Perceived Environmental Impact of Foods and Their Consumption Frequency

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Darwin's Finches

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Executive Summary

One of the largest contributors of climate change is the global food system – the way we produce, consume, and distribute food. Estimates find that the food system as a whole is responsible for 15 to 20 percent of all GHG emissions in developed countries, as well as 70 to 80 percent of all human water withdrawal (Garnett, 2013). Considering the environmental impact of the food system, for this study, we sought to examine if the perceived environmental impact of food items is related to the frequency at which they are consumed. We administered an online questionnaire to 162 students from the University of British Columbia (UBC). Students were randomly assigned to one of six conditions, three of which were animal-based food categories (humane, factory-farmed, unspecified), and the other three were plant-based food categories (organic, genetically-modified, unspecified). In each condition, students were shown labelled images of food items from a single food category. We measured students' perceptions of the environmental impact of each food item, as well as how often they consumed the displayed food item in a week. We found however, that the consumption frequency of food items was unrelated to the perception of the food's environmental impact.

Research Question and Hypothesis

Given that the global food system contributes to the continued degradation of the environment through agriculture, farming, food preparation, waste, and extensive use of energy and water resources, there is an urgent need to change the way that we produce, consume, and distribute foods. There is evidence that even if mitigations are implemented to increase the sustainability in the production of foods, GHG emissions from agriculture will continue to rise if current dietary trends do not change (Popp, Lotze-Campen, & Bodirsky, 2010). In consideration of the importance of consumption behaviour, we sought to understand how individuals perceive the environmental impact of different food categories, and whether this perception is related to the way people consume their food.

In particular, we examined whether differences in the perceived environmental impact of food categories are associated with the frequency at which they are consumed. We hypothesized that food categories with greater perceived environmental impact will be associated with lower consumption frequencies. We predicted that the overall perceived environmental impact of food categories would rank in the following order, from greatest to lowest: factory-farmed, genetically modified, animal unspecified, plant unspecified, humane, organic. In addition, we predicted that the perceived environmental impact of food categories will be negatively correlated with their consumption frequency.

Methods

Participants

We recruited a total of 162 students from UBC, of which there were 64 male students (39.5%), 92 female students (56.7%), and 6 non-binary students (3.7%). Participants were recruited in one of two ways. Some were approached at various public locations on campus, including the AMS Student Nest, Irving K. Barber Learning Centre, Sauder School of Business. Others were recruited online via direct messages, or through posts on UBC student Facebook pages. All recruitment and data collection occurred between March 16 to March 23, 2017.

Procedure

After we obtained students' verbal consent to participate in the study, they were asked to complete a five-minute Qualtrics questionnaire. During the questionnaire, each participant was shown images of three different food items from the same category, and answered questions about their perception of the food items' environmental impact, as well as how frequently they consume the displayed food items on a weekly basis.

Conditions

Once participants opened the survey, they were randomly assigned by Qualtrics to one of six conditions, each representing a different food category (See Figure 1 in Appendix). Three of these conditions were animal-based food categories that included humane animal food products (n = 20), factory-farmed animal food products (n = 30), and unspecified animal food products (n = 30). The other three conditions were plant-based food categories that included organic plant food products (n = 25), genetically modified plant food products (n = 29), and unspecified plant food products (n = 28).

The food items shown for animal-based food categories were beef, egg, and a glass of cow's milk. For plant-based food categories, the food items were tomato, apple, and rice (See

Figure 2 in Appendix). The food items that were displayed for animal-based food categories were held constant across humane, factory-farmed, and unspecified conditions. Similarly, the food items that were displayed for plant-based food categories were held constant across organic, genetically modified, and unspecified conditions. However, the label that identified which category the food item belongs to varied from participant to participant, depending on which condition they were sorted into.

For example, if a participant was randomly assigned to the humane animal food condition, then they saw images with the labels "humane beef", "humane egg", and "humane cow's milk". On the other hand, if a participant was assigned to the factory-farmed animal food condition, then their images were labelled "factory-farmed beef", "factory-farmed egg", and "factory-farmed cow's milk". Importantly, participants that were sorted into the unspecified animal food condition saw the same food images, but their labels did not indicate a category. Instead, their food items were simply labelled "beef", "egg", and "cow's milk".

