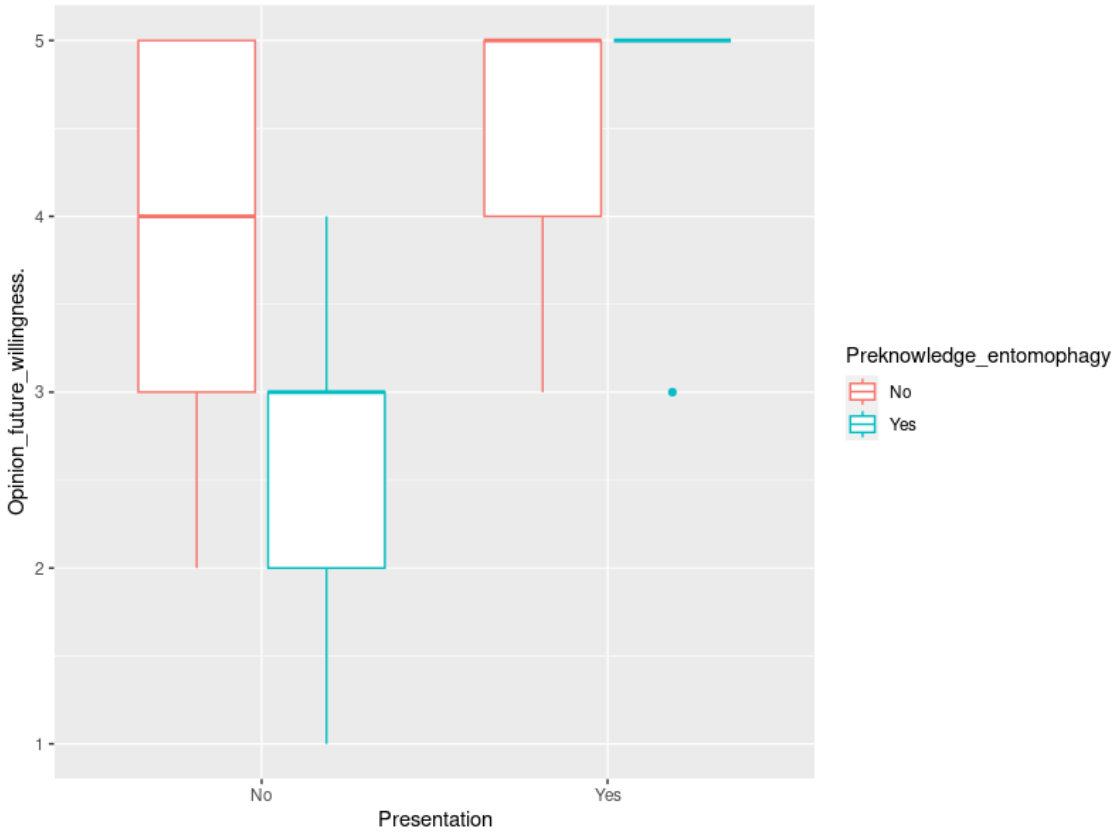

FIGURE 3. Box Plot of Future Willingness to Consume ICF by Informational Presentation

Pre-knowledge	Presentation	Min	Q1	Median	Q3	Max	Mean	SD	n
Yes	No	1	2	3	3	4	2.667	1.118	9
	Yes	3	5	5	5	5	4.6	0.894	5
No	No	2	3	4	5	5	3.95	0.999	20

	Yes	3	4	5	5	5	4.4	0.707	25

TABLE 3. Descriptive Statistics of Two Variables (Pre-knowledge and Presentation)

One extra factor was the effect on students' willingness, considering both pre-knowledge and presentation. The prior tests only considered one independent variable, but this test examines the overlap between pre-knowledge and presentation. For example, the mean value for the yes presentation group does not distinguish the yes pre-knowledge group or the no pre-knowledge group. Therefore, a Two-way Analysis of Variance test was performed and visualized in a box plot (Figure 3). The test was unlikely due to a random chance supported by statistical evidence ($p = 0.012$, $\alpha = 0.05$). Looking at the outcomes from Table 3, students who had pre-knowledge and got presentations had a mean value of 4.6 (SD = 0.89). Students who did not have pre-knowledge and got presentations resulted in a mean value of 4.4 (0.71). This proves that whether or not the participants had pre-knowledge, the presentation enhanced their future willingness. Another thing to note is that students who did not receive the presentation but had pre-knowledge had the lowest future willingness mean of 2.67 (SD = 1.12). This suggests that what students learn may be more important than what they know. As aforementioned, Lesnik stated that "disgust is learned," so it is reasonable to infer that most people who had pre-knowledge had a bad impression of insects aligning with the study's previous belief that prior knowledge might reinforce negative stereotypes.

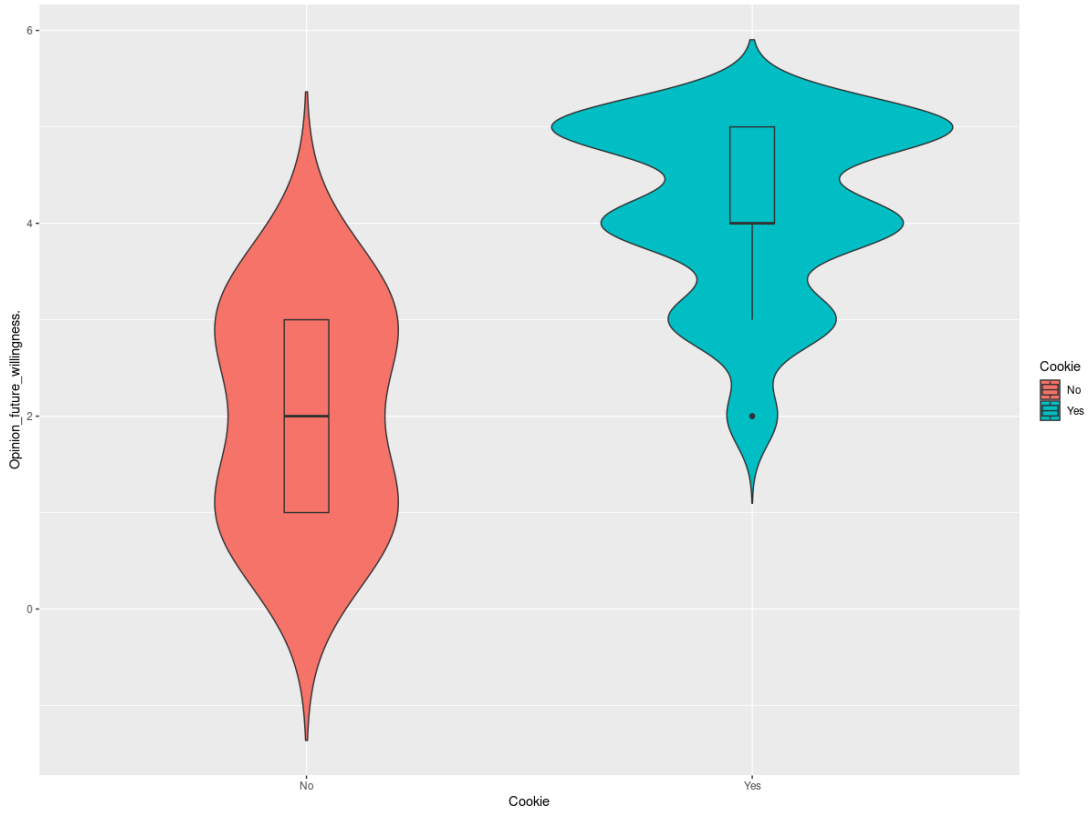

FIGURE 4. Violin Plot of Future Willingness to Consume ICF by Cookies

Cookies	Min	Q1	Median	Q3	Max	Mean	SD	n
No	1	1	2	3	3	2.000	1.154	4
Yes	2	4	4	5	5	4.145	0.911	55

TABLE 4. Descriptive Statistics of Cookies

The t-Test was done to compare future willingness responses for the yes-cookie group and the no-cookie group. This independent variable of cookies was not divided into experimental or control groups as it is not ethical to force people to consume ICF if they are not willing. The test revealed a statistically significant result ($t(57) = 4.48$, $p = 0.031$, $\alpha = 0.05$), which provides evidence to accept the hypothesis: students who tased insect-power-made cookies would have a higher willingness to try edible insects again in the future than those who did not taste cookies. The mean value for the yes-cookie group was 4.14 (SD = 0.91), while the mean value for the no-cookie group was 2.00 (SD = 1.15), with a 95% confidence interval for the difference in means between 0.99 and 3.30.

This suggests having an opportunity to taste ICF is related to students' future willingness because those who did not take the cookies (n = 4) had low willingness scores and even the maximum score was 3 (Table 4). Meanwhile, students who tasted cookies showed much more positive results. The visual representation also provides evidence that a willingness score of 5 appears more frequently for the yes-cookie group. The data validated the third hypothesis by demonstrating that tasting cookies made a notable difference in future willingness scores.

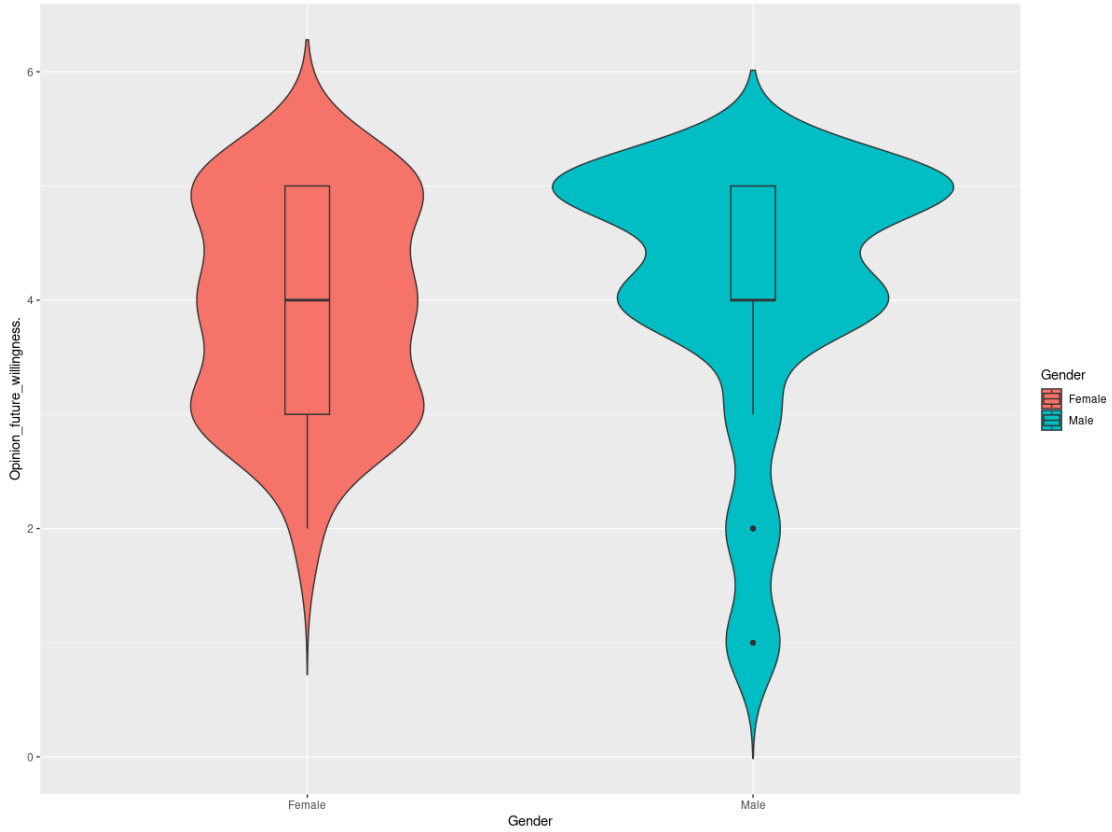

Figure 5. Violin Plot of Gender Comparison on Future Willingness

Gender	Min	Q1	Median	Q3	Max	Mean	SD	n
N/A	3	3	3	3	3	3.000	N/A	1
Female	2	3	4	5	5	3.925	0.917	27
Male	1	4	4	5	5	4.097	1.193	31

Table 5. Descriptive Statistics of Gender Comparison

Lastly, gender was compared to determine if there is any demographic influence on future willingness value. This independent samples t-test was conducted to determine if the additional factor might be related to the future willingness score, other than pre-knowledge, presentation, and tasting ICF. The results showed a statistically insignificant difference between males and females ($t = 0.61$, $p = 0.54$, $\alpha = 0.05$). The p-value exceeding the alpha value implies that gender does not significantly influence high school students' willingness to consume edible insects. Table 5 shows that the mean score of 3.925 (SD = 0.917) for participants who identified themselves as female is very close to the mean score of 4.097 (SD = 1.193) for males. The 95% confidence interval for the difference in these means, ranging from -0.736 to 0.392, provides additional context supporting the conclusion that the difference is unlikely to be significant. Alhujaili et al.'s research indicated that 19 out of 27 studies they reviewed found gender to be a significant predictor, with males being more willing than females to accept insect-based food (Alhujaili et al., 2023). While some studies indicated gender differences in willingness to consume edible insects, my findings suggest that the personal factor may be less influential than others. Further investigation on how different demographic factors might vary in their impact and which factors play a more critical role in enhancing willingness to consume edible insects would be a useful strategy.

Students were also asked to explain what aspects influenced their responses regarding future willingness to consume ICF (Appendix E, Column K) for more in-depth analyses. Participants' qualitative responses helped me understand why students shifted their minds (or not) by comparing their willingness scores, as indicated by the Likert scale, and the reasoning behind their scores. Using thematic analysis, two separate common themes were discovered for students with lower willingness scores (1-3) and higher willingness scores (4-5). Out of the 17 students who indicated a low willingness score, 12 mentioned their perceptions of edible insects themselves, including disgust, grossness, stereotypes, etc. The themes identified here were negative associations due to insects' natural appearance and the pessimistic mindset of people toward edible insects. Some examples of the respondents' comments are as follows:

> Student A: "I haven't seen it as common when growing up." - Willingness score of 1
> Student B: "It just sounds gross." - 2
> Student C: "I feed crickets to my lizard and it's gross" - 3
> Student D: "They do not look appetizing, and I am not used to eating them." - 3

In contrast, 42 students who indicated high willingness scores mentioned a topic related to insect-containing food more than simply talking about edible insects. 22 students mentioned that insect-powder-based cookies tasted similar and that they couldn't find any difference. The common theme in their responses was the similarity

between the tastes of ICF and normal food. For example:

> Student E: “It makes sense that it wouldn't necessarily taste any different. It is just a little hard to get over the
> perception of eating insects. It also cooks a little differently.” - 4
> Student F: “It tastes the same as the normal cookie.” - 5
> Student G: “It’s a good food source and doesn’t taste bad at all.” - 5

These responses suggest that students with high willingness scores are more likely to separate their perceptions of insects as a concept and the experience of consuming ICF. These students often described ICF as similar to conventional food, focusing on sensory experience–taste and texture–rather than their natural feelings about the insect component. The difference in perspective between students with low and high willingness scores highlights how the aspects individuals focus on can significantly influence their willingness to engage in entomophagy. This finding emphasizes the potential of education and positive experiences to overcome initial bias toward ICF.

V. Discussions & Conclusions

The present study investigated high school students’ willingness to consume ICF in the future if they had another opportunity. Through multiple statistical analyses, the data suggests that three variables are related to students’ willingness. First, the manipulation of the independent variable (informational presentation) influenced their opinions positively. Students who had pre-knowledge resulted in a low willingness score, but students who had pre-knowledge and also got a presentation resulted in the highest willingness score. This suggests that educating students is necessary when trying to implement entomophagy in society because correcting their knowledge greatly influences them. Tasting cookies impacted students' willingness to try ICF again in the future greatly. This data suggests that future strategies of making every student try to taste ICF is critical, as people who already had a pessimistic view did not try cookies at all, which resulted in a low willingness score. Gender, in comparison, did not provide statistical evidence that the factor influenced students’ willingness to consume ICF. This was still a valuable finding because it rejected the idea that “Males are 2.17 times more likely than females to adopt insects" (Verbeke, 2015). The result might be different because Verbeke's (2015) research had participants with an average of 42 years old compared to my experiment with students of 17.32 years old on average. Thus, the result implies that demographic factors impact less on high school students and they are more heavily influenced by education and familiarity. Qualitative data also provided evidence to support the overall hypothesis that familiarity influences students’ opinions positively. The thematic analysis suggests that the mindset students have and what they experience greatly influence their willingness score.

The study's limitations may have affected some of the results presented. First, a small amount of the student population of 59 students does not represent the overall high school student population. Especially for the data with the yes-cookie group and no-cookie group, only 4 people did not taste the cookies, which does not meet the Central Limit Theorem of the sample size of 30. Depending on where participants live and what education they have, these factors might influence students' responses. Because this experiment was only conducted in one high school, the result may only apply to this population or others with similar demographics and locations. Lastly, entomophagy is not limited to just consuming crickets. As I mentioned before, there are over 1900 edible insect species, and every insect tastes different than the others. This implies that the discovered results may be divergent when tested with another insect species. All of these reasons might have skewed the results.

Despite these limitations, the results presented were still substantial, with p-values of less than 0.05. Therefore, the study proposes that there is a significant relationship between high school students' familiarity with entomophagy and their willingness to consume ICF again in the future. More importantly, the study provided evidence that what students "learn" is more important than what they already "know" when comparing the pre-knowledge and presentation to the future willingness. This implies that learning correct information is crucial to increasing high school students' willingness to adopt ICF.

The study's understanding establishes a high potential for implementing entomophagy in Western countries. Considering past researchers' suggestions that further research is required to break the barrier of consumer acceptability towards insects and that more strategies are necessary to attract consumers (Jones 2020, Tang et al., 2019), the present study implies that just 8 minutes of proper education and having a chance to try ICF drastically improved students' opinions. Breaking their stereotypes that edible insects are disgusting, would help entomophagy to gain popularity in Western countries because the main reason why consumers do not prefer consuming edible insects is because of their "disgust-based rejection" (Woolf et al., 2019). Knowing that Jones's (2020) strategy is a feasible way to increase high school students' willingness to consume ICF as well, this study can add to the overall discussion of the entomophagy research field to understand consumers' opinions even better. This also supports the idea that edible insects could replace traditional meat products in order to manage food and nutritional problems caused by an increase in the global population (Verbeke 2015).

5.2 Future Directions

More research is essential in the research field to strengthen the results presented and to address the limitations described. Some suggestions for future research are as follows. The experiment could be repeated with a larger sample size, including students from other states or even from other

countries, to discover more accurate and conclusive data. Larger student representatives would help execute three-way ANOVA tests to examine any overlying effects of pre-knowledge, presentation, and consuming ICF on future willingness. Additionally, an applicable qualitative analysis by doing post-experiment interviews instead of just open-ended questions could also be employed to add depth to these findings. More specific questions such as when they tried ICF, how they got to know entomophagy, etc., with a bigger student representative would help to understand the relationship between pre-knowledge and future willingness better. It would also be helpful in the research field if studies were done comparing multiple common edible insect species to implement better strategies and markets for entomophagy. Moreover, studies using various teaching strategies, not only giving students an informational presentation, are worth investigating.

One of the survey questions asked if students had any suggestions to improve edible insects in order to implement entomophagy. Many students indicated making it more accessible, using better market strategies, changing their names, and educating more people, which suggests ideas for the future (Appendix E, Column O). Using students' responses, more researchers can discuss effective ways to market edible insects by increasing consumer awareness.

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Appendix A

Parental Consent Form

Parent / Guardian Consent Form

Principal Investigator: Catherine Seo
Faculty Advisor: [redacted]
Study Title: Understanding the Consumers' Acceptability and Perception of Edible Insects as an Emerging Protein Source

Dear Parents and Guardians,
I am a junior at Timberline High School. I am conducting a research study, using high school students as subjects, to investigate if more knowledge and familiarity in edible insects decreases the disgust-based rejection of Insect-Containing Food (ICF). The school administration is familiar with this and has given me permission to conduct this research at the school. Below is some information about the experiment.

Description: If you allow your child to participate, I will first ask them their gender, grade, if they have ever tried ICF, and if they have heard about the term "entomophagy". Then they will complete a short survey. One group will only be given chocolate chip cookies made with acheta (cricket) protein powder and will be asked if they are willing to try the cookies. They will have an opportunity to try eating the food and will answer a few questions afterward about their experience and feelings about trying ICF. Another group will listen to a short presentation about ICF's benefits and potential. Then they will get to try the same food as the first group and will be asked the same questions. Your child will be randomly assigned to either group 1 or 2 and the whole survey will approximately take 10 minutes. If students showed significant changes, they might be asked to do an additional interview after the short survey.

Ingredients & Nutrition Facts: Flour, eggs, baking soda, salt, butter, sugar, brown sugar, vanilla extract, chocolate chips, and EXO acheta protein powder (Fat 3g, cholesterol 25mg, sodium 45mg, carbohydrate 1g, protein 7g, vitamin D 2.101 mcg, calcium 28.6mg, iron 1.023mg, potassium 109 mg, riboflavin, niacin, vitamin B12, biotin, pantothenic acid, zinc).

