

# “Clean Plates, Zero Waste”: An Examination of Anthropomorphic Figures and Positive Affect in Poster Design to Reduce Food Waste

Prepared by: Hayley Jones, Dayvin Chiu, Makayla Lubinich, Maya Sly, Leopold Tse, & Nathan Bullock

Prepared for: UBC Food Services

PSYC 421

The University of British Columbia

April 2024

Cover Photo: Brooke Lark on Unsplash

*Disclaimer: UBC SEEDS Sustainability Program provides students with the opportunity to share the findings of their studies, as well as their opinions, conclusions and recommendations with the UBC community. The reader should bear in mind that this is a student research project and is not an official document of UBC. Furthermore, readers should bear in mind that these reports may not reflect the current status of activities at UBC. We urge you to contact the research persons mentioned in a report or the SEEDS Sustainability Program representative about the current status of the subject matter of a report.*



# Executive Summary

## Introduction

After successfully reducing back-of-house waste, the University of British Columbia (UBC) Food Services and UBC SEEDS are working to reduce food waste produced in UBC-Vancouver (UBC-V) residence dining halls.

## Research Question

How do posters with an anthropomorphic figure and positive focus influence food waste production in a residence dining hall?

## Methods

We analyzed previous studies on food waste reduction, behaviour change, and visual interventions, aiming to create a visual intervention promoting food waste reduction. The team designed a poster with minimal written information and a positive tone, hypothesizing that this would reduce food waste from plates. During a six-day baseline period at Place Vanier's dining hall, Gather, the plate waste of diners was observed and rated on a 0-5 point scale from 5:00 to 7:00 pm. UBC Food Services collected the weight of plate waste in kilograms each day, which was used to augment our analysis. Posters were placed in various locations after this baseline period, and observations and kilogram data were collected in the same fashion.

## Results

Results from our observational data showed a marginal difference in plate waste between conditions ( $U = 201,265.00$ ,  $p = .05$ ,  $r_{rb} = 0.063$ ); however, this was not corroborated by the kilogram data ( $U = 20.00$ ,  $p = .95$ ,  $r_{rb} = -0.048$ ). Though the hypothesis was partially supported, further studies are required.

## Recommendations

We suggest that residence dining halls consider putting up posters based on the ideas of nudge influence, with a positive focus relating to the reduction of food waste. A future study also needs to be conducted to understand why students are so frequently tossing burgers, burger buns, and cakes. Finally, obtaining student feedback could allow the residence dining hall to make necessary adjustments to the menu, reducing potential food waste.

# Table of Contents

<i>Executive Summary</i> .....	2
<b>Introduction</b> .....	1
<b>Research Question</b> .....	1
<b>Methods</b> .....	1
<b>Results</b> .....	1
<b>Recommendations</b> .....	1
<i>Introduction</i> .....	3
<i>Research Question and Hypothesis</i> .....	5
<i>Methods</i> .....	6
<b>Participants</b> .....	6
<b>Conditions</b> .....	6
<b>Measures</b> .....	6
<b>Procedure</b> .....	7
<i>Results</i> .....	8
<i>Discussion</i> .....	9
<i>Recommendations for UBC Clients</i> .....	11
<i>References</i> .....	12
<i>Appendices</i> .....	14
<b>Appendix A: The Conditions</b> .....	14
<b>Appendix B: Methods &amp; Results</b> .....	15
Methods .....	15
Results.....	16

## Introduction

Food waste has become an economic, social, and environmental burden that significantly impacts sustainable development efforts. At UBC, food waste and production make up 31% of total greenhouse gas emissions produced by the community (UBC Sustainability, n.d.). Within UBC's campus-wide action plan to eliminate waste, the "Climate-Friendly Food Systems" strategy targets aspects of the waste management system, including food production, service providers, food waste recovery, and consumer behaviour (UBC Sustainability, n.d.). As the Campus and Community Planning team focused on their sustainability action plan, UBC Food Services transformed the UBC-V meal plan into an All-Access Dining model in 2021. Although this change did not derive from the campus food waste reduction plan, sustainability is a key benefit of the model, along with promoting a communal atmosphere, eliminating buyer's remorse, and providing expansive and healthy food options while maintaining food security for students, staff, and visiting patrons (*All Access Dining*, n.d.). As a result, UBC Food Services has reported success in reducing pre-consumer food waste by repurposing inventory (Zhao, 2024). This achievement has enabled a shift in focus to post-consumer waste and dining hall patron behaviour (Zhao, 2024).

While all dining halls on campus have adopted the all-access model, our observations are specific to Place Vanier's residence dining hall, "Gather." Considering the model's emphasis on eliminating single-use plastics, the consumer waste stations have changed to reflect these values. Diners have access to a liquid waste container, garbage, and compost. As our team began evaluating post-consumer waste behaviours, we identified any avoidable or unavoidable refuse disposed of in the compost bins, as plate waste. By observing post-consumer plate waste, our team aimed to assess baseline patron behaviour compared to behaviours within the presence of a nudge intervention. Most of the research that examines nudging, a factor that can facilitate change in human behaviour (Luo et al., 2023), focuses on providing long, educational messages to inform a target audience of the impact of their behaviour. Various studies have determined the role of social comparison when influencing behavioural nudges, finding they tend to be most effective when placed publicly (Zhang et al., 2023) while appealing to individualistic mindsets and actions (Putnam-Farr et al., 2023; Pandey et al., 2023). A meta-analytic review of nudging toward sustainable food consumption demonstrated a pattern of messaging related to personal health benefits associated with a decrease in food waste (Pandey et al., 2023). A similar literature review determined various categories of nudges, seeing a pattern of prