How Education on Entomophagy Influences Customer Willingness to Purchase Edible Insects in the US

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ABSTRACT

As our world population grows, it is imperative to find a sustainable protein alternative to conventional meat production. One option, proposed by the FAO, is adapting entomophagy. While bugs are diet staples in over 80% of countries, they have yet to penetrate Western markets where they carry a stigma of being unsanitary. To dispel this misconception, consumers must learn about the benefits of entomophagy. This study aimed to identify which benefits are most effective in convincing US consumers to purchase edible insects. It also assessed if certain age, race and gender demographics are more or less likely to engage in entomophagy, and if accessibility to bug-based products influences one's willingness to purchase them. Data was collected from 114 participants through a Google Forms survey. Participants were asked to read a series of statements on the environmental, nutritional, taste, cultural and sanitation benefits of insects, and rank how each affected their willingness to try insects. Sustainability and nutrition were found to significantly increase a participant's likelihood of purchasing insects. Asian individuals, and individuals aged 35-44 were found to be the most likely to engage in entomophagy while Black or mixed race individuals, and individuals over the age of 75 were found to be the least likely. However, the greatest difference in willingness to consume insects was found between individual demographics including race and gender versus race and gender alone. This reflects that all demographic characteristics of an individual should be taken into account when assessing which educational initiatives are most effective.

KEYWORDS

neophobia, entomophagous, consumer willingness to buy, demographic, accessibility

INTRODUCTION

As our population climbs towards an expected 10 billion people by 2050, natural resources such as food, water and land, will dwindle. Meat production is too resource intensive to sustainably support our growing population and will only perpetuate this environmental crisis further. The beef industry alone emits 3.7% of the US's total greenhouse gas emissions (Rotz et al 2019). Livestock rearing also takes up 70% of the world's agricultural land, and uses almost 100 times more water in total than grain production (van Huis et al 2013). While traditional animal raising practices may leave a smaller carbon, land and water footprint, they make up only a small fraction of meat production (USDA APHIS 2010). Conventional meat production practices also increase the risk of zoonotic viruses, such as COVID-19, SARS and H1N1, due to the close proximity of animals to other livestock and to humans (van Huis et al 2013). Yet, as our world's population grows, so will the demand for meat by 75% (van Huis et al 2013). Therefore, to feed our world with minimal environmental degradation and zoonotic pandemic risk, it is imperative to find an alternative agricultural practice with a minimal land, water and carbon footprint that does not sacrifice the essential nutrients that meat can provide.

A promising livestock substitute is entomophagy, the practice of eating edible insects, which has been present for millennia in 80% of countries and done by over 2 billion people, mainly throughout Asia, Africa and Latin America (Foster 2019). Edible insects require low amounts of water and land relative to the amount of protein, vitamins, and fat they provide. For example, producing 1 g of protein from mealworms uses half the amount of water and 2-3 times less land than producing 1 g of protein from chicken (van Huis et al 2013). Even more stark, 1 g of protein from beef needs 500% more water than 1 g of protein from edible insects and emits 6-13 times more CO2 in the production process (van Huis et al 2013). Over the past two decades, entomophagy has become a more popular center of study for prominent academic institutions and international organizations such as the UN's FAO as a way to promote sustainable food production and ensure global food security (van Huis et al 2013). Bug-based products are now being seen in Western markets, mostly as "invisible ingredients" integrated into flours, protein bars and chips to facilitate a consumer's transition to entomophagy (Melgar-Lalanne et al 2019). These new items are popping up mainly in European countries and have yet to become

widespread in the US (Megido et al 2016). A massive barrier to market entry for these products is neophobia, or perceived disgust of an unfamiliar food, which can be combated through proper education about edible insects (Macini et al 2019).

There is limited research on which entomophagous education topics are most effective in persuading consumers to try edible insects, and if factors such as demographic, diet, and accessibility influence an individual's likelihood to engage in entomophagy (Aguanta 2018, Megido et al 2016, Macini et al 2019). While food organizations and bug-centric companies aim to educate Western customers about the sustainability of eating insects, education alone has proved insufficient and can feel too far removed from a consumer to successfully convince them to partake in entomophagy (Melgar-Lalanne et al 2019). Studies have also explored gender as a potential influence on willingness to try insects, however, there is still a lack in data on the influence of age and race/ethnicity (Macini et al 2019, Megido et al 2016). Understanding the influence demographic has on an individual's likelihood to engage in entomophagy is crucial in gaining a more thorough understanding of the market for edible insects. There is also limited research on accessibility to edible insects, which is a key factor in determining shopping habits and diet (Alemu et al 2016). With this information, bug-based organizations can determine where to target education efforts and where to expand product offerings. Lastly, given that it is one of the last Western countries to adopt bug-based products in their market, there are very few studies on entomophagous education in the US (Hartmann et al 2016). Studying how a meat alternative performs in the US market is especially important since the US consumes the most meat out of any country in the world (Statistica 2020).