Risks & Benefits: There are no known risks to your child from participating in this study. If your child has a specific allergy to ingredients or has entomophobia then you don't need to turn this form back (Just simple disgust towards insects is different than entomophobia). It is a common misconception that insects are unsafe to consume, yet cricket powder is safe and does not cause adverse health effects. In January of 2023, the European Union approved the sale of these

insects for human consumption in powder and other dried forms and there are currently many online stores and 22 offline stores around the world that sell ICF. This experiment is completely separate from your child's curriculum and their grades will not be affected in any way if they do, or do not, participate. Your child will not directly benefit from this research, however, their participation may benefit other researchers in the field by providing more information on what young students think about entomophagy.

Confidentiality: This research is anonymous. No names or other identifying information will be collected. Rather, each child will be given an identification letter for their experiment.

Freedom to Withdraw or Refuse Participation: If a child indicates at any time that they do not want to participate, they have the right to stop and also have the right to refuse to answer surveys or interview questions.

Questions: If you wish to share any concerns or dissatisfaction with any aspect of this experiment, feel free to contact me at catherineseo05@gmail.com.

This form is adapted from Hampshire College Sample Informed Parental Consent Form

_ _

Informed Consent Statement

I, _______________, give permission for my child, _______________ to participate in the research project entitled, "Understanding the Consumers' Acceptability and Perception of Edible Insects as an Emerging Protein Source." The study has been explained to me and my questions are answered to my satisfaction. I understand that my child's right to withdraw from participating or refuse to participate will be respected and that his/her responses and identity will be kept confidential. I give this consent voluntarily. It would be appreciated if you submit this form to your class teacher **by next Tuesday, 02/28/23**.

*If you are over 18, you do not need to get your parents' signature.

____

Print Child's Name

_____ _____

_____

Parent/Guardian's Name Parent/Guardian's Signature

Date

Appendix B

Chocolate Chip Cricket Cookies Recipes

Ingredients

- [ ] 2 ¼ cups cricket flour
- [ ] 1 teaspoon baking soda
- [ ] ½ teaspoon salt
- [ ] 1 cup butter, softened
- [ ] 1 cup sugar
- [ ] ½ cup brown sugar
- [ ] 1 teaspoon vanilla extract
- [ ] 2 eggs
- [ ] 1 12-ounce package chocolate chips
- [ ] ½ cup dry-roasted chopped crickets

Directions

Step 1

Preheat oven to 375 degress

Step 2

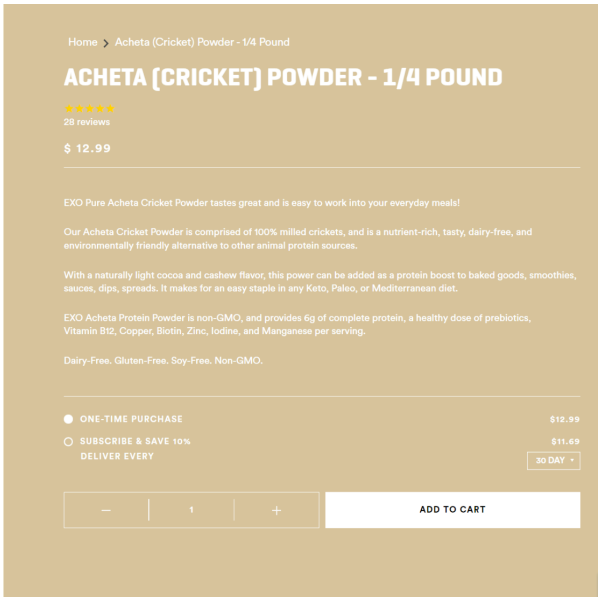
In small bowl, combine flour, baking soda and salt; set aside. In large bowl, combine butter, sugar, brown sugar and vanilla; beat until creamy. Beat in eggs. Gradually add cricket flour mixture and mix well. Stir in chopped crickets and chocolate chips.

Step 3

Drop by rounded measuring teaspoonfuls onto ungreased cookie sheet. Bake for 8-10 minutes.

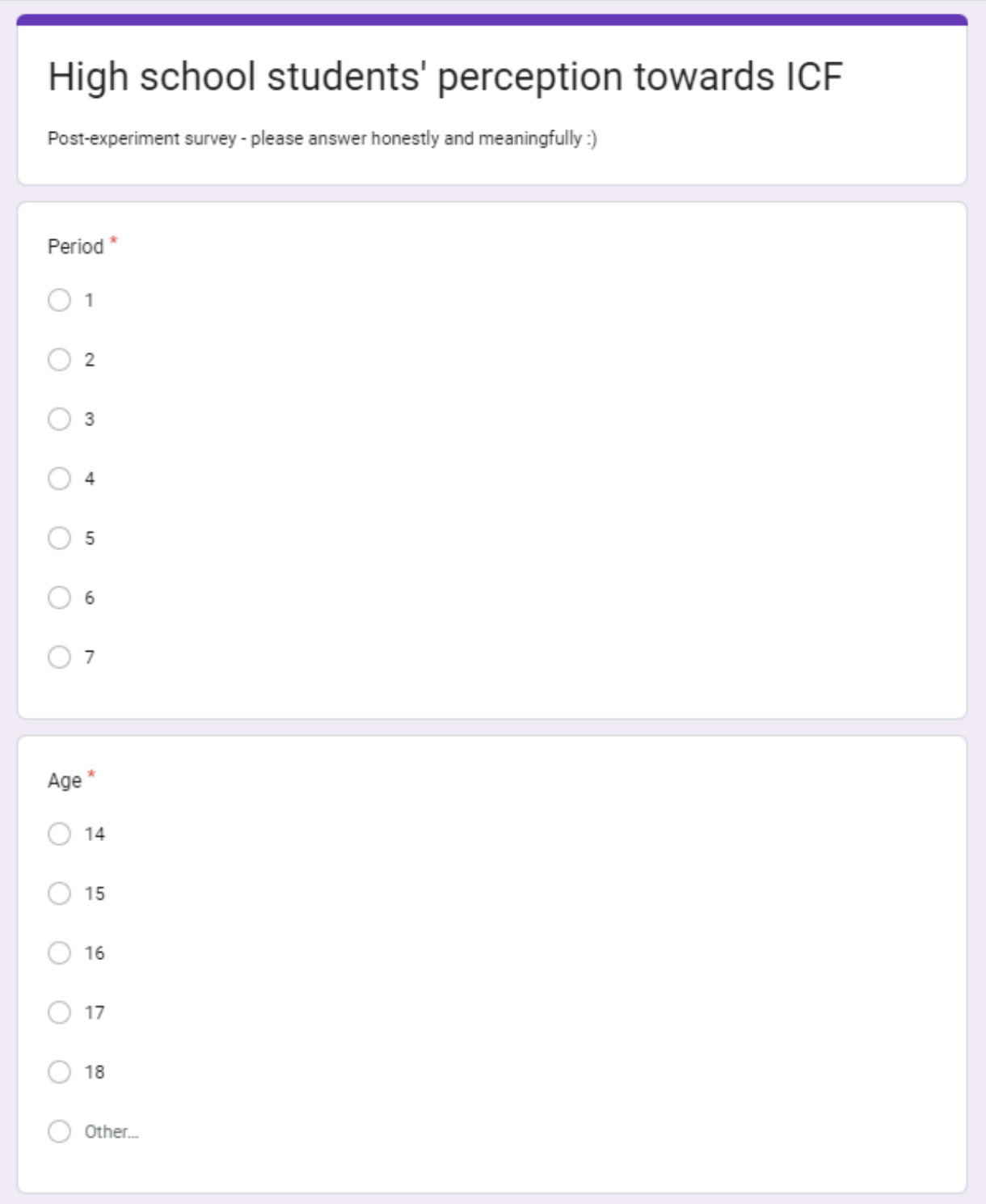
**This recipe is adapted from My Recipes*

- Used half cricket powder and half cookie flour instead of 2 ¼ cups of cricket flour.



Appendix C

Survey Questions



High school students' perception towards ICF

Post-experiment survey - please answer honestly and meaningfully :)

Period *

- 1
- 2
- 3
- 4
- 5
- 6
- 7

Age *

- 14
- 15
- 16
- 17
- 18
- Other...

Grade *

- Freshman
- Sophomore
- Junior
- Senior

Gender *

- Male
- Female
- Prefer not to say
- Other...

Did you know that insects could be consumed by humans as a protein source before being involved in this experiment? *

- Yes
- No

Do you know what entomophagy means? *

- Yes
- No

Did you take the cookie? *

- Yes
- No

Did you get the presentation? *

- Yes
- No

What is your opinion on eating edible insects? *

	1	2	3	4	5	
disgusting	○	○	○	○	○	delicious

What factors/aspects of insects-containing foods make you think that way? *

Long answer text

How safe do you think edible insects are to consume? *

	1	2	3	4	5	
dirty/unsafe	○	○	○	○	○	clean/safe

Why? *

Long answer text

How likely would you be willing to try more insect-containing food in the future if you have an opportunity? *

	1	2	3	4	5	
Very unlikely	○	○	○	○	○	Very likely

What are some suggestions you have for improving edible insects in general (e.g. accessibility, acceptance, familiarity, palatability)? *

Long answer text

Has your experience today changed your perception of edible insects? *

- ○ Yes
- ○ No
- ○ Other...

Can you explain why you chose yes/no/other for the previous question? *

Long answer text

What is your reason for not choosing or choosing to eat cricket powder-based cookies today? *

Long answer text

Appendix D

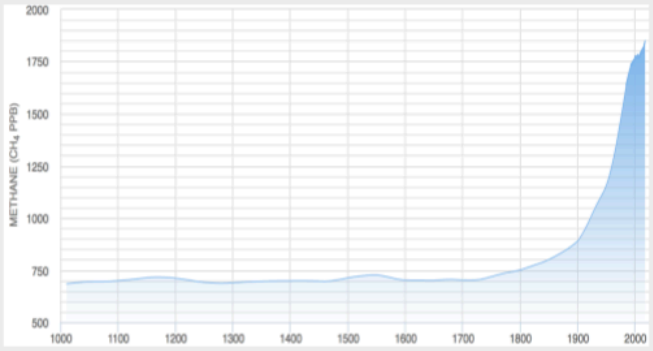
Informational Presentation about Entomophagy

Meat Product Alternatives in the U.S.

[redacted]

Importance of Methane

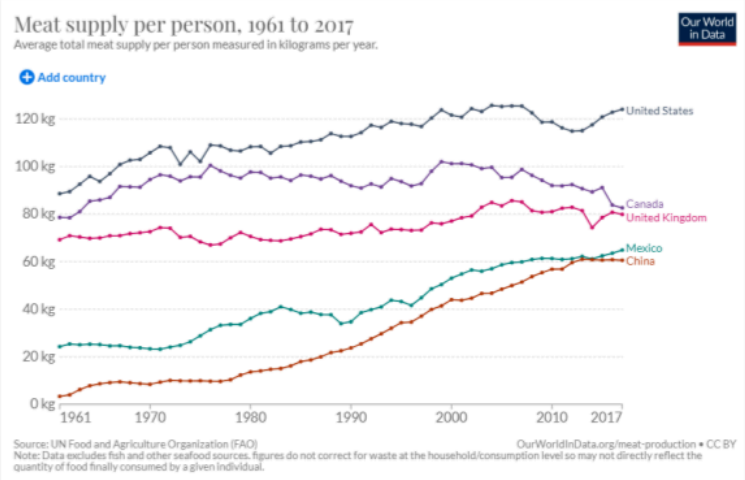
Global CH4 (Methane) Levels



Methane Levels Organization, 2002

- 20-30% of global warming
- 80x potent than CO2 at trapping heat
- Ground-level ozone
  - 60,000 premature human death
  - 25 million tons of crop losses

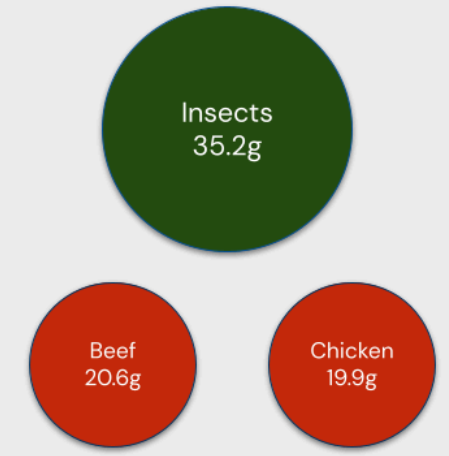
Significance



United Nations Food and Agricultural Organization (FAO), 2020

- Methane emissions
- Livestock: 37%
  - Cattle: 86.2%
- 124 kg meat consumption / year
- Overpopulation
  - Food insecurity

Entomophagy - Consumption of Edible Insects

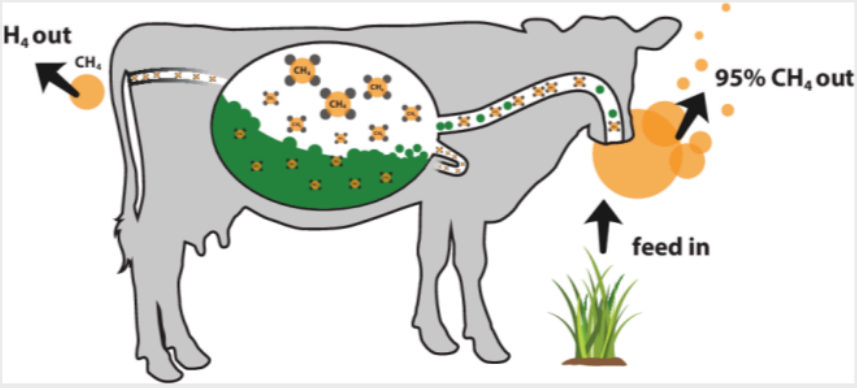


Food and Agriculture Organization of the United Nations, 2020

- Importance of Protein
  - MedlinePlus (National Library of Medicine)
    - Growth & Development
    - High nutrition - vitamin B12, iron, zinc, fiber, amino acids, omega-3, etc.
- No known diseases / parasitoids
- Low risk of transmitting zoonotic diseases
  - H1N1 (bird flu) & BSE (mad cow disease)
  - Food and Agriculture Organization of the United Nations (FAO)

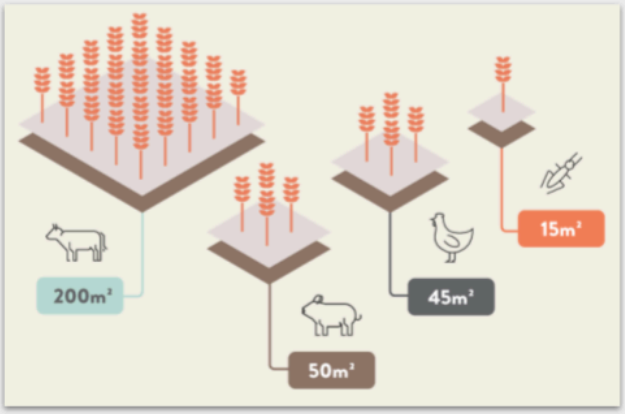
Environmental Benefits (1)

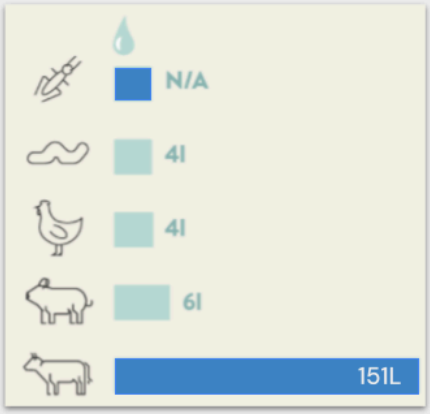
- Edible insects: 10–80x less methane
- Livestock: Enteric fermentation



Environmental Benefits (2)

- High feed conversion efficiency





Gardner, n.d.; Miglietta, Leo, Ruberti, et al., 2015

Insects' Economic Costs

- Farming Insects

  -Department of Entomology, Food and Nutritional Science, 2020

  - Make profit with a small investment
- As demand grows, prices would drop

Entomophagy

The key to cope with the some of
the major food & nutritional challenges around the world.

Challenges of Entomophagy

- Appearance
- Palatability

→ Negative point of view →

Powder & Meal

- Institutes of Nutritional Science

Bamboo worm powder. Researchers from the Karlsruhe Institute of Technology

Overcome the Palatability

- Insects → Powder & Meal - Institutes of Nutritional Science

- More opportunities
  - School lunch
- Develop new recipes
  - Easy & Tasty
- Give new names
  - Cow → Beef

Osnabrück (Germany), 2014

One of the first to sell insect-based products in the Netherlands and Belgium.

Insect based products are now sold in several states, Texas, California, Washington, Oregon, etc.

Now you should try one!

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Appendix E

Survey Responses

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Timestamp	Period	Age	Grade	Gender	Did you know that insects could be	Do you know what entomophagy means?	Did you take the cookie?	Did you get the presentation?	What is your opinion on eating edible insects?	What factors/aspects of insects-containing foods make you think that way?	How safe do you think edible insects are to consume?	Why?	How likely would you be willing to try more insect-containing food in the future if	What are some suggestions you have for improving edible insects in general (e.g.	Has your experience today changed your perception	Can you explain why you chose yes/no/other for the previous question?
2	3/7/2023 13:34:	2	16	Sophomore	Male	Yes	No	Yes	Yes	2	When I think of eating insects I think about how the have legs	5	Not sure	5	Make it more appealing by advertising	Yes	Because it tasted like a regular cookie
3	3/7/2023 13:41:	6	17	Senior	Female	Yes	Yes	Yes	Yes	2	The image of the bug when I'm eating it	4	Because of the presentation, it seems gross but you said it's clean.	3	Renaming the food, using powder form.	Yes	I am more open to eating it but I still wouldn't seek it out.
4	3/7/2023 8:11:4	1	17	Junior	Male	Yes	No	Yes	Yes	3	They tasted fine, and seemed about equivalent to normal food	5	The presentation helped show how safe they are, with no real diseases that could harm humans	4	I would agree with giving it another name like beef to decrease affiliation	Yes	It changed how safe I viewed insects, however not too much, as i already viewed them in a more positive light than negative before this
5	3/7/2023 9:06:2	2	18	Senior	Male	Yes	No	Yes	Yes	3	It doesn't taste very different than normal food	5	I have no evidence to suggest otherwise	3	Push to get people past there fear of insects	No	My perception has always been that I should not knock it till I try it
6	3/7/2023 9:06:3	2	18	Senior	Male	Yes	No	Yes	Yes	3	If its cooked inside of something else or turner into a powder I am fine with it. I would have issues looking at an insect in its entirety and consuming it	5	I dont see what would make them dirty or unsafe if they are being farmed	4	Just making it more available. All sorts of options in grocery stores, restaurants, etc... also making more options of food	Yes	I realize the benefits of eating insects and would like to try more options
7	3/7/2023 10:00:	3	17	Senior	Female	No	No	Yes	Yes	3	it's just another source of food	5	it's processed into powder	3	making the labels seems more friendly less bug	Yes	yes because the food seemed the same as the original
8	3/7/2023 13:45:	6	15	Sophomore	Female	Yes	No	Yes	Yes	3	Knowing that it's actually an insect that made up the cookie (but it doesn't change the taste of the cookie)	4	The presentation said there were no known diseases that are transmitted from the insect. The taste didn't change.	3	Changing the name was a good idea, as well as stocking stores with insect powder so that people get more used to the idea of insects being a source of protein.	Yes	The cookie tasted the same as a regular chocolate chip cookie, which i didn't really realize before.
9	3/7/2023 8:09:0	1	16	Junior	Female	Yes	Yes	Yes	Yes	4	It's tastes good	5	It just is	5	Make it more well known and not such a weird thought	No	I've eaten edible insects before
10	3/7/2023 8:09:0	1	16	Junior	Female	Yes	No	Yes	Yes	4	It tastes the same as the normal cookie	5	Because it's just as healthy as eating any animal	5	Making them more accessible and/or changing the name so you don't think of insects	Yes	Because I had never considered them as inside other foods and had only ever thought of them as insects

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11	3/7/2023 9:03:5	2	17	Senior	Female	Yes	No	Yes	Yes	4	the appearance is the only thing that gets to me	5	if produced properly then they are totally safe	4	decreasing the stigma behind bugs. we are taught from a young age that bugs are gross and dirty.	Yes	i barely even tasted th powder!
12	3/7/2023 9:07:4	2	18	Senior	Female	Yes	No	Yes	Yes	4	I know insects are perfectly edible, just eating them pure can taste gross. I think using them inside foods is like using other things as ingredients: for example horse hoof for gelatin	4	There will be risks with using anything as a food or ingredient, but I don't think insects are any more particularly unsafe then a lot of other options, if anything they're "strangely" safer (given their appearance you'd not usually think that)	4	Maybe just more widespread and greater advertising, with those good data points to them like the presentation had- just more knowledge in general	No	I've never eaten a big cookie but I didn't thir it would taste bad and was right it didn't
13	3/7/2023 9:09:0	2	16	Junior	Female	Yes	No	Yes	Yes	4	tasted the same as the normal cookie	4	there isn't and proven research that insects can cause harm	4	i think changing the name is a good idea so it doesn't gross people out	Yes	they seem less disgusting than they c before
14	3/7/2023 12:39:	5	18	Senior	Male	Yes	Yes	Yes	Yes	4	It's a good food source and doesn't taste bad at all.	5	Nothing that says otherwise, and diseases probably don't transfer from bugs to people.	5	More accesable	Yes	I agreed before but af the presentation I agr with bug food even more. The cookies we very good.
15	3/7/2023 12:42:	5	18	Senior	Female	No	No	Yes	Yes	4	I think it would take a little to wrap my head around eating insects, but I overall think it's a good solution. I think making insects into some form of powder would make it easier for people to be more open in eating insects.	5	I think insects are way more safe then any meat I've had and probably way cleaner.	5	I think changing the insect food into something other then insects would be very beneficial because people wouldn't worry so much on the fact that they are eating insects.	Yes	I think it's comforting know that insects wouldn't have a negative impact on health and seeing hov much of a difference can be caused by eating insect based food on the environm makes my mind chan
16	3/7/2023 13:37:	6	18	Senior	Female	Yes	No	Yes	Yes	4	It makes sense that it wouldn't necessarily taste any different. It is just a little hard to get over the perception of eating insects. It also	5	They aren't any different than other animals and they actually carry less diseases.	4	I like the idea of giving seperate names because that makes it seem less like they are bugs	Yes	I am definitely more amenable to eating insect based foods no
17	3/7/2023 13:38:	6	16	Junior	Male	Yes	No	Yes	Yes	4	it tasted like a normal cookie	4	insects aren't that dangerous	5	make is seem normal	No	I already knew insects were healthy and I hadn't changed my mind

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18	3/7/2023 12:39:	5	18	Senior	Male	Yes	Yes	Yes	Yes	4	It's a good food source and doesn't taste bad at all.	5	Nothing that says otherwise, and diseases probably don't transfer from bugs to people.	5	More accesable	Yes	I agreed before but the presentation I a with bug food even more. The cookies very good.
19	3/7/2023 12:42:	5	18	Senior	Female	No	No	Yes	Yes	4	I think it would take a little to wrap my head around eating insects, but I overall think it's a good solution. I think making insects into some form of powder would make it easier for people to be more open in eating insects.	5	I think insects are way more safe then any meat I've had and probably way cleaner.	5	I think changing the insect food into something other then insects would be very beneficial because people wouldn't worry so much on the fact that they are eating insects.	Yes	I think it's comfortin know that insects wouldn't have a negative impact on health and seeing h much of a differenc can be caused by eating insect based food on the environ makes my mind cha
20	3/7/2023 13:38:	6	16	Junior	Male	Yes	No	Yes	Yes	4	it tasted like a normal cookie	4	insects aren't that dangerous	5	make is seem normal	No	I already knew inse were healthy and I hadn't changed my mind
21	3/7/2023 13:40:	6	18	Senior	Male	Yes	No	Yes	Yes	4	Cricket lollipops, never had a bad tasting insect	5	Just from listening to what others have told me, if i did my own research I'm sure I'd come to the same conclusion	5	Palatability, I say just start using more insects more often without telling the public	Yes	Because it was a ne experience, and i w happy to do it
22	3/7/2023 13:47:	6	16	Junior	Female	Yes	No	Yes	Yes	4	It doesn't taste very different from normal food	4	Well if you can eat them and it gives nutrients then I'd say it safe	5	I'd say doing more of putting them in something sweet	No	I've had food with cricket powder befo
23	3/7/2023 8:09:0	1	18	Senior	Male	Yes	No	Yes	Yes	5	It tasted like a normal cookie, it was good.	4	I'd assume it is safe,	5	Change the name	Yes	I have experienced first hand and I liked
24	3/7/2023 8:09:2	1	15	Sophomore	Female	Yes	No	Yes	Yes	5	I never had a problem with eating insects before	5	Because of the slide show it showed me that insects are safe to consume even more safe then cows	5	I think it was very well presented	Yes	Because it makes m think of what consu now
25	3/7/2023 9:05:2	2	18	Senior	Male	Yes	No	Yes	Yes	5	Well it tasted really good. It is odd to think about crickets when I am eating it though.	5	It is no different then eating animals as long as they are properly treated	5	Coming up with a different term like you talked about, other than insect.	Yes	Because I didn't kn how good it could te
26	3/7/2023 9:05:3	2	17	Junior	Female	Yes	Yes	Yes	Yes	5	They don't really have a flavor by themselves so they're pretty much good in anything	5	Most insects aren't inherently dirty	5	Like the presentation said marketable and changing people's perception on eating insects	I've already eaten insects quite a few times before but I learned more about how we can expand it into everyday life	Bugs are pretty yun

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27	3/7/2023 12:39	5	17	Junior	Male	Yes	No	Yes	Yes	5	As long as it's not just a whole insect it's pretty good	5	It's almost like any other food additive	5	Not sure	Yes	Because I always thought insects would taste bad
28	3/7/2023 12:43	5	18	Senior	Male	Yes	No	Yes	Yes	5	It honestly tasted the same to me personally after having each one and feel like it could be similar with other foods as well	4	I'm not sure as to if all insects are safe to eat but I know that a solid amount are safe and full of protein, I just don't know much about insects	5	I think the name change like how it's beef instead of calling it a cow would be a solid change	Yes	I knew it was a good option but never really got to trying it but now that I have I'm all for it
29	3/7/2023 13:37	6	18	Senior	Male	Yes	No	Yes	Yes	5	They are bugs	4	They crawl it's weird	5	Make them more available	Yes	It was super tasty
30	3/7/2023 13:38	6	18	Senior	Male	No	No	Yes	Yes	5	The chocolate chips	5	I feel like we know science really well and I trust that	5	Just getting people comfortable with the idea that they are eating insects	Yes	I feel like it would normally gross me out but it didn't
31	3/7/2023 13:41	6	18	Senior	Male	Yes	Yes	Yes	Yes	5	It seemed to have a very similar structure (same texture and similar taste as a normal cookie)	5	It would have to FDA approved just like the other meat products right?	5	I think once more products come out that taste good people will lose the stigma of bugs = gross	Not really because I've had something similar before. I have even had just straight cooked ants, mealworms, and crickets	Look previous
32	3/7/2023 14:10	6	18	Senior	Male	Yes	Yes	No	No	1	I haven't seen it as common when growing up.	5	Its just a bug.	1	Make it known that it is safe.	Yes	Im vegetarian and I never knew about it, b now I do.
33	3/7/2023 14:14	6	18	Senior	Male	Yes	Yes	No	No	3	I didn't eat the cookie since i'm vegetarian	4	It's the same as other protein sources: natural and can be just as clean	1	People need to be more educated on how safe and reliable insects are as a food source	No	Didnt eat the cookie
34	3/7/2023 10:55	4	18	Senior	Female	Yes	No	Yes	No	2	It just sounds gross	4	They just seem like another animal	2	They don't taste like much	Yes	It's not near as gross a I thought it would be
35	3/7/2023 8:16:2	1	18	Senior	Male	No	No	Yes	No	4	Insects are gross but the cookies where good	3	Insects are considered gross in our society	2	Reducing the stigma about eating bugs	Yes	The cookies tasted the same and that's a goo thing
36	3/7/2023 14:11	6	18	Senior	Male	Yes	Yes	Yes	No	5	Common visual aspect of living insect	4	Insects could have germs perhaps	2	Increase familiarity by creating less visual aspect of living insects	Yes	It was delicious
37	3/7/2023 14:11	6	16	Junior	Female	Yes	Yes	No	No	2	They do not look appetizing and I am not used to eating them.	4	If we can consume animals, I feel like insects won't be much different.	3	Changing their appearance and making them more familiar to the public would help.	No	I did not try the cookie nor did I receive the presentation. I wasn't allowed to by my parents.
38	3/7/2023 9:47:4	6	17	Junior	Female	Yes	No	Yes	No	3	the exoskeleton	5	We eat all other animal products	3	If the consumer doesn't know that there's bugs, they will enjoy the product the same.	Yes	insects don't affect the taste of the cookie like thought they did

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39	3/7/2023 9:59:2	3	18	Senior	Female	Yes	No	Yes	No	3	stereotypes	5	i trust	3	keep it a secret	Yes	not bad
40	3/7/2023 11:00	3	17	Senior	Prefer not to say	Yes	No	Yes	No	3	Insects are just not something id ever think to eat they're what other animals eat	3	it's just a feeling i have to get over, i think they would be perfectly fine i just don't associate them as something to eat	3	i guess just making it more known but i don't have really any suggestions	No	i still feel they same, know they're edible i just don't want to eat them
41	3/7/2023 9:45:0	6	16	Junior	Female	Yes	Yes	Yes	No	4	I feed crickets to my lizard and it's gross	5	they're just animals like other meat	3	make it more widely known	Yes	I liked the insect coo more. It wasn't too sweet and I got a litt saltiness to balance out.
42	3/7/2023 9:58:5	3	18	Senior	Female	Yes	No	Yes	No	4	Our culture definitely hasn't normalized eating insects, so it' feels foreign to me	5	I don't see why they'd be any less safe than meat	3	Market insects with cute packaging!	Yes	I've never had cricke before, but I couldn't even tell they were i there!
43	3/7/2023 18:40	6	17	Senior	Female	Yes	Yes	No	No	4	I think the shape or the idea of what insects look like is what makes me cringe, but I realized that ICFs like your cookie don't have insect parts, it's actually like a powder. Also, learning about the nutritious aspects of it helped me embrace ICFs better.	4	Because you explained the benefits and how there aren't many harms to eating it.	3	Make them more common in foods we see everyday, like in our school cafeteria or common places people go to eat.	Yes	Your presentation an research is amazing. That's why. And the cookies looked awesome.
44	3/7/2023 14:10	6	18	Senior	Male	Yes	Yes	Yes	No	5	It doesn't taste bad	5	It's animal protein	3	No	Yes	It doesn't taste bad
45	3/7/2023 9:58:5	3	18	Senior	Female	Yes	No	Yes	No	3	how they look	4	i don't see any harm in it	4	don't present them in their original bug form	Yes	the collie didn't taste bad
46	3/7/2023 10:55	4	18	Senior	Male	Yes	Yes	Yes	No	3	If I can tell it's bugs I might be a little grossed out but if I can't tell I don't care	4	They are just bugs idk	4	Just more normalizing it would go a long way probably	Yes	The cookie was gas
47	3/7/2023 10:57	4	18	Senior	Female	Yes	No	Yes	No	3	If I can't taste them then I don't care but they are gross to think about	5	They are just protein and are grown to be eaten	4	Inform people and teach young kids to not be grossed out by them	Yes	Because I was curio
48	3/7/2023 8:18:2	1	18	Senior	Female	Yes	Yes	Yes	No	4	The cookies taste the same	5	They are fda approved	4	Educating more people	Yes	I didn't like to eat insects before

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49	3/7/2023 10:02	3	18	Senior	Female	Yes	No	Yes	No	4	Insects are a natural part of life, much like other parts used in baking/cooking. It's not much different than different types if eggs in baking.	5	They're natural, probably better than preservatives or other ingredients.	4	Use better marketing techniques, increase knowledge about edible insects. Make them more accessible to the public.	Yes	It tasted a lot better tha I was expecting
50	3/7/2023 10:55	4	16	Junior	Male	Yes	No	Yes	No	4	Protein	5	FDA regulated	4	Idk	No	I've eaten insects before
51	3/7/2023 10:55	4	18	Senior	Male	Yes	No	Yes	No	4	Protein	4	FDA approved	4	Acceptance	Yes	It wasn't disgusting
52	3/7/2023 10:55	4	18	Senior	Male	No	No	Yes	No	4	Protein	5	Bc you said so	4	Don't tell anyone there is bugs in it	Yes	It has positively affecte it, I'm more open to it
53	3/7/2023 8:17:3	1	18	Senior	Male	No	No	Yes	No	5	No change in flavor and consistency	5	Because it's been brought down to a powder form	4	Having more recipes for/including the edible insects	No	I'm not really scared to try anything new
54	3/7/2023 8:17:1	1	18	Senior	Male	Yes	No	Yes	No	1	they're bugs	4	because they're edible?	5	don't tell me they're edible?	Yes	since i didnt realize the can have no taste
55	3/7/2023 10:00	3	18	Senior	Male	Yes	No	Yes	No	3	Because there edible and people have been eating them for generations, but it seems a little less sanitary	4	Because when cooked most comes off	5	They have a slightly different flavor than regular flour or whatever else it is substituted so work around that new flavor or work with it	Yes	Because it tasted fairly similar just a different texture
56	3/7/2023 8:17:0	1	16	Sophomore	Male	Yes	No	Yes	No	4	Tastes the same one cookie is just harder.	5	Because they are a powder	5	Not telling me it's insects just telling me to eat it.	Yes	I chose yes because when I think of eating insects I think of eating them alive.
57	3/7/2023 8:22:0	1	17	Junior	Female	Yes	No	Yes	No	4	I feel like that since you can't taste the difference and since it's just a powder I don't see why it would be disgusting. That's more of a mindset you have, it's the mindset that eating bugs is disgusting no matter what form it takes.	4	I believe some forms, such as a powder, is safe to consume but live bugs are probably not due to sanitary reasons.	5	I would say improve accessibility and the acceptance of the idea, if you change the mindset and have it more available, it is more likely to become more common as a source of protein.	Yes	Every time I would hea someone talk about edible insects I would think of someone eatin a live bug, but now I know that it comes in many forms.
58	3/7/2023 10:01	3	18	Senior	Female	Yes	No	Yes	No	5	I wasn't very concerned about insect flour. Eating a live bug might gross me out, but insects are valid proteins and the concept of creating a flour seems really cool.	5	They're edible and not dangerous so why not?	5	I don't have any.	No	I wasn't really concern or repulsed before.
59	3/7/2023 10:55	4	18	Senior	Female	Yes	No	Yes	No	5	It tasted the same!	5	Because I ate it	5	Make it more common, reduce the stigma	Yes	I thought it would be gross and it wasn't