Plant Based Diets: Sensory Attractiveness Increases Acceptability of Meat

Substitutes

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Appearance Matters: Sensory Attractiveness Increases Acceptability of Meat Substitutes

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Abstract

To promote plant-based diets, research has been focusing on finding potential barriers faced by consumers when adopting meat substitute products. Some major barriers include texture, price, and appearance. We are interested in how the appearance of meat substitute influence people's willingness to eat plant-based diet. Our hypothesis is meat substitutes with higher sensory attractiveness will increase participants' willingness to follow plant-based diet, but the effect may be weaker for those who have high level of meat attachment. We use surveys to conduct the study. There are two conditions in our surveys, one contains a colorful and moisturized meat-free burger, the other one has a dry and not colorful burger. Participants' meat attachment levels were also being tested at the end of the surveys. The results fully support our hypothesis: meat substitutes with higher sensory attractiveness increases people's willingness to adopt plant-based diets, and a significant mediating effect exists for participants' meat attachment levels. Our findings show that appearance of meat substitute has an impact. This suggests that UBC can improve the appearance of meat substitute products to increase students' willingness to adopt plant-based diets in the future.

Introduction

In the upcoming decades, the world faces a global food security challenge. By 2050, global food production needs to sustain a 9 billion population, a gargantuan increase in demand of food by 60 percent greater than today's standards (Stuart, 2015). Increasing food production will bring along irreversible consequences to the earth. Production of meat and animal by-products negatively impacts the environment and contributes to climate change (Hedenus at el., 2014). One example is the level of greenhouse gas emission, which eventually results in global warming. Hence, it is important to consider alternative dietary options that substitute animal products to mitigate greenhouse gas emissions.

One possible substitute to animal products is plant-based diet items. A plant-based diet may be defined as an eating pattern dominated by fresh or minimally processed plant foods and decreased consumption of meat, eggs and dairy products (Lee, Crawford, Worsley, 2006). Compared to plant-based diets, meat-based diets require more energy, land and water resources in the production process (Pimentel, Pimentel, 2003), which makes meat-based diets less sustainable than plant-based diets. Another major benefit to plant-based diet is the greater health benefits. Craig (2009) found that plant-based diets is rich in fibre, folic acid, vitamins C and E—which are vital for reducing the risks of developing cancer or heart diseases.

Despite the environmental and health benefits, those promoting plant-based diets can encounter multiple barriers. Lea at el. (2006) found the lack of information to be one of the major perceived barrier to plant-based diets. Some examples include the lack of dietary information and concerns about the taste of plant-based diets. Furthermore, Lea et al. (2006) found that the participants disagreed that there were barriers to eating a plant-based diets. This suggests that although many people understand the perceived benefits associated with plant-based diets, perceived benefits alone are insufficient in encouraging a dietary change.

Another major barrier to eating plant-based diets is strong meat attachment. Lea and Worsley (2003) found that 78 percent of the participants reported enjoyment of meat as the main barrier to adopting plant-based diets. One possibility could be the historically-rooted presence of meat in diets of many people (Macdiarmid, Douglas, & Campbell, 2016). In Macdiarmid at el. (2016) study, the authors found that personal and social values are used by participants to justify their reluctance to eat less meat. Finally, looking within the population of people who avoid or consume little meat substitutes, their main barrier is the unfamiliarity and poor sensory attractiveness of eating plant-based products (Hoek, et al. 2011).

In short, plant-based diets are generally perceived as healthy and beneficial to the environment. However, the lack of information, unfamiliarity, low sensory attractiveness has prevented many from transferring knowledge into action. These studies measured the attitudes and beliefs of readiness and perceived barriers of plant-based diets but lacked the practical aspect of testing with plant-based diets imagery. Hence, our study aims to investigate the sensory

attractiveness of meat substitutes on the willingness of plant-based diet adoption by presenting visual stimuli.

We hypothesise that meat substitutes with high sensory attractiveness, characterized by more moisturized and colorful appearances, will increase participants' willingness to consider adopting meat substitutes as a dietary option, but the effect may be negatively mediated by a high level of meat attachment among participants.

Method

Our research was conducted online via social media by distributing Google form surveys on Facebook and WeChat. We mentioned that the research is about willingness to adopt a plant-based diet without mentioning our manipulation of the pictures presented. Participation is voluntary.

There were 132 UBC students participating in our study, with age ranging from 18 to 30. 27.3 percent of our sample are male, 71.9 percent are female, and 0.8 percent prefer not to disclose gender. 86.4 percent are East-Asian. 65 of the 132 received surveys with a low-attractiveness image, and 67 of the 132 received surveys with a high-attractiveness image.

Participants will receive surveys from one of the two conditions: low attractiveness or high attractiveness. They are either presented with a low-attractiveness burger or a high-attractiveness burger before any survey questions are asked (Appendix A). To avoid confounds, we cropped out the background or plating to restrict visual focus on the burger only. The operationalization of sensory attractiveness is based on previous research done by Lee et al. (2013) and Cole&Endler (2015), highlighting the importance of color in terms of food preferences, as well as moisture level. Such standards are applied when we select and manipulate meat substitute pictures. To ensure difference in attractiveness exists, we included manipulation check questions, and used a one-way ANOVA to analyze variance (Appendix E).

We used a two-part survey measure and the questions are simplified versions of surveys used in previous studies.

(1) Willingness questions (Brett A &Kirsten K, 2010)

It is used to measure participants' willingness to adopt plant-based diet immediately after they saw the picture of meat substitute burger. Participants' attitudes, perceived control and intentions are all measured. Attitudes scale is applied in those questions: Participants were asked how ''bad'' to ''good,'' ''harmful'' to ''beneficial,'' ''unpleasant'' to ''pleasant,'' and ''unenjoyable'' to ''enjoyable'' following a plant-based diet in the next year would be.

(2) Meat attachment questionnaire (MAQ) (Graca et al, 2015) and demographic filter questions

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They are combined to avoid priming. Demographic questions include participants' gender, age and ethnicity. MAQ is used to measure the degree of participants' meat attachment. Participants indicated the extent to which they agreed or disagreed with each statement on a 5-point scale with 1 being strongly disagree and 5 being strongly agree.

The independent variable of our study is the different levels of sensory attractiveness, and the dependent variable is the reported willingness of adopting a plant-based diet from the surveys. Meat attachment is the mediator variable.

Results

The likelihood of following a plant-based diet reported by participants in the low-attractiveness condition has a mean of 2.52 (SD=1.30) out of 5, which is 0.57 points lower than the mean of 3.09 (SD=1.11) reported by those in the high-attractiveness condition. Using an independent sample t-test, we obtained a p=.008. Since our hypothesis is directional, we divide the p value in half to be p=.004, which is lower than the set value of p=.05 at the 95% confidence level. Therefore, we conclude that a one-tailed sign test revealed that improved sensory attractiveness of the meat substitute picture presented significantly increased participants' willingness to following a plant-based diet. To test the effect of meat attachment as a mediating variable, we conducted a bivariate correlation analysis between reported meat attachment scores and participants' willingness to follow a plat-based diet for participants in the high-attractiveness group and the low-attractiveness group separately. We obtained a significantly negative correlation (r=-.33) with a two-tailed p=.007, which is also lower than the set value of p=.05 (Appendix D). For those in the low-attachment group, there is also a statistically negative correlation (r=-.47) with a two-tailed p<.001 (Appendix C). Another correlational analysis is also conducted for all participants for all three variables: sensory attractiveness, meat attachment scores, and willingness to follow a plant-based diet. We found a significantly negative correlation (r=-.37) with p<.001 between the level of meat attachment and the willingness to follow a plant-based diet (Appendix B). Furthermore, a significant positive correlation (r=.23) with p=.008 exists between sensory attractiveness and willingness, which implies higher the sensory attractiveness of the picture presented, higher the reported willingness to follow a plant-based diet.

Implications

Derived from the results above, there is a significant positive effect of improved sensory attractiveness on participants' willingness of adopting a plant-based diet, yet this effect is mediated by their level of meat attachment given the statistically negative correlation of r=-.33 for high-attractiveness only, and r=-.37 for all respondents. This implies that higher the participants' meat attachment scores, weaker the effect of improved sensory attractiveness even in the high-attractiveness condition. This is likely due to a higher level of resistance towards the

lack of meat in a diet for those with a higher meat attachment score, making these participants more reluctant to try meat substitutes as part of a plant-based diet. Yet despite the existing correlation between meat attachment and willingness, a significant effect is still found for the improved sensory attractiveness variable. Moreover, it appears that the mediating nature of meat attachment becomes even stronger with the low-attractiveness group given the correlation is in fact the most negative (r=-.47). This may imply that those who are already meat-attached may be more resistant if the meat substitute presented is not attractive. Therefore, sensory attractiveness is perhaps more important than other factors for those with high meat attachment, because overall, participants reported moderate to high perceived health benefits, and those in the low-attractiveness condition even reported higher environmental awareness (Appendix F). It may not be the case that participants' reluctance stems from the lack of knowledge or awareness; sensory attractiveness may play an important role in motivation. This suggests that enhancing the appearance of meat substitutes, and plant-based food items overall, can potentially decrease the level of reluctance, even for those who are very meat-attached, since the correlation is the weakest for the high-attractiveness group. Practical implications include selling more good-looking plant-based products in grocery stores on campus, providing information about health benefits accompanied by attractive pictures on brochures promoting plant-based diets, and recognizing that individual level of meat attachment can vary, therefore we should develop different tactics in promoting plat-based diets targeting different groups.

Limitations

Due to methodological limitation, surveys were not randomly assigned. If the study is still conclusively positive after randomization, it should be more reliable. Additionally, acknowledging the length of the survey is very long, problems regarding survey fatigue may be present. Future studies should replicate with a more representative sample, given that our sample is skewed towards female and East Asians. The conditions tested in our study are restricted, other factors such as the taste of meat substitutes should be tested in future studies as well as other aspects of plant-based diets like dairy substitutes and nuts. Moreover, survey items are simplified versions of what was used in previous studies which may potentially be problematic in terms of validity.

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Appendix

Appendix A.

Pictures of high attractiveness burger and not low attractiveness burger

High attractiveness burger

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Low attractiveness burger

Appendix B.

Overall correlation

Correlations

		Likelihood of following diet in next year	Meat Attachment Rating	Attractiveness of Picture Presented
Likelihood of following diet in next year	Pearson Correlation	1	-.369[**]	.230[**]
	Sig. (2-tailed)		.000	.008
	N	132	132	132
Meat Attachment Rating	Pearson Correlation	-.369[**]	1	.096
	Sig. (2-tailed)	.000		.271
	N	132	132	132
Attractiveness of Picture Presented	Pearson Correlation	.230[**]	.096	1
	Sig. (2-tailed)	.008	.271	
	N	132	132	132

[**]. Correlation is significant at the 0.01 level (2-tailed).

Appendix C.

Correlation of low-attractiveness picture and meat attachment rating

Correlations

		Likelihood of following diet in next year	Meat Attachment Rating
Likelihood of following diet in next year	Pearson Correlation	1	-.465[**]
	Sig. (2-tailed)		.000
	N	65	65
Meat Attachment Rating	Pearson Correlation	-.465[**]	1
	Sig. (2-tailed)	.000	
	N	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix D.

Correlation of high-attractiveness picture and meat attachment rating

Correlations

		Likelihood of following diet in next year	Meat Attachment Rating
Likelihood of following diet in next year	Pearson Correlation	1	-.329[**]
	Sig. (2-tailed)		.007
	N	67	67
Meat Attachment Rating	Pearson Correlation	-.329[**]	1
	Sig. (2-tailed)	.007	
	N	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix E.

Manipulation Check and ANOVA results

Levene's Test of Equality of Error Variances[a]

Variable: Rating of Attractiveness

F	df1	df2	Sig.
8.276	1	130	.005

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Condition

High-attractiveness Group
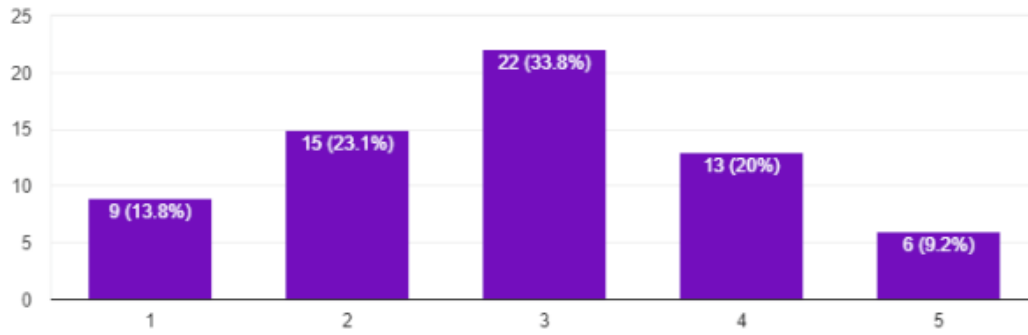
How tasty do you think this burger is?

67 responses
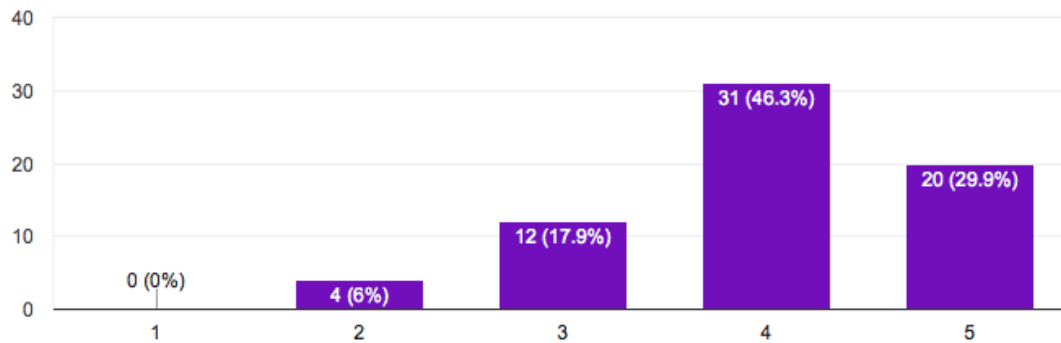
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Low-attractiveness Group

How tasty do you think this burger is?
65 responses

High-attractiveness Group

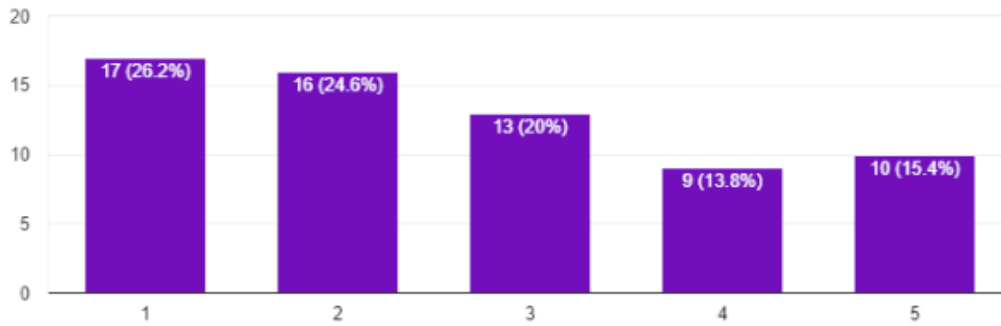## How willing are you to try this burger?
67 responses
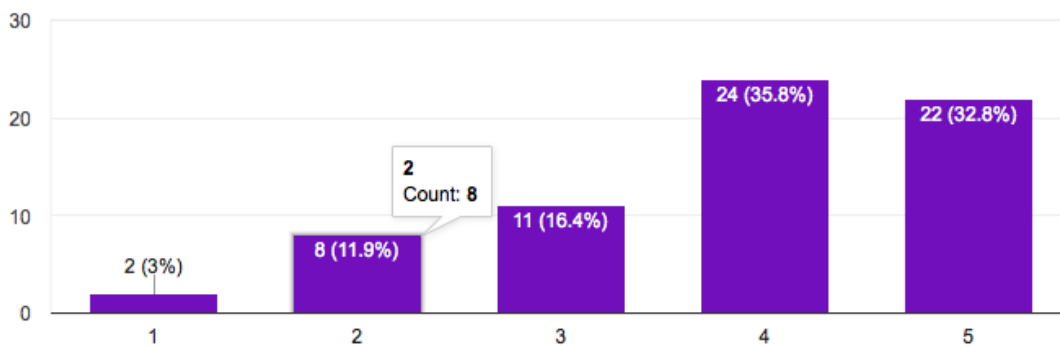
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Low-attractiveness Group
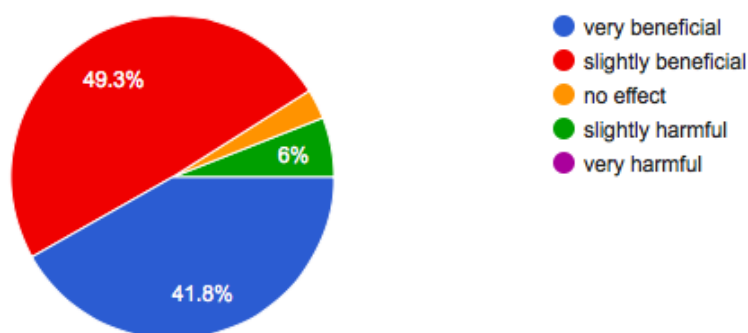
How willing are you to try this burger?

65 responses

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Appendix F.

Environmental Awareness and Perceived Benefits

High-attractiveness Group

Following a plant-based diet in the next year would be _____ for my health.
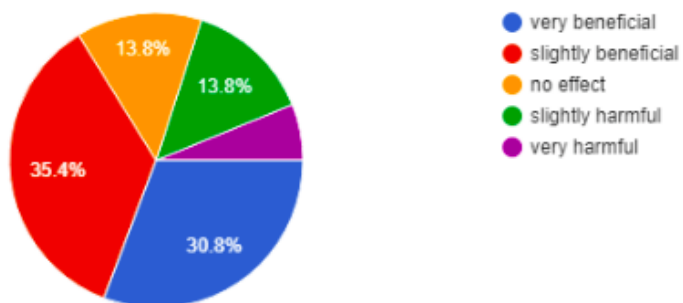
67 responses

Low-attractiveness Group

Following a plant-based diet in the next year would be _____ for my health.
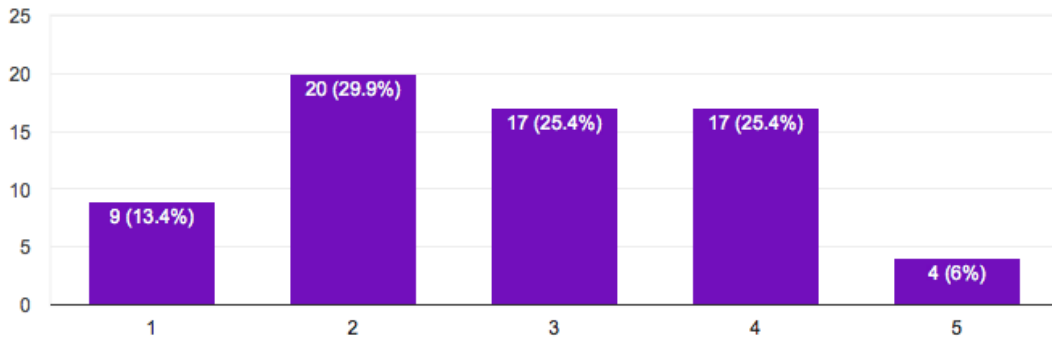
65 responses

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High-attractiveness Group

I am aware of environmental effects of meat production.

67 responses

Low-attractiveness Group

I am aware of environmental effects of meat production.

65 responses