In this study, the central research question (CRQ) I will analyze is: How does education on edible insects, their accessibility and participant demographic affect an individual's willingness to engage in entomophagy? My sub research questions (SRQ) will answer the following: (1) How does education on each benefit of entomophagy: nutrition, sustainability, cultural significance, taste and sanitation, influence a US consumer's willingness to try edible insects? (2) Do demographic characteristics such as age, gender and race/ethnicity affect a US consumer's willingness to try insects? (3) How does access to edible insects or bug-based products affect a US consumer's willingness to engage in entomophagy?

I expected that cultural significance and sanitation will be the most persuasive in encouraging participants to try edible insects, with an average response of 4, and sustainability to be the least persuasive, with an average response of 3.5. Existing research notes that sustainability alone is not enough to convince consumers to try edible insects, and that likelihood to engage in entomophagy greatly increases when consumers learn about the cultural importance and safety of eating insects (Melgar-Lalanne et al 2019, Aguanta 2018). I also expected that demographic factors such as age and race will significantly influence one's willingness to engage in entomophagy and their accessibility to edible insects. I predicted White and Asian participants would have a significantly higher willingness and accessibility likelihood than Black and Latinx individuals by over 10%, but that there would be no difference between genders in accordance with a previously conducted Italian study (Macini et al 2019). I predicted that the young participants, aged 18-24, would be the most likely to try edible insects while those aged 75 + would be the least likely, with a 40% difference in willingness to engage in entomophagy between the two age groups. To perform this research, I will survey at least 100 participants in the US asking questions about their demographic characteristics, accessibility to bug-based products, and their likelihood of trying edible insects after reading statements on each topic.

METHODS

Data Collection Methods

To gauge the likelihood of a consumer in the US buying edible insect products, I conducted a short survey using Google Forms. In this survey, I first asked if the participant had ever consumed edible insects and to rate their experience on a scale 1 to 5, 1 being very bad and would never try again and 5 being a great experience that they are willing to try again. If they have never eaten edible insects, they will answer their reasoning with the answer choices: "distaste towards the idea", "do not know where to purchase/access edible insects", "would not know how to prepare edible insects", "never considered the idea", and "other" where the participant can write in an answer. Secondly, the participant answered what their current diet is with the options: "vegan/vegetarian", "pescatarian", "do not eat red meat", "restrictive food allergies", "no dietary restrictions", and the write-in option "other". Next, participants were

asked to disclose their age, ethnicity and gender in a write-in answer with the option to select "prefer not to answer". After completing this preliminary information, consumers read a series of 3-7 sentence statements describing five benefits of edible insect consumption that are commonly used in persuasive arguments for entomophagy: sustainability, nutrition, sanitation, taste, and cultural significance. After reading each statement, participants ranked how each statement influenced their likelihood of trying edible insects on a scale of 1 to 5 with 1 being "significantly less", 5 being "significantly more" and 3 being "no change". Lastly participants answered if they currently know where they could purchase edible insects if they so choose, and if they would purposefully seek out an edible insect source.

This survey featured 114 participants of all ages, genders, and races backgrounds from across the US. To obtain surveyees, I posted my survey on Facebook and Snapchat, shared it via email to friends and family members, and conducted a city-wide Easter egg hunt. Along with my survey, I included a description of who I am, the purpose of this study, and an assurance that all answers are confidential and are used for academic purposes only.

Data Analysis Methods

To analyze collected data, I performed a one-way ANOVA test using R for each statement category with the null hypothesis that the average response is "3". If there is a significant difference between the response average for a category and the mu value of 3, then there is evidence that the statement can influence a consumer's willingness to buy edible insects. I then compared the responses of different genders, races/ethnicities, and age groups to determine if any one demographic is more or less inclined to try edible insects. Between these categories, I calculated the percent of participants willing to try edible insects based on their response to the question "Would you be willing to look for a place to purchase edible insects from (in-person or online)?" and performed a one-way ANOVA test again in R to find if there was a significant difference in responses between demographic groups. If the tests showed that there was a significant difference, I ran an ad hoc test to identify which group(s) had a difference in means. I analyzed and compared demographic results to determine if a significant difference in accessibility between groups exists.

RESULTS

Educational Initiatives

Participants that learned about the environmental benefits of eating insects were most likely to have a more favorable view of consuming them afterwards, suggesting that this educational point is the most influential. After reading a statement describing the sustainable benefits of eating edible insects, 50.4% of the 114 participants surveyed said that they were slightly more likely to purchase edible insects and 23% said they were significantly more likely to purchase edible insects (Figure 1). Nutrition was found to be the second most influential, with 51.3% reporting to be slightly more likely to purchase edible insects and 18.6% of participants reporting to be significantly more likely to purchase edible insects (Figure 1). I found that both sustainability and nutrition were statistically significant in persuading participants to purchase edible insects using a one-way ANOVA test in RStudio ($p < 0.05$)(Table 1). The least persuasive educational statement was cultural significance, with 45.6% of participants stating that there was no change in their willingness to purchase insects and 6.2% of participants stating that they were actually less likely to purchase insects (Figure 1). The visual example of entomophagy represented by a Refinery29 educational video was also effective, with 54.4% of participants saying that they were slightly more likely to purchase edible insects after watching the video and 10.5% of participants saying that they were significantly more likely to purchase edible insects (Figure 1). However, the video was not statistically significant in persuading participants to purchase edible insects.

Table 1: One-Way ANOVA Test Comparison Between Statistically Significant Statements. Compares degrees freedom (Df), sum squares (Sum Sq), mean squares (Mean Sq), F Value, and P Value between the two statistically significant statements - nutrition and sustainability - and the remaining educational statements.

Statement					Significance
	Df	Sum Sq	Mean Sq	F value	P value
Nutrition					
Sanitation	1	13.71	13.715	39.75	6.15e-09 ***
Cultural Significance	1	7.35	7.345	21.29	1.07e-05 ***
Taste	1	17.58	17.584	39.187	7.79e-09 ***
Sustainability	1	23.29	23.289	76.814	2.96e-14 ***
Sustainability					
Cultural Significance	1	15.14	15.138	33.99	5.52e-08 ***
Nutrition	1	23.29	23.289	76.814	2.96e-14 ***
Sanitation	1	6.75	6.752	22.270	7.14e-06 ***
Taste	1	1.74	1.745	5.755	0.0182 *

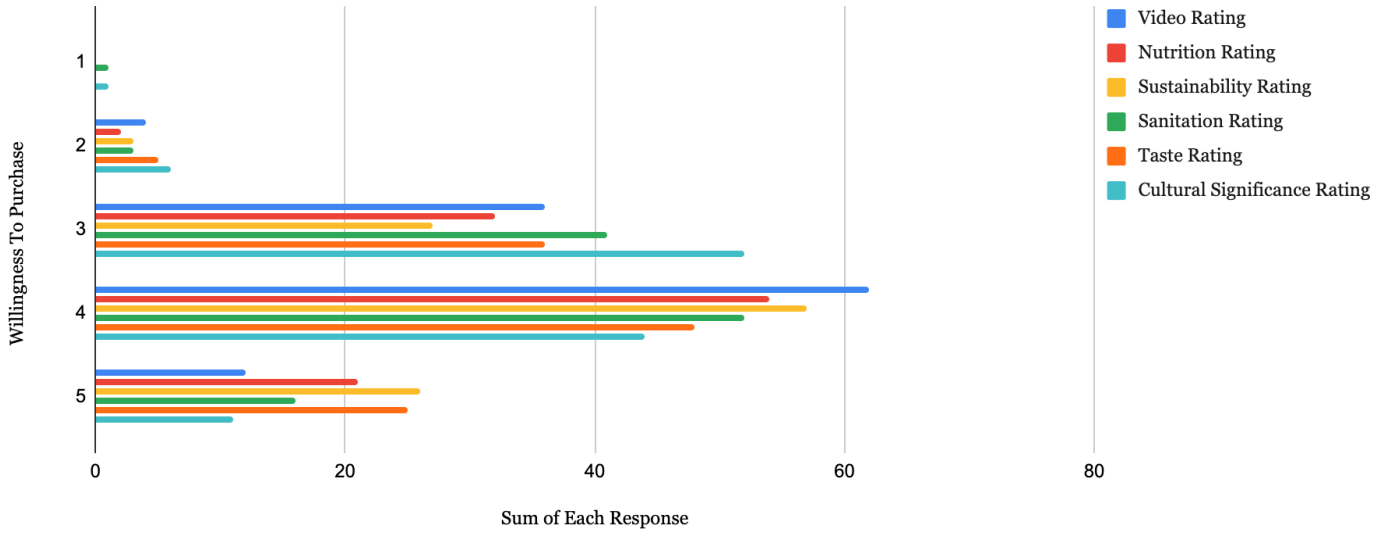

Figure 1: Sum of Participant Responses on How Educational Initiatives Influenced Their Willingness to Purchase Edible Insects on a Scale of 1-5. A response of "1" indicates that a participant was "significantly less likely to purchase edible insects" after reading a statement, a response of "2" indicates that a participant was "slightly less likely to purchase edible insects", a responses of "3" indicates "no change", a response of "4" indicates that a participant was "slightly more likely to purchase edible insects", and a response of "5" indicates that a participant was "significantly more likely to purchase edible insects" after reading a statement. The statements on nutrition and sustainability both significantly increased an individual's likelihood of purchasing edible insects ($p < 0.05$).

Demographic Differences

When analyzing the responses of different genders, races/ethnicities, and ages, Asian individuals, and individuals between the ages of 35-44 were found to be the most likely demographics to engage in entomophagy while Black or mixed race individuals, and individuals over the age of 75 were found to be the least likely based on their responses to the question "Would you be willing to look for a place to purchase edible insects from (in-person or online)?" (Table 2). However, none of these demographic differences were statistically significant. While 7% more males responded "Yes" to this question, 7% more females answered either "Yes" or "Maybe" (Table 2). Asian individuals were 10% more likely to purchase edible insects compared to the average of all racial demographics, although not statistically significant (Table 2).
Participants aged 35-44 were 21% more likely to try edible insects (Table 2). Black and Mixed race participants were 46% less likely to try edible insects compared to the sample population (Table 2). Respondents aged 75+ were 21% less likely to try edible insects compared to the average response (Table 2). It should be noted that some surveyed demographic groups had a much smaller sample size than others. For instance, Black, Latinx, Mixed, aged 25-34, 35-44, 45-54, 55-64, and aged 75 + groups all had sample sizes less than 10, whereas White, Asian and aged 18-24 groups all had sample sizes greater than or equal to 20.