To summarize, the food items that were shown remained the same for all three conditions of animal-based food categories. The food items that were shown also remained the same for all three conditions of plant-based food categories. However, participants saw different categorizing labels for their food items, depending on which condition they were sorted into.

Measures

1. Perceived Environmental Impact

Perceived environmental impact was assessed using five items, each reflecting a different dimension of environmental impact, including greenhouse gas emissions, energy use, travel distance, production space, and water footprint (See Figure 3). Participants were asked to report how much of each dimension they thought was required to produce each food item (e.g. How much greenhouse gases do you think are emitted to produce this food?). All five items were measured on an eight-point Likert scale (e.g. "0 = None" to "7 = A Great Amount").

2. Consumption Frequency

Participants were asked to report the number of days per week that they consume a particular food item. This item was measured on an eight-point Likert scale ("0 = Never", "7 = seven days a week").

3. Demographics

We also collected demographic information including gender, ethnicity, political orientation, faculty, and dietary behavior.

Results

A mixed two-way ANOVA was conducted. Food category was the between-groups factor. Dimension of environmental impact was the within-groups factor. There were no significant interactions between the two factors. Exposure to different food categories was significantly associated with perceived environmental impact across environmental impact dimensions, $F(5, 780) = 8.52$, $\eta^2_p = 0.05$, $p < .001$. Additionally, environmental impact dimension was significantly associated with overall perceived environmental impact across food categories, $F(4, 780) = 20.62$, $\eta^2_p = 0.10$, $p < .001$. A Tukey HSD test was then conducted to identify any significant pairwise differences.

The animal unspecified category was significantly different from the following categories, on overall perceived environmental impact: genetically-modified ($p = .003$), humane ($p = .001$), organic ($p < .001$), and plant unspecified ($p < .001$). Likewise, the factory-farmed

category was significantly from the following: humane (p = .044), organic (p = .015), and plant unspecified (p = .001). Please refer to figure 5.

The food travel distance dimension was significantly different from the following ones, on their association with overall perceived environmental impact: energy usage (p = .012), GHG emissions (p = .001), production space (p < .001), and water footprint (p < .001). Likewise, the energy usage dimension was significantly different from the following: production space (p = .006) and water footprint (p < .001). Lastly, the GHG emissions dimension was significantly different from the following: production space (p = .048) and water footprint (p < .001). Please refer to figure 6.

Food category differences across environmental impact dimensions

Food category was significantly associated with food travel distance, $F(5, 156) = 2.64$, $\eta^2_p = 0.08$, p = .026. A follow-up Tukey HSD revealed that the humane food category was significantly different from the genetically-modified (p = .017) and organic (p = .049) categories. Please refer to figure 7. Food category was significantly associated with energy usage, $F(5, 156) = 2.74$, $\eta^2_p = 0.08$, p = .021. A follow-up Tukey HSD revealed that the plant unspecified category was significantly different from the factory-farmed (p = .050) and animal unspecified (p = .050) categories. Please refer to figure 8. Food category was significantly associated with GHG emissions, $F(5, 156) = 4.79$, $\eta^2_p = 0.13$, p < .001. A follow-up Tukey HSD revealed that the plant unspecified category was significantly different from the factory-farmed (p = .026) and animal unspecified (p < .001) categories. Also, the animal unspecified category was significantly different, p = .016, from the organic category. Please refer to figure 9. Food category was significantly associated with production space, $F(5, 156) = 3.59$, $\eta^2_p = 0.10$, p = .004. A follow-up Tukey HSD revealed that the organic category was significantly different from the animal unspecified (p = .025) and factory-farmed (p = .048) categories. Please refer to figure 10. Lastly, food category was not significantly associated with water footprint, $F(5, 156) = 0.99$, $\eta^2_p = 0.03$, p = .425. Please refer to figure 11.

Relationship between perceived environmental impact and consumption frequency

An average of the weekly food consumption frequency of the three presented food items was obtained. We calculated a Pearson product-moment correlation coefficient between consumption frequency and overall perceived environmental impact, and determined that there is no significant association between these two measures, $r(160) = -.04$, p = .587.

