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Student Research Report

Examining the Influence of Educational Posters on People's Food Choice

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Course: PSYC 421

Instructor: Dr. Jiaying Zhao

Themes: Climate-Friendly Food System (CFFS) Label Evaluation

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Executive summary

Our current study aimed at examining how educational posters combining traffic light labels and CO_2 emission data influence people's sustainable food choice. We hypothesized that the poster combining traffic light labels and CO_2 emission data will increase willingness to choose sustainable food, and other conditions will increase people's willingness to a lesser degree. Due to the impact of COVID-19, we published an online survey to collect data. Our participants were randomly assigned into the four conditions in the survey. They were first shown posters with different elements (meaning different conditions), and answered the same set of questions, asking about willingness to choose pepperoni pizza, English muffin, and plant-based salad. Also, they were asked about future willingness to choose more sustainable food. After collecting data, we used one-way between groups ANOVA tests to analyze them. Unfortunately, we only found statistical significance in increased willingness to choose plant-based food in two conditions, and trivial statistical significance in increased willingness for future sustainable food choice. Therefore, the result did not generally support our hypothesis.

Key words: CO_2 emission, traffic light labels, plant-based food, sustainable food choice

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Examining the Influence of Educational Posters on People's Food Choice

Introduction

The production of food produces significant greenhouse gas (GHG) emissions. Evidence has shown that the food system accounted for one-third of total global anthropogenic emissions in 2018 but reducing the intake of animal products in the daily diet could effectively reduce the food-related carbon footprint (Tubiello, 2021). Studies have shown that meat uses more energy to produce than plant-based foods and has higher greenhouse gas (GHG) emissions, with the average high GHG emissions of 2,000 calories produced by meat foods being 2.5 times that of the average vegan diet (Scarborough, 2014). Obviously, meat per unit of weight on the table produces more greenhouse gas emissions than plant-based foods. Therefore, increasing plant-based eating is an effective strategy to mitigate climate change. However, the diet structure of many countries around the world is based on meat, and it is difficult for the public to make changes. Therefore, we can increase people's willingness to choose plant-based food.

Label is an effective psychological suggestion method for communication between producer and consumer. Among them, traffic-light labels can significantly improve consumers' eating habits and make them more willing to buy healthy food (Osman, 2019). In fact, consumers generally lack knowledge of food nutrition, and the "traffic light" label can give consumers the most intuitive hint, setting up positive and negative standards in their minds, thus affecting their consumption habits. Researchers found that the percentage of red light labeled foods sold dropped from 24 percent to 20 percent in the 24 months after the start of the study, while the percentage of green light labeled foods increased from 41 percent to 46 percent (Osman, 2019). Another research showed that accurate numbers on labels could help consumers compare differences between environmental influences of products, because labels mainly measure the total amount of carbon dioxide (GHG) emitted during food production and inform consumers of the carbon information in the form of labels (Vlaeminck, 2014). In this way, people can clearly know the environmental impact of the food they buy. Carbon labels can increase consumers' willingness to choose sustainable food by guiding consumers' consumption psychology to buy

low-carbon and environmentally friendly food. Both of these two kinds of information on labels can effectively influence consumers' food choices.

While past studies have shown that "traffic light" labels and digital information labels can influence behavioral changes, no study has investigated the interaction between the two to increase willingness to make plant-based food choices. However, studies have proved that two methods are always better than one in solving problems, because it will maximize the success of the combination (Kanai, 2010). The above psychological perspectives and lack of research prompted us to investigate whether combining "traffic light" labels and carbon emission data can influence food choices more effectively, leading us to propose a research question. Thus, our research question is “how do educational posters combining traffic light labels and CO_2 emission data influence people’s willingness to choose sustainable (plant-based) foods?” So, we hypothesized that the educational poster combining traffic light labels and CO_2 emission data will increase willingness of choosing sustainable (plant-based) foods as compared with a poster with traffic light and a poster with only emission data. However, people's eating habits are difficult to change immediately. Thus, participants in the experiment chose foods they liked or were used to, even though they knew that meat had a higher carbon footprint than plant-based foods. And many plant-based foods are more expensive, so eating habits and prices may lead to bias in our results.

Methods

Participants

In a power analysis (assuming a minimum effect size = 0.2, alpha = 0.05, power = 0.8), we aimed to recruit a minimum of 280 participants consisting of UBC students from various faculties in our study (see Appendix I Figure1). The UBC Qualtrics survey was distributed through social media including Facebook and Instagram. Participants would have a chance of winning a $50 UBC bookstore gift card. A total of 295 participants were recruited, with a mean age of $M = 22$ ($SD = 2.89$), which is 53.4% Females, 39.36% Males, 2.81% Non-binaries, 3.61%Transgender, 0.40% Two-spirited, and 0.40% Other (see Appendix I Figure2). 75.58% of our participants were identified as Asian, 11.63% were White, 11.63% were Black, 3.10% were Latin, Central or South American, 2.33% were Indigenous peoples of North America, 2.33% were Arab, 1.55% were identified as Other (see Appendix I Figure3).

Conditions

Our independent variable is the type of information provided by the poster: pictorial information (traffic light symbol), numeric information (CO_2 emission number), and combined information containing images and numeric information (traffic light symbol and CO_2 emission number). There are four conditions in our study. Each condition contains a poster with a slogan “Plant-based, Planet Hurrays’’ and icons of 3 food choices: pepperoni pizza, English muffin, and plant-based salad. The three food choices have three different levels of CO_2 emission calculated by Food Carbon Footprint Calculator from My Emissions website (https://myemissions.green/food-carbon-footprint-calculator), among which the plant-based choice has the lowest emission amount, thus being the most sustainable option. For the control conditions (65 responses), The poster contains three food icons and the food name (see Appendix II Figure 1). For the CO_2 Emission only condition (63 responses), the poster contains three food icons, the food name and the CO_2 Emission numbers (see Appendix II Figure 2), in which the pepperoni pizza has the highest emission number, and the plant-based salad has the lowest

emission number. For the traffic light condition (59 responses), the poster contains food icons inside the traffic light symbol (see Appendix II Figure 3), which for the color of the light corresponding to each food, pepperoni pizza is in the red light, English muffin is in the yellow light, and the plant-based salad is in the green light. The last condition (60 responses) contains the poster with a combination of traffic light symbols and CO_2 emission numbers (see Appendix II Figure 4).

Measures

Our measurement questions were presented after the presence of educational posters, and they consisted of four survey questions and demographic questions (see Appendix III). The first three questions measured dependent variables, which measured participants' willingness to choose pepperoni pizza, English muffin, and plant-based salad respectively. The last survey question measured participants' future willingness to choose more sustainable food. The four survey questions were in Likert scale from one to ten: one being unwilling at all, and ten being extremely willing to, and participants rated their level of willingness by clicking at the slider in the survey (see Appendix IV). The survey questions aimed at examining whether or not the educational posters brought influence on participants' current and future food choices. We used multiple choice questions for demographic information (year level, age, gender, ethnicity, and stress level for climate change).

Procedure

Since our study was carried out online, we spread it out in the following ways: printing out posters with QR code to access the survey, asking residential advisors to send emails to residents, and putting the survey link on social media. Our data collection lasted for a month and received 237 responses in total. We chose these methods because they were easily accessible to UBC students, who are our target population. The study started by presenting a consent form to participants, and then participants were randomly assigned into four conditions by Qualtrics (see Appendix III). There are four different educational posters put into respective conditions. Participants were then asked about their willingness to choose pepperoni pizza, English muffin, plant-based salad, and future willingness to choose more sustainable food. The last part of the survey collected demographic information. Finally, we thanked participants for their time and the survey ended. After exporting our raw data, we ran one-way between groups ANOVA tests to see if our results were statistically significant, and whether our hypothesis was supported.

Results

A one-way between group ANOVA revealed a significant main effect of people's willingness to choose plant-based salad on the posters with different compositions of information, $F(3, 237) = 3.14$, $p = .026$, $\eta^2 = .04$ (see Appendix V Table 1). Post hoc comparisons using Tukey's *HSD* test indicated that people's willingness to choose plant-based salad in the CO_2 emission only condition ($M = 6.571$, $SD = 2.212$) were significantly higher than people's willingness to choose plant-based salad in the control condition ($M = 5.410$, $SD = 2.604$) ($p = .048$). People's willingness to choose plant-based salad in the combined condition ($M = 6.583$, $SD = 2.638$) were significantly higher than people's willingness to choose plant-based salad in the control condition ($M = 5.410$, $SD = 2.604$) ($p = .049$) (see Appendix V Table 2). Which indicates that our two educations (the poster with CO_2 emission number condition and the poster with combined condition) have the same effect in increasing people's willingness to

choose salad as compared to control posters. And it was not our hypothesis that using educational poster combining traffic light labels and CO_2 emission data will increase willingness to choose plant-based salad as compared with a poster with traffic light and a poster with only emission data.

A one-way between groups ANOVA revealed a no significant main effect of people's willingness to choose pizza on the posters with different compositions of information, $F(3, 237) = 2.09$, $p = .103$, $\eta^2 = .03$ (see Appendix V Table 3). Which indicates that our educational posters do not change people's willingness to choose pizza. Therefore, our results do not support our hypothesis as we reason that the educational poster combining traffic light labels and CO_2 emission data will decrease willingness to choose pizza as compared with a poster with traffic light and a poster with only emission data.

A one-way between groups ANOVA revealed a no significant main effect of people's willingness to choose muffin on the posters with different compositions of information, $F(3,237) = 0.294$, $p = .830$, $\eta^2 < .01$ (see Appendix Table V 4). Which indicates that our educational posters do not decrease people's willingness to choose muffins. Therefore, our results do not support our hypothesis that using educational poster combining traffic light labels and CO_2 emission data will decrease willingness to choose muffins as compared with a poster with traffic light and a poster with only emission data.

A one-way between groups ANOVA revealed a significant marginal main effect of people's willingness to choose future sustainable food on the posters with different composition of information, $F(3, 237) = 2.21$, $p = .087$, $\eta^2 = .03$ (see Appendix V Table 5). Post hoc comparisons using Tukey's *HSD* test indicated did not reveal any marginal or significant effect in any conditions (see Appendix Table V 6). Which indicates that our educational posters do not increase people's willingness to choose future sustainable food. Even though we have a marginal effect of the willing will influence on choosing sustainable food, the Post hoc comparisons does not prove which poster is better than which one. So, we cannot say it matches our hypothesis. Therefore, our results do not support our hypothesis that using educational poster combining traffic light labels and CO_2 emission data will increase willingness to choose future sustainable food as compared with a poster with traffic light and a poster with only emission data.

Discussion

The result of our study failed to support the hypothesis. An educational poster with CO_2 emission numbers, traffic light design, and a combination of traffic light symbols and CO_2 emission numbers all failed to impact people's willingness to choose pepperoni pizza and English muffins. This may be due to the greater recognition of meat and non-vegetarian foods by most people. Because students who do not eat meat, especially vegetarians, can disrupt social conventions of family and friends (Markowski & Roxburgh 2019). Babakhani, Lee and Dolnicar (2020)'s research on the level of consumer concern about carbon labels suggests that carbon labels and labels that communicate environmental benefits may receive little attention. This suggests that CO_2 emission labels are not visible enough to lead people to choose low-emission foods. However, a poster with combination information of traffic light symbols and numeric comparison of CO_2 emission could also significantly increase people's willingness to choose salad. In addition, our result shows that only providing CO_2 emission numbers could significantly increase people's willingness to choose plant-based salads. Which proves that CO_2 emission labels itself is as effective as combined labels. And a poster of only traffic light design without numeric information has no impact on participants' willingness to choose salad.

One limitation of our research is that there are limited food options in the survey. There are only three food choices that pepperoni pizza as a symbolic meat food, English muffin as the representative vegetarian food and plant-based salad as a vegan food. Participants' choices may have been based on preferences for specific foods rather than on considerations of the environmental friendliness of the food. Also, with the difference in numbers between these three food choices in terms of CO_2 emission numbers might not be significant enough to change participants' decisions. An additional significant limitation is that some data were missing. Some participants did not provide answers to all questions in the survey so that some responses were not considered. Moreover, our participants were relatively lacking in diversity. With 75.58% of participants being Asian, the participants may not be representative of the general UBC student population. It is unclear whether the ethnicity diversity of the sample is beneficial to the accuracy of the experimental results. Therefore, it may be possible in the future to increase the ethnic diversity of the sample. And directing people to more prominent CO_2 emission labels may increase participants' consideration of the environmental friendliness of food.

Recommendations

Indicated by the UBC Sustainability Students website, we recognized that it was one of "SEEDS Big 5 Research Priorities" to research and promote food system sustainability. To help our campus move forward a little bit in promoting sustainable food choice, we studied the impact of educational posters on people's willingness to consume plant-based food. While the hypothesis in our study was not totally supported, we still gained statistical significance in increased willingness to choose plant-based salad; specifically in the condition with CO_2 emission data next to each food, and the condition combined CO_2 emission data with traffic light labels (see appendix for posters). Therefore, we learned that maybe adding specific CO_2 emission numbers to educational posters alone could demonstrate how eco-friendly a bowl of plant-based salad was, and thus boosted people's willingness to consume. We recommend UBC clients try this design in future educational poster design, and thus boost the consumption of plant-based food. Also, we believe CO_2 is a common concept that most people are familiar with, so using this element alone, rather than combining other GHG like nitrous oxide, would be more easily understood by people. Surprisingly, the question measuring participants' future willingness to choose more sustainable food did not yield any statistical significance. Originally, we expected most participants would have increased willingness in this response. We suspected that perhaps the combination of too many elements (CO_2 emission data, traffic light design, food names, slogan, and food icon) made participants less patient in looking and thinking about the questions, and thus led to an insignificant result. Therefore, we recommend UBC clients limit the number of elements in one poster. In other words, the educational poster will be more effective when participants comprehend it with less effort.

Additionally, we would recommend using a more diverse sampling population if this study were to be replicated or improved upon. Our current sampling population consisted of 75.6% Asian students, so it is reasonable to suspect that their habitual diet style, or other factors like religion affected the results. For our final suggestion, we think it is more effective to use food icons that UBC serves. In this way, students can be alerted when choosing their meal, because they can associate the food categories in the poster with what they see in the cafeteria, and the educational information may be applied when purchasing food.

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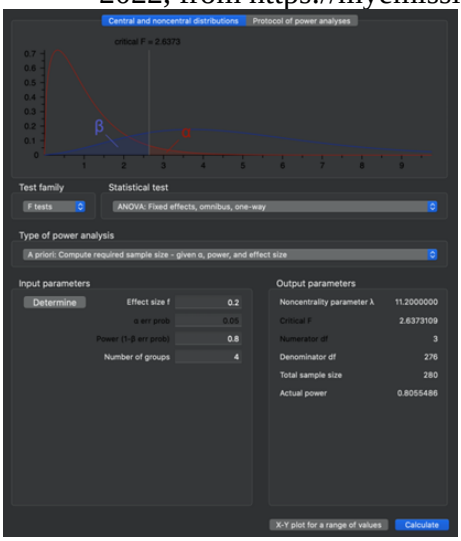

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Appendix I

Participants

Figure 1: School Year.

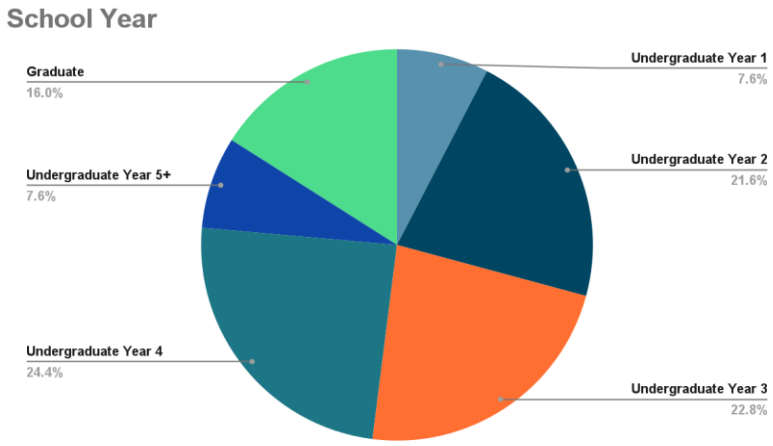


Figure 2: Gender Distribution.

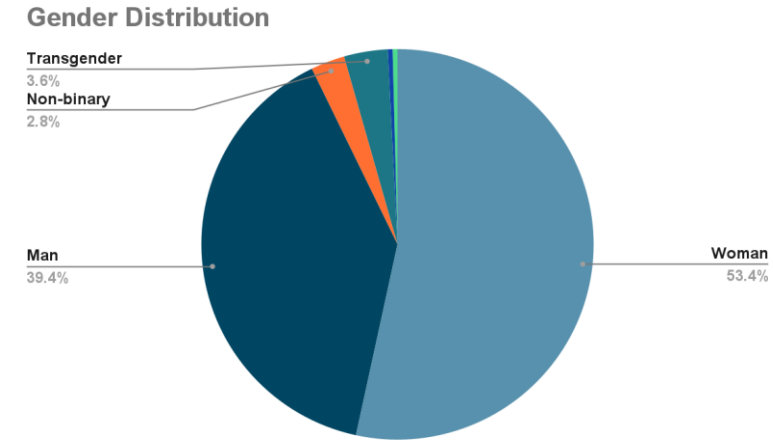
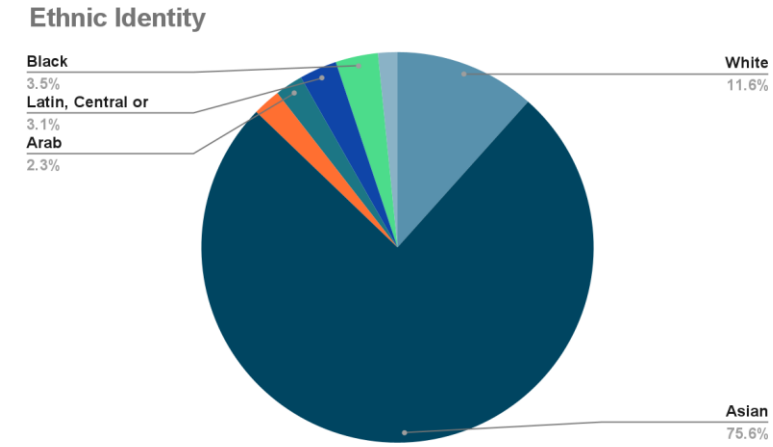


Figure 3: Ethnic Identity.



Appendix II

Conditions

Figure 1: Control Condition.

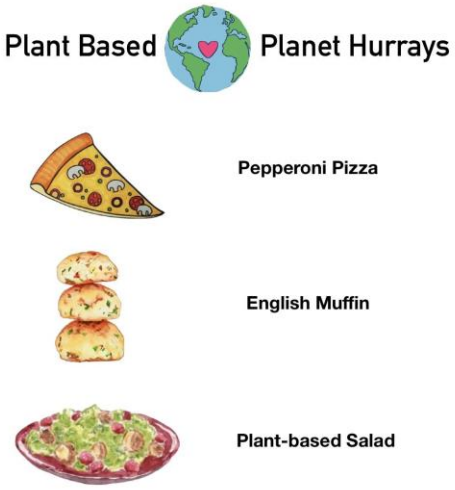


Figure 2: CO_2 Emission Only Condition.

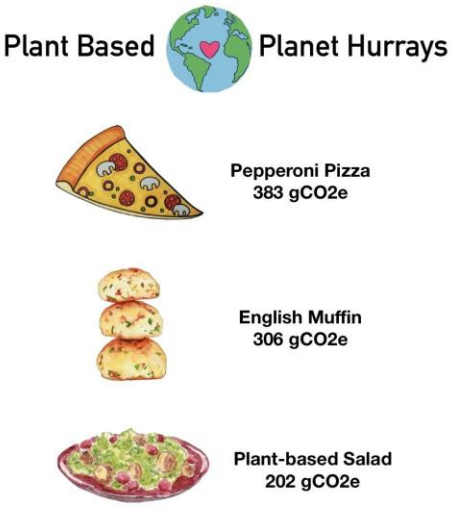
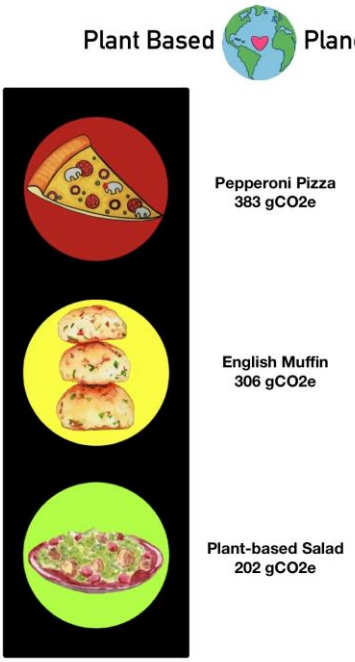


Figure 3: Traffic Lights Only Condition.