Table 2: Demographic Proportion Response to the Question "Would you be willing to look for a place to purchase edible insects from (in-person or online)?"

Demographic	Responses			Sample Size
	"Yes"	"No"	"Maybe"	
Race				
White or Caucasion	0.46	0.23	0.31	79
Black or African American	0	0	1	4
Latinx or Hispanic	0.4	0.4	0.2	5
Asian	0.56	0.11	0.33	20
Mixed	0	0	1	2
Age				
18-24	0.44	0.19	0.37	76
25-34	0.57	0.29	0.14	9
35-44	0.67	0	0.33	6
45-54	0.43	0.29	0.29	7
55-64	0.4	0.2	0.4	6
65-74	0.5	0.25	0.25	4
75 +	0.25	0.25	0.5	5
Gender				
Male	0.5	0.25	0.25	36
Female	0.43	0.18	0.39	74
Total				
Overall Average	0.46	0.2	0.34	114

Females were most responsive to educational statements on nutrition and sustainability, while males were most responsive to the educational statement on taste and sustainability (Figure 2). Individuals between the ages of 18-34 and 55-64 were most responsive to the environmental benefits of entomophagy, while those between the ages of 35-44 were most influenced by taste. Different age groups were found to have significantly different responses to the statement on nutrition ($p < 0.05$), especially those aged 18-24 and 25-34 ($p < 0.05$). Participants between the ages of 45-54 were most affected by the two-minute Refinery29 video, participants between the ages of 65-74 were most impacted by edible insects' nutritional benefits and participants over the

age of 75 were most affected by statements on sanitation and sustainability (Figure 3). Asian respondents were most likely to try edible insects after reading the statement on sustainability, White/Caucasian respondents were most likely to try edible insects after reading the statement on nutrition, Black/African American respondents were most likely to try edible insects after reading the statements on taste, and Latinx/Hispanic respondents were equally more likely to try edible insects after reading statements on nutrition and taste, and watching the two minute Refinery29 video (Figure 4). There was a significant difference ($p < 0.05$) in the responses to sanitation benefits between individuals from different races and genders, namely between Black and Asian females ($p < 0.05$), Black and White females ($p < 0.05$) and Asian males and Black females ($p < 0.05$). This same significant difference also existed in the responses to the statement on cultural significance between individuals from different races and genders with a p-value of 0.00607.

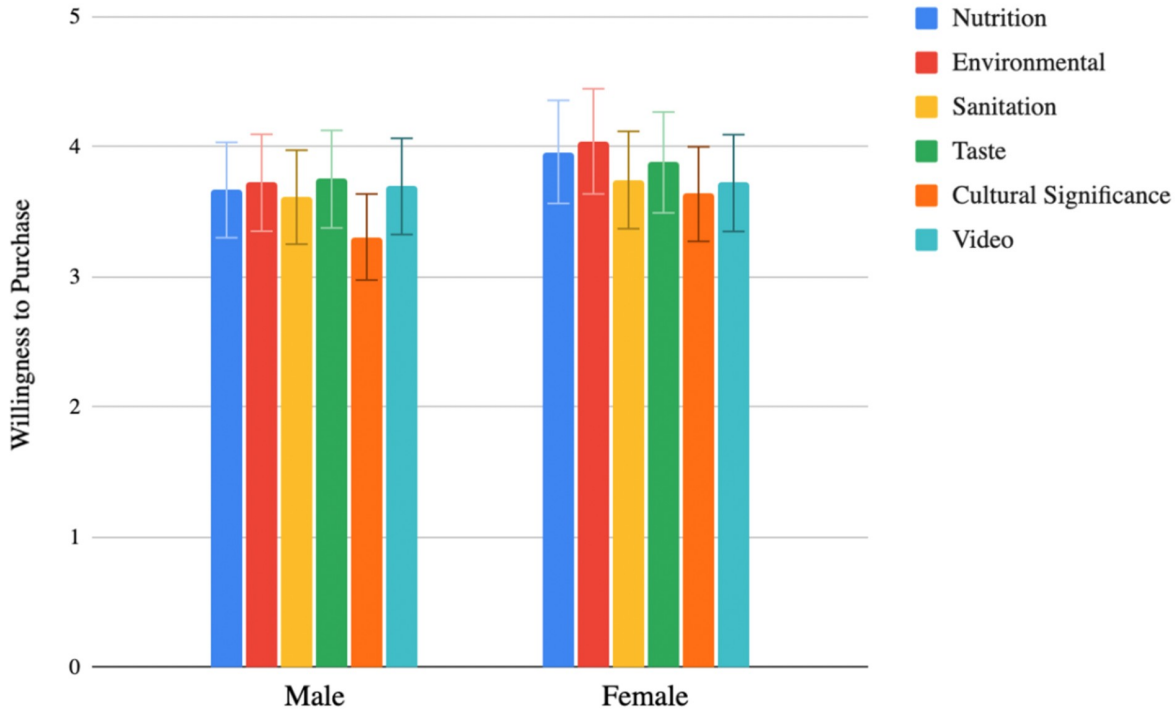

Figure 2: Average Gender Response On How Educational Initiatives Influenced Their Willingness to Purchase Edible Insects on A Scale of 1-5. Males were most receptive to educational statements on taste with a 3.75 average response. Females were most influenced by nutrition and sustainability, with 3.96 and 4.04 response averages to these statements respectively. However, none of these initiatives significantly influenced the willingness response of males and females.

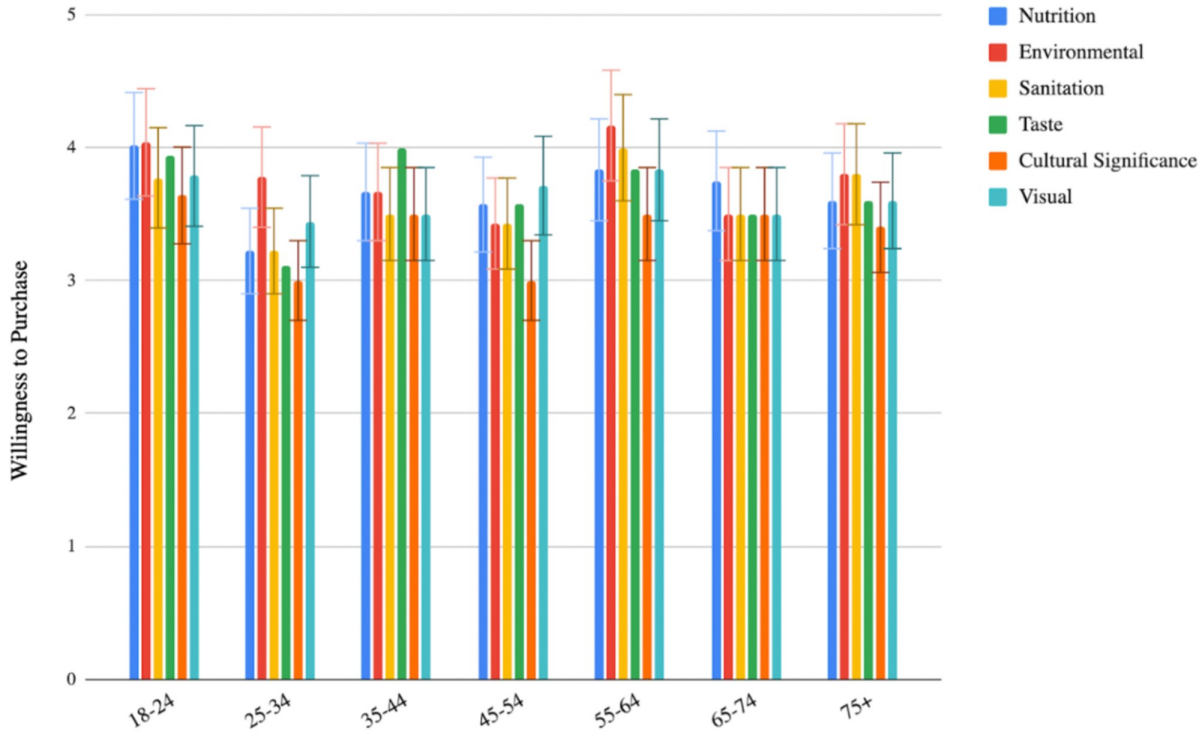

Figure 3: Average Age Response On How Educational Initiatives Influenced Their Willingness to Purchase Edible Insects on A Scale of 1-5. Participants aged 18-24 were most receptive to the statement on sustainability (4.04), aged 25-34 also to sustainability (3.78), 35-44 to nutrition and sustainability (3.67), 45-54 to the Refinery29 video (3.71), 55-64 to sustainability (4.17), 65-74 to nutrition (3.75), and 75 + to sustainability and nutrition (3.8). The statement on nutrition was significantly affected by age ($p < 0.05$) with 18-24 vs. 25-34 having the largest response difference ($p < 0.05$).

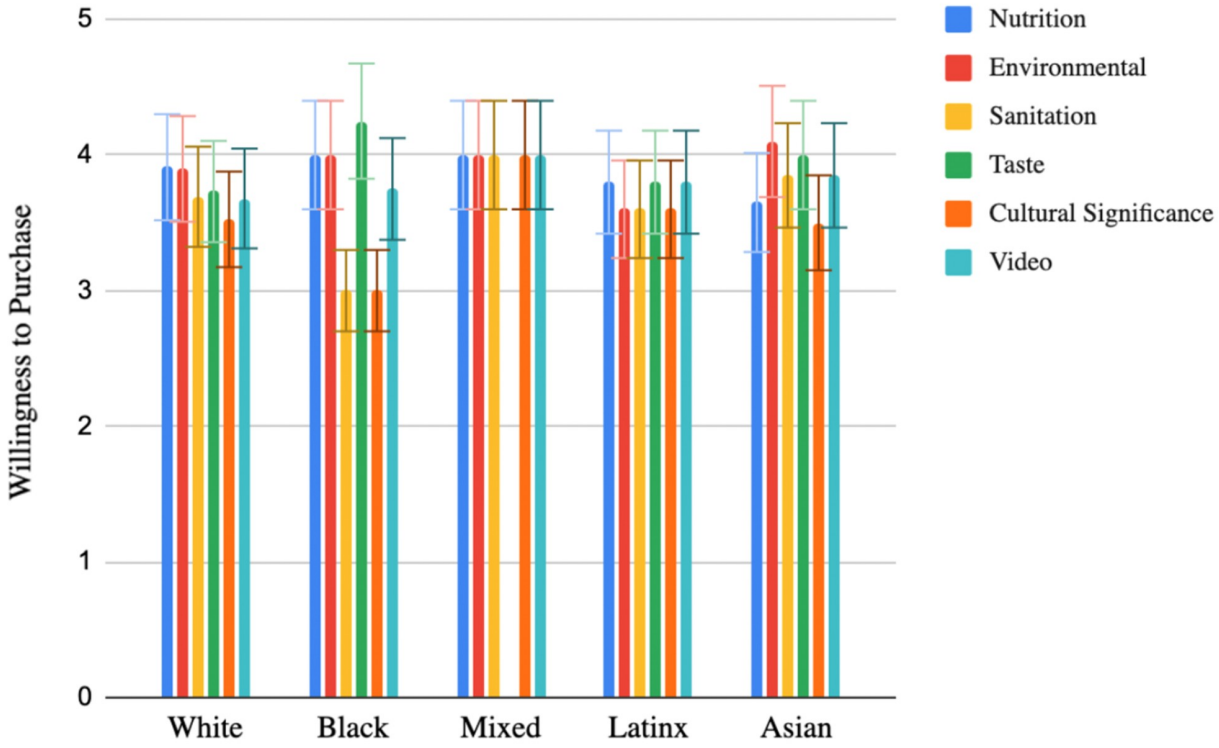

Figure 4: Average Race Response On How Educational Initiatives Influenced Their Willingness to Purchase Edible Insects on A Scale of 1-5. White surveyees were most affected by statements on nutrition (3.91), Black by taste (4.25), Mixed race by nutrition, sustainability, sanitation, cultural significance and the Refinery29 video equally (4), Latinx by nutrition, taste and the video equally (3.8) and Asian by sustainability (4.1). However, none of these initiatives significantly influenced the willingness response of any racial group.

Accessibility

Accessibility to edible insects is poor, as 11.4% percent of participants knew where they could buy edible insect products from if they so desired based on their response to the question "Do you currently know where you could purchase edible insects if you so choose (in-person or online)?" (Figure 5), yet 80.4% percent said they were willing to seek them out after completing the survey (Figure 5). Again, no statistically significant differences in accessibility on the basis of demographic were found. Out of these respondents, Black/African American and Asian participants were 14% and 9% respectively more likely to know where to purchase edible insects (Table 3). Male and female participants were roughly equally likely to know where to purchase insects, and participants aged 25-34 and 55-64 were both 22% more likely to know where to purchase insects compared to the average response (Table 3).

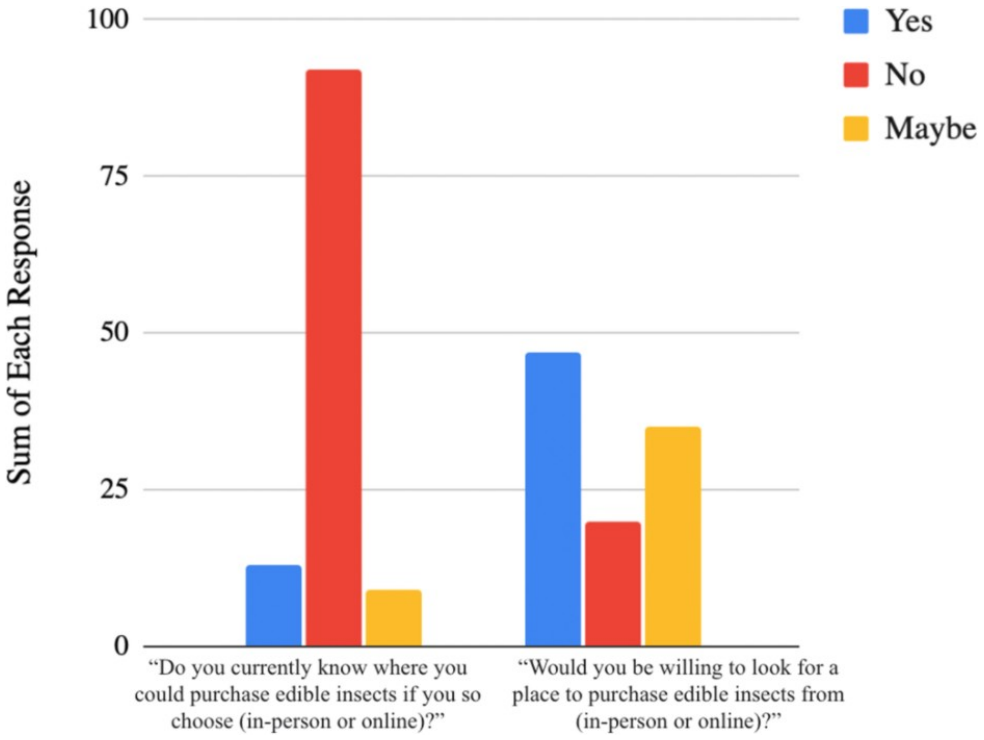

Figure 5: Accessibility to Edible Insects vs. Willingness to Seek Out Edible Insects. Sum of individual responses to the questions "Do you know where you could purchase edible insects if you so choose (in-person or online)?" to gauge accessibility to edible insects and "Would you be willing to look for a place to purchase edible insects from (in-person or online)?" to gauge consumer willingness to see out edible insects.

Table 3: Demographic Proportion Response to the Question "Do you currently know where you could purchase edible insects if you so choose (in-person or online)?"

Demographic	Responses			Sample Size
	"Yes"	"No"	"Maybe"	
Race				
White or Caucasion	0.09	0.82	0.09	79
Black or African American	0.25	0.75	0	4
Latinx or Hispanic	0	1	0	5
Asian	0.2	0.7	0.1	20
Mixed	0	1	0	2
Age				
18-24	0.09	0.82	0.09	76
25-34	0.33	0.67	0	9
35-44	0.17	0.83	0	6
45-54	0	1	0	7
55-64	0.3	0.67	0	6
65-74	0	0.75	0.25	4
75 +	0	0.8	0.2	5
Gender				
Male	0.11	0.83	0.06	36
Female	0.12	0.79	0.09	74
Total				
Overall Average	0.11	0.81	0.07	114

DISCUSSION

This study determined that environmental educational initiatives are most effective in persuading US consumers to try edible insects. Asian individuals, and participants between the ages of 35-44 were most likely to engage in entomophagy as well as have access to edible insects. Black and Asian individuals were most likely to have access to edible insects as well as people between the ages of 25-34. Both males and females were roughly equally likely to try edible insects and know where to purchase them. While this study fills in gaps regarding demographic response to entomophagy, its findings suggest that future studies should be conducted to get an accurate representation of different racial, gender and age groups as well as expand insects' market presence.

Willingness to Engage in Entomophagy

Although Asian individuals, surveyees between the ages of 35-44, groups with high accessibility and participants that read the statement on sustainability were most likely to engage in entomophagy, there is high variation in the responses within each of these groups. There were more statistically significant differences found within demographic groups rather than between them. This shows that willingness to purchase edible insects is impacted most by specific combinations of demographic characteristics rather than just one. For example, there was a significant difference in how Asian males and Black females responded to the statement on sanitation, but not between just Asian and Black individuals or male and female individuals.
Accessibility positively correlates to one's willingness to try edible insects with consumers aged 25-34 and Asian individuals having one of the highest accessibility rates as well as interest in purchasing edible insects. However, this correlation is not also the case since Black participants had the highest rate of accessibility but also the lowest willingness to try edible insects. Similar to the demographic data, there is high variation in an individual's willingness to purchase edible insects within each accessibility response group. Thus, when analyzing one's willingness to partake in entomophagy, all characteristics (age, gender, race, accessibility) should be assessed holistically to maximize the efficacy of educational initiatives rather than just one.

Demographic Differences

This study found Asian individuals, and participants between the ages of 35-44 were most likely to engage in entomophagy while Black and mixed race individuals, and participants over the age of 75+ were the least. This supports my hypothesis and existing research which suggests that there is no difference in the likelihood of purchasing edible insects between genders, as found in a 2019 edible insect acceptance study (Mancini et al 2019). I did not hypothesize which races would be the most or least likely to engage in entomophagy since there was little pre-existing literature on this topic. However, the differences in responses from each racial group reflects that underlying reasons for this variance in willingness to try edible insects may exist. Again, some racial demographics had less representation than others, meaning that this study may not offer a fully accurate depiction of how likely each race is to engage in entomophagy. Future studies should include a larger sample size with more representation from each race and analyze why these differences in responses exist between racial groups. I did predict that the youngest demographic surveyed, participants aged 18-24, would be the most likely to purchase edible insects and the oldest demographic surveyed, participants aged 75+, would be the least likely to purchase edible insects. While the latter statement was true, the most likely age demographic to purchase edible insects was actually 35-44. Identifying which demographics are most and least likely to engage in entomophagy is important to recognize in marketing edible insects to ensure that vendors are targeting the most receptive consumers possible. The most represented demographic groups- Asian and White individuals as well as participants aged 18-24, also were more likely than the response average to engage in entomophagy. Response data from demographics with a smaller sample size may not represent that group's opinions as accurately as a demographic with a larger sample size, and thus, are more likely to be skewed towards one extreme.This survey mainly was taken by college-aged individuals, specifically from UC Berkeley which is predominately White and Asian. from In the future, studies should aim to have an equitable distribution of participants from each demographic group to ensure that demographic data is as accurate and representative of groups as possible.

Accessibility

The large discrepancy between those who know where to purchase edible insects compared to the amount of consumers that are willing to seek them out reveals that accessibility is a major barrier to market entry for edible insects. Over 80% of people said they did not know where they could find edible insects despite almost 70% of individuals willing to or maybe willing to purchase them. Black and Asian participants had the highest rate of accessibility to edible insects despite Black individuals being one of the least likely groups to purchase bug-based products. Participants aged 25-34 had the highest accessibility rate of any age group likely due to prior interests in entomophagy or more knowledge about where to purchase non-mainstream food products (Alemu et al 2016). Despite these discrepancies, there was no statistically significant difference in accessibility within or between demographic groups. Nevertheless, vendors should be aware of which groups have less access to edible insects so that they can expand their product offerings to these demographics, specifically Latinx individuals and those over the age of 45.

Educational Initiatives

Sustainability was found to be the most influential benefit in convincing participants to consume edible insects. This conflicts with existing literature that inspired my initial hypothesis which argues that cultural significance and sanitation are the most persuasive benefits of edible insects (Aguanta 2018). However, since the aforementioned research was conducted at an edible insect festival, consumers had the opportunity to see, smell and taste insects on top of learning about their benefits. It was also conducted in a location where entomophagy is more common than in the US. This immersion could have increased the influence benefits like sanitation and cultural significance have on an individual's willingness to try edible insects. Since this study only utilized small, informational paragraphs to gauge the influence of each educational initiative rather than sensory exposure, future research should study consumer responses in a more immersive and interactive environment to see if consumer responses vary (Aguanta 2018). Since consumers were shown to take environmental impact into account in their purchasing decisions, edible insect companies and vendors should market sustainability benefits most heavily.

Researchers should also study edible insects environmental footprint more deeply to expand the list of their eco-friendly benefits.

Limitations & Future Directions

This study used Google Forms to gather data on the efficacy of different educational initiatives in persuading participants to purchase edible insects. However, since education on entomophagy was only one short video and five short, informational paragraphs, this could have limited the influence on a participant's willingness to try edible insects. Further studies should immerse participants more into other sensory aspects of edible insects such as their smell, taste and feel (Aguanta 2018). Further studies should extensively and exclusively analyze the influence of demographic on an individual's willingness to purchase edible insects. These studies should include adequate and equitable sample sizes of each surveyed racial, age or gender to ensure that collected data accurately represents each group. Lastly, since there is such a large gap in those between those who have access to edible insects and those who are willing to purchase them, future research should investigate how to expand the bug-based market to these unaccounted for individuals. The more studies that measure the efficacy of these educational initiatives, and identify demographic differences in willingness and accessibility, the more precisely vendors can target demographics and expand to areas with less market coverage.

Broader Implications

Using this information regarding the demographics most and least likely to engage in entomophagy, the accessibility gap for bug-based products and the efficacy of different educational initiatives on a diverse group of participants, government agencies and companies can implement more precise marketing measures to integrate edible insects into mainstream US markets. As American food systems are shifting to prioritize sustainability and food security amidst climate change, edible insects are an increasingly promising alternative. Therefore, it is essential to translate educational, demographic, and accessibility data into tangible initiatives that broaden the market span of edible insects and effectively persuade more consumers to engage in entomophagy.

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REFERENCES

Aguanta, L. M. 2018. Is Insect Eating Festival a Viable Strategy in Promoting Entomophagy? An Investigation in Marawi City, Philippines. International Journal of Humanities and Social Sciences. 10:72-78.

Alemu, M., Olsen, S. B., Vedel, S.E., Kennedy, P., V. Owino. 2016. Combining product attributes with recommendation and shopping location attributes to assess consumer preferences for insect-based food products. Food Quality and Preference. 55:45-57.

Hartmann, C., M. Siegrist. 2016. Insects as food: perception and acceptance. Science & Research. 1:1-7.

Mancini, S., Sogari, G., Menozzi, D., Nuvoloni, R., Torracca, B., Moruzzo, R., G, Paci. 2019. Factors Predicting the Intention of Eating an Insect-Based Product. Foods. 8:7-270.

McCarthy, N. 2020. The Countries That Eat The Most Meat. Statistica. 1:1-1.

Megido, R. C., Gierts, C., Blecker, C., Brostaux, Y., Haubruge, E., Alabi, T., and F. Francis. 2016. Consumer acceptance of insect-based alternative meat products in Westerncountries. Food Quality and Preference. 52:237-243.

Melgar-Lalanne, G., Hernandez-Alvarez, A.J., A, Salinas-Castro. 2019. Edible Insects Processing: Traditional and Innovative Technologies. Comprehensive Reviews in Food Science and Food Safety. 18:1166-1191.

Rotz, A., Asem-Hiablie, S., Place, S., G. Thoma. 2019. Environmental footprints of beef cattle production in the United States. Agricultural Systems. 169:1-13.

USDA APHIS. 2010. Overview of U.S. Livestock, Poultry, and Aquaculture Production in 2010 and Statistics on Major Commodities. USDA. 1:1-37

Van Huis, A., Van Itterbeeck, J., Klunder, H., Mertens, E., Halloran, A., Muir, G., and P. Vantomme. 2013. Edible insects: future prospects for food and feed security. FAO Forestry Paper. 1:1-201.