Discussion

The current study assessed individual differences in the perceived environmental impact of six different food categories and how such differences were associated with consumption frequency. In our original ranking of perceived environmental impact of food categories, we predicted that factory-farmed animal-based food would be perceived to have the highest environmental impact. However, contrary to our prediction, we found that both factory-farmed animal-based food and unspecified animal-based foods were rated to have the highest perceived environmental impact. This suggests that participants may have viewed factory-farmed and unspecified animal products as being similar. In other words, the participants may have thought that unspecified animal products are derived from factories and thus, may have perceived these two categories to have similar environmental impact. Furthermore, participants were only exposed to one of the six conditions, and therefore were not be able to compare the

environmental impact of their assigned food category relative to other food categories. As a result, it is unclear whether the similar perceptions of factory-farmed and unspecified animal categories were due to the lack of comparison between the two, or because people in fact perceive these two categories as having the same environmental impact.

Furthermore, our results indicated that unspecified and factory-farmed animal food categories were perceived to have significantly higher environmental impact than all the other categories, namely, genetically modified plants, humane animals, organic plants, and unspecified plants. In addition, the factory-farmed animal food category was perceived to have significantly higher environmental impact than humane animals, organic plants, and unspecified plants. This ranking does not support our initial prediction about the perceived environmental impact of different food categories. Overall, factory-farmed animal food products were consistently rated to have the highest environmental impact. This suggests that students at UBC are aware of the adverse environmental impact of farming. However, it appears that participants did not distinguish between the categories of humane animals, organic plants, and unspecified plants in terms of their environmental impact. This lack of difference found in our study may have also been due to the lack of comparison between food categories when participants completed their questionnaire.

Our prediction that foods with the highest environmental impact would be consumed less frequently, was not supported by our results. Indeed, we found that weekly consumption frequency of food from different categories was not related to their overall perceived environmental impact. This null finding does not necessarily suggest that people are unaware or do not care about the environmental impact their consumed food is associated with. Although these interpretations are possible, the lack of relationship may have also been the result of our small sample size. Especially given that we have six conditions, our study may not have had enough power to detect this relationship. Moreover, we calculated Pearson's *r* correlation instead of multiple regression analysis to estimate the relationship between perceived environmental impact and consumption frequency. The fact that we did not hold other variables constant (such as demographic variables) may have also reduced our ability to detect a significant relationship between perceived environmental impact and consumption frequency.

Our results have a few implications. First, UBC students may have misperceptions about the environmental impact of the foods they consume. By misperception, we mean that UBC students have a wrong or incorrect understanding about the environmental impacts that are associated with certain foods. Second, participants may have been confused by food labels with the same valence. For example, humane food is associated with positive characteristics which the participants may have misattributed when rating its environmental impact. Humane food, such as beef, is viewed positively as we associate it with ethical treatment of animals. However, humane beef requires an enormous amount of space for the cows to roam freely. As well, there is high GHG emission that is associated with this practice (Notarnicola, Tassielli, Renzulli, Castellani, & Sala, 2017). Third, the results revealed an overall consensus that unspecified animal products are perceived to have the highest environment. Lastly, food consumption seems to be unrelated to perceptions of environmental impact. This may be because people are unaware of the potential impact certain foods have on the environment.

There are a few limitations to consider when interpreting the results and developing future studies. To begin, our question assessing the perceived distance the food travelled was confusing for some participants. Since there was no indication regarding the region where the food was produced, it was difficult for them to report how far they thought it had travelled.

Secondly, no units were given for food items. This raised an issue of standardization as answers could vary depending on the amount or serving of the food we asked to evaluate. Thirdly, a within-subjects design may have been a more appropriate research design. Since only label was presented per participant, we were not able to make meaningful comparisons between our conditions. Fourthly, as mentioned earlier, unspecified animal product, beef, may have been confused with factory-farmed beef. Participants may have been confused as to what "type" of beef was being referred to. Lastly, allowing the participants to categorize environmental impact factors from most detrimental to least detrimental would have been more justified to method employ. This way, we could assess which food category the participants thought was the most sustainable for the environment relative to the other food categories presented.

Recommendations for UBC client

The results of our study showed that there was no meaningful relationship between the frequency of food consumption and the perceived environmental impact of different food categories. This is important because it generates two main potential interpretations: either, 1) students at UBC are either uninformed regarding the environmental impact of their food choices, or 2) simply do not care about the impact their food choices has on the environment.

Consistent with the first interpretation, the results from a previous SEEDS project suggest that students are willing to purchase organic and sustainable foods, however, they are uneducated on what foods qualify as being sustainable (Hsieh et al., 2016). Building off of a proposal made by another previous SEEDS project, we recommend that UBC Food Services could work on spreading the awareness of sustainable, local and organic foods on campus, utilizing posters, campaigns, and informational engagements with students (Lehmann et al., 2015). Furthermore, considering that there was no distinction observed between factory-farmed and unlabeled animal products in the current study, it will be important to inform students about the origin of their foods as well, to allow them to make more informed food choices. For example, food wrappers can be filled with information regarding the environmental impact it caused to produce the food.

With respect to the second interpretation, one possible reason for this lack of care regarding the sustainability of their food choices could be that students do not feel as if the environmental impacts are relevant to their own lives. It might be important to find ways to make the impacts of their food choices more relatable and immediate, and help students understand that their choices do matter in the context of their own lives. One approach could be to target the health interests. For example, plant-based foods are known to be far less burdening on the environment as well as more nutritiously beneficial (Garnett, 2013). Consistent with a finding by a previous SEEDs project (Albashir, Babinski, Carandang, Hadley, & Lin, 2016), providing nutritional information for food provided at dorm cafeterias and food services decreases the amount of meat consumption.

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Notarnicola, B., Tassielli, G., Renzulli, P., Castellani, V., & Sala, S. (2017). Environmental impacts of food consumption in Europe. Retrieved 5 April 2017, from http://www.sciencedirect.com/science/article/pii/S0959652616307570

Popp, A., Lotze-Campen, H., & Bodirsky, B. (2010). Food consumption, diet shifts and associated non-CO2 greenhouse gases from agricultural production. *Global Environmental Change-Human and Policy Dimensions, 20*(3), 451-462. doi:10.1016/j.gloenvcha.2010.02.001

Appendix

Figure 1

Different labels indicating different conditions.

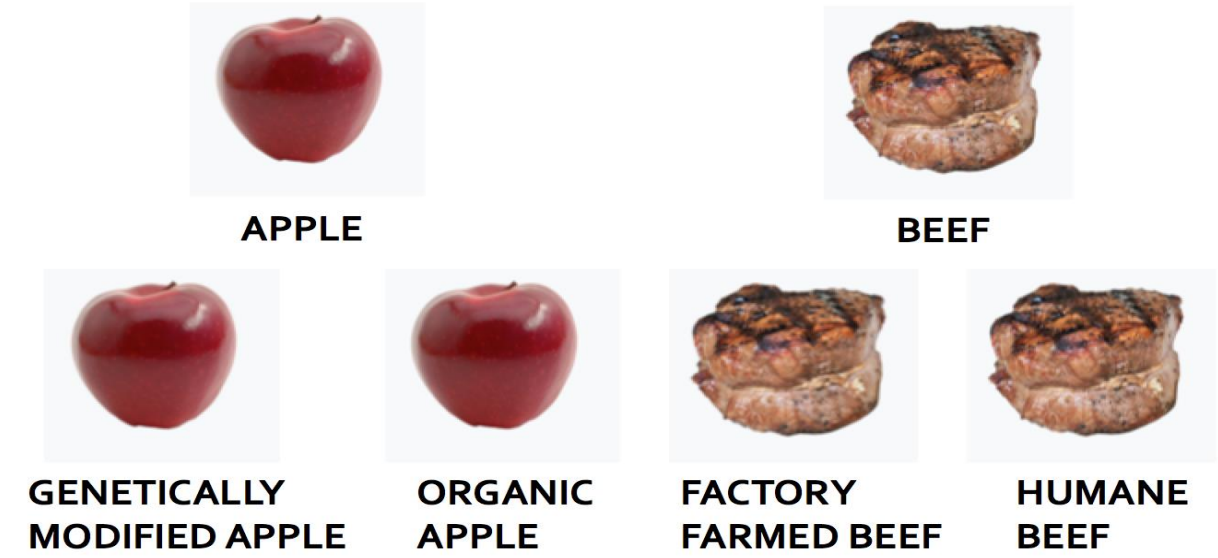

Figure 2

Images of animal-based food items and plant-based food items.

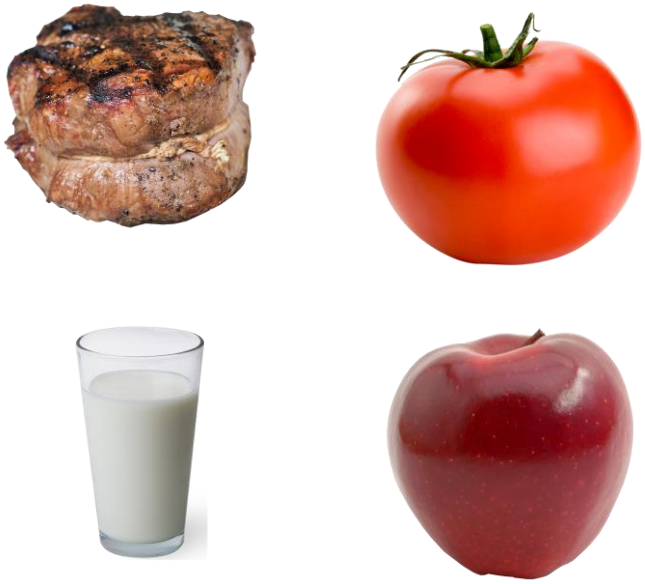

Figure 3

Example of qualtrics question.

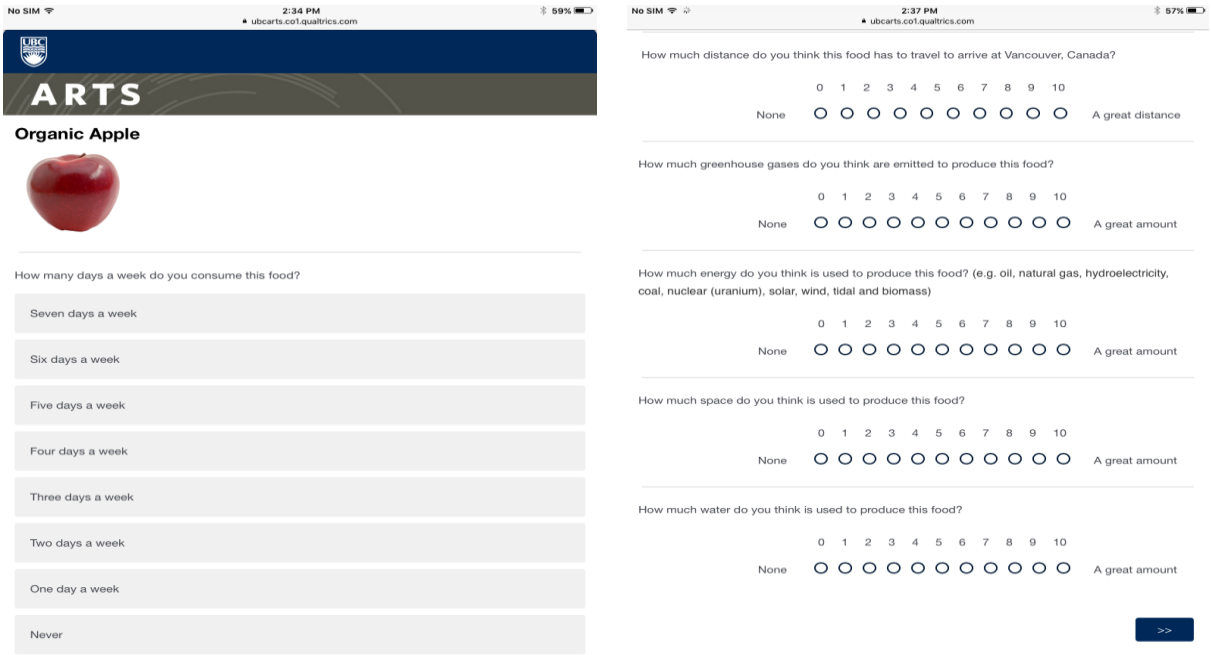

Figure 4

Pearson r correlation matrix between consumption and environmental impact variables.

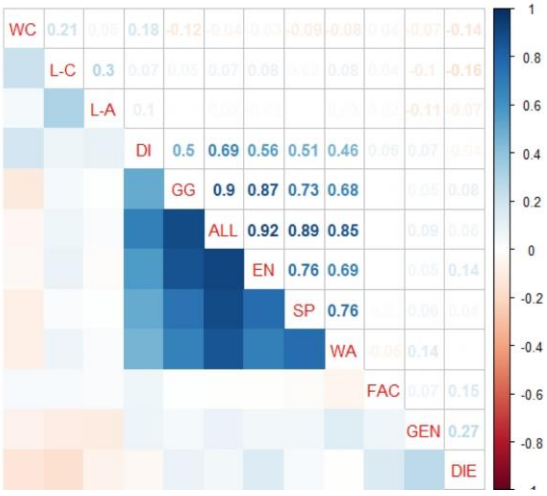

Figure 5

Differences in perceived environmental impact of the food categories

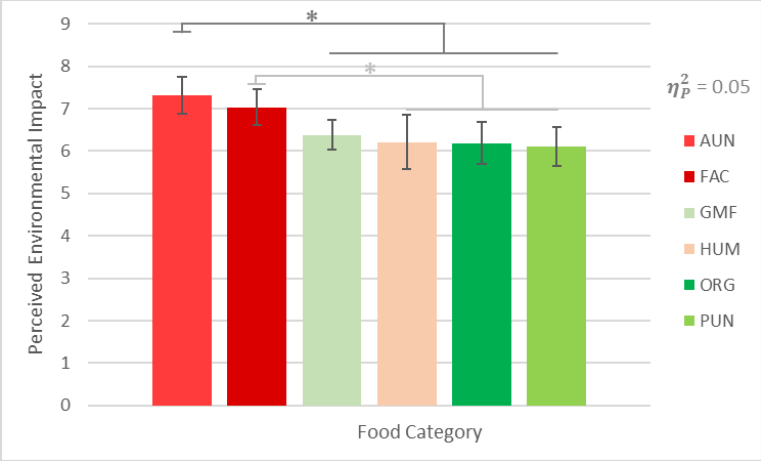

Figure 6

Differences in perceived environmental impact of the different dimensions of environmental impact

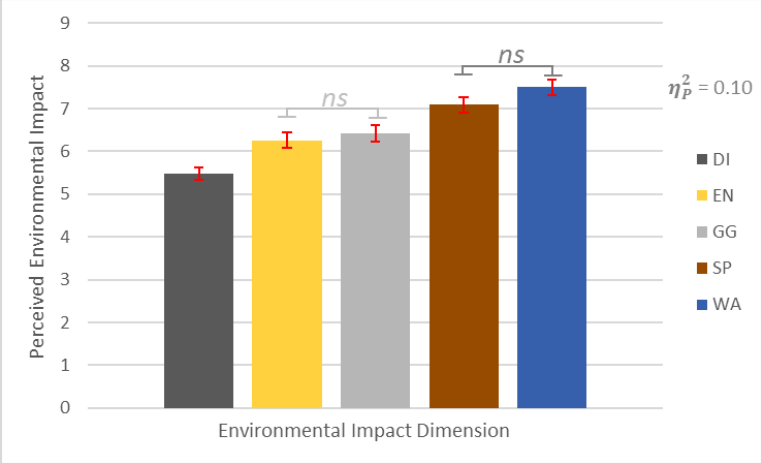

Figure 7

Differences in food travel distance of the food categories

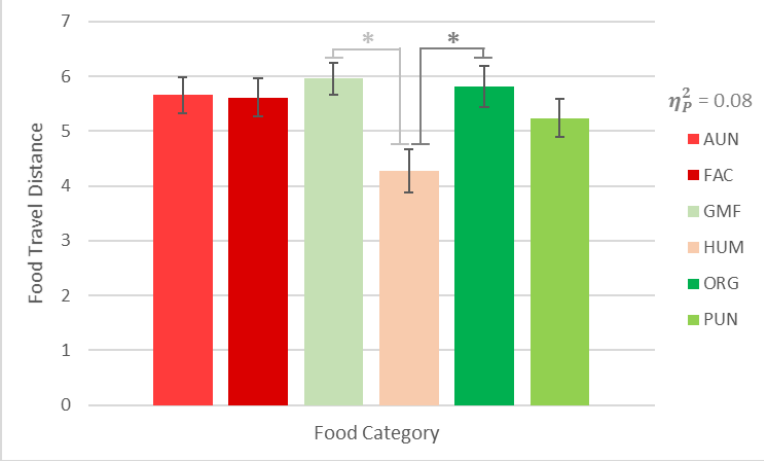

Figure 8

Differences in energy usage of the food categories

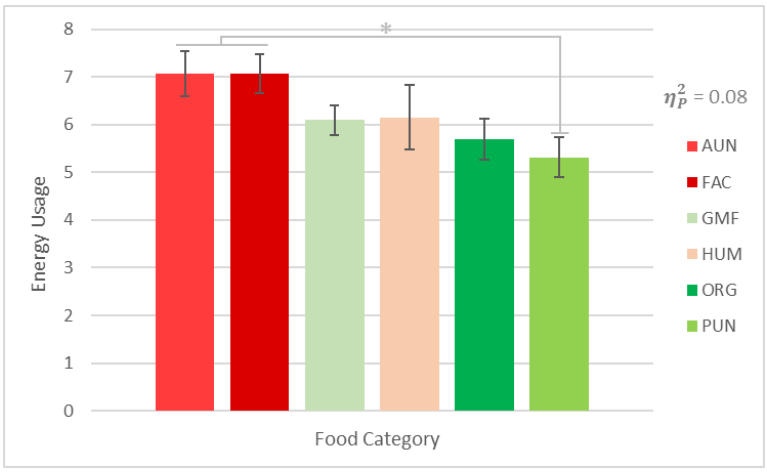

Figure 9

Differences in GHG emissions of the food categories

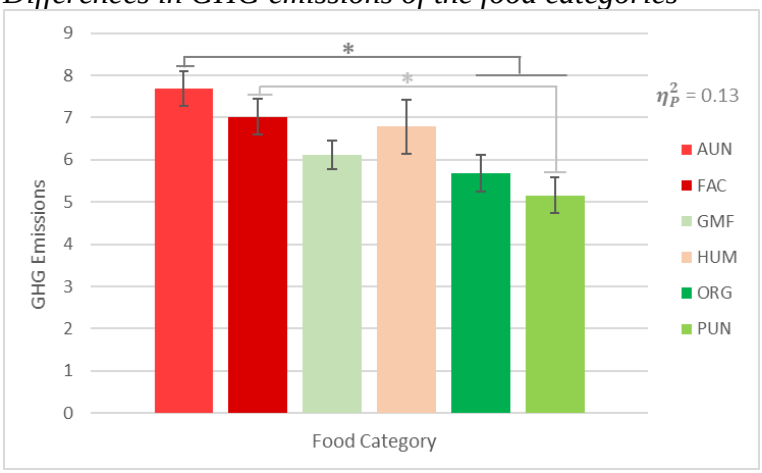

Figure 10

Differences in production space of the food categories

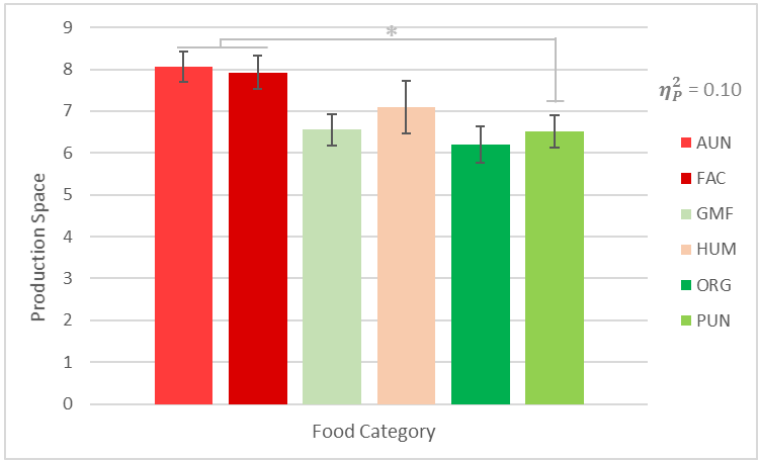

Figure 11

Differences in water footprint of the food categories