Figure 4: Traffic Lights and CO2 Emission Comparison Condition.

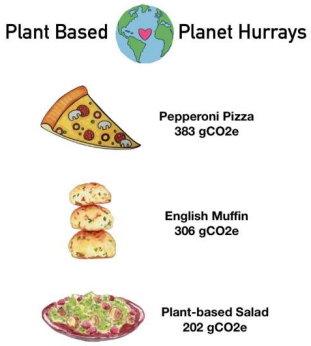


Appendix III

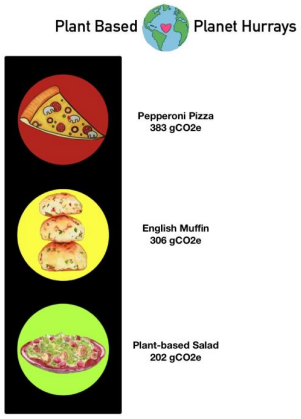
Survey on UBC Qualtrics

Please see our poster and answer our questions afterwards

Control Condition



Control Condition *CO_2 Emission Only Condition*



Traffic Lights Only Condition *Traffic Lights and CO2 Emission Comparison Condition*

Demographic questions present below conditions:

1. On a scale of 1 to 10, 10 being extremely willing to, 1 being unwilling at all. I am willing to choose pepperoni pizza.

2. On a scale of 1 to 10, 10 being extremely willing to, 1 being unwilling at all. I am willing to choose English Muffin.

3. On a scale of 1 to 10, 10 being extremely willing to, 1 being unwilling at all. I am willing to choose plant-based salad.

4. On a scale of 1 to 10, 10 being extremely willing to, 1 being unwilling at all. I am willing to choose more plant-based food in the future.

5. Which year are you in?
Undergraduate Year 1
Undergraduate Year 2
Undergraduate Year 3

Undergraduate Year 4
Undergraduate Year 5+
Graduate

6. What is your age (in years)?

7. What do you identify with?
Women
Men
Non-binary
Transgender
Two spirited
Other

8. With which of the following do you identify? (Select all that apply)
White
Asian
Indigenous peoples of North America
Arab
Latin, Central or South American
Black
Other

9. Generally speaking, how stressed are you regarding climate change?
No stress at all
A negligible amount of stress
A small amount of stress
A noticeable but tolerable amount of stress
A just manageable amount of stress
A slightly stressful amount of stress
A noticeable amount of stress
A considerable amount of stress
An overwhelming amount of stress

Appendix IV

Measurement

Figure 1: Likert scale for willingness to choose pizza/muffin/salad.

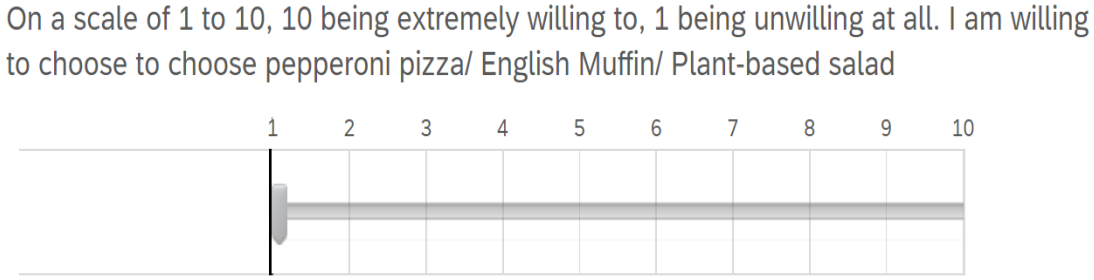
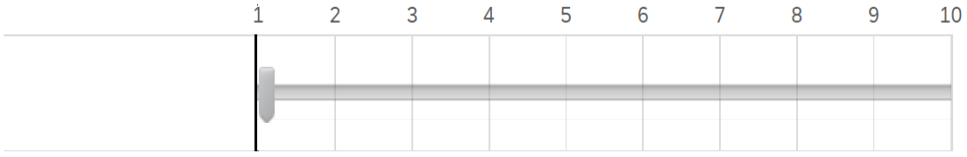


Figure 2: Likert scale for willingness to choose future sustainable food.

On a scale of 1 to 10, 10 being extremely willing to, 1 being unwilling at all. I am willing to choose more plant-based food in the future.



Appendix V

Table

Table 1. Descriptive and ANOVA for salad willingness.

Descriptives - Salad willingness

Condition	Mean	SD	N
CO2	6.571	2.212	63
Combine	6.583	2.638	60
Control	5.410	2.604	61
Traffic Lights	6.439	2.486	57

ANOVA - Salad willingness ▼

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Condition	58.261	3	19.420	3.138	0.026	0.038
Residuals	1466.801	237	6.189			

Note. Type III Sum of Squares

Table 2. Post Hoc comparison for salad willingness.

Post Hoc Comparisons - Condition

		Mean Difference	SE	t	p_{tukey}
CO2	Combine	−0.012	0.449	−0.027	1.000
	Control	1.162	0.447	2.599	0.048
	Traffic Lights	0.133	0.455	0.292	0.991
Combine	Control	1.173	0.452	2.594	0.049
	Traffic Lights	0.145	0.460	0.315	0.989
Control	Traffic Lights	−1.029	0.458	−2.245	0.114

Note. P-value adjusted for comparing a family of 4

Table 3. Descriptive and ANOVA for pizza willingness.

Descriptives - Pizza willingness

Condition	Mean	SD	N
CO2	5.905	2.092	63
Combine	5.583	2.782	60
Control	6.656	2.330	61
Traffic Lights	6.175	2.550	57

ANOVA - Pizza willingness

Cases	Sum of Squares	df	Mean Square	F	p	η²
Condition	37.474	3	12.491	2.088	0.103	0.026
Residuals	1418.028	237	5.983			

Note. Type III Sum of Squares

Table 4. Descriptive and ANOVA for muffin willingness.

Descriptives - Muffin willingness

Condition	Mean	SD	N
CO2	5.492	2.015	63
Combine	5.550	2.205	60
Control	5.738	1.879	61
Traffic Lights	5.386	2.289	57

ANOVA - Muffin willingness

Cases	Sum of Squares	df	Mean Square	F	p	η²
Condition	3.884	3	1.295	0.294	0.830	0.004
Residuals	1043.908	237	4.405			

Note. Type III Sum of Squares

Table 5. Descriptive and ANOVA for future sustainable food choice.

Descriptives - Future sustainable food choice

Condition	Mean	SD	N
CO2	6.397	2.091	63
Combine	6.567	2.807	60
Control	5.541	2.624	61
Traffic Lights	6.544	2.619	57

ANOVA - Future sustainable food choice

Cases	Sum of Squares	df	Mean Square	F	p	η²
Condition	42.949	3	14.316	2.213	0.087	0.027
Residuals	1533.101	237	6.469			

Note. Type III Sum of Squares

Table 6. Post Hoc comparison for future sustainable food choice.

Post Hoc Comparisons - Condition

		Mean Difference	SE	t	P_{tukey}
CO2	Combine	−0.170	0.459	−0.370	0.983
	Control	0.856	0.457	1.873	0.242
	Traffic Lights	−0.147	0.465	−0.316	0.989
Combine	Control	1.026	0.462	2.218	0.121
	Traffic Lights	0.023	0.470	0.048	1.000
Control	Traffic Lights	−1.003	0.469	−2.140	0.143

Note. P-value adjusted for comparing a family of 4

Contribution of each team member

We have a very cohesive team; we work together throughout the terms and maintain constant and effective communication. We meet at school or use Zoom to communicate before completing each assignment. All contributed equally to the proposal and collecting data as well as in the presentation. For the final report, Mingxin focused on executive summary, measure, procedure, and recommendations. Xichang focused on participants, conditions, and discussion. Yorke focused on results, references, and appendix. Yudie focused on the introduction. We all supported others where needed. In general, each member performed to the best of their ability throughout the term. We are happy to work together and complete this exciting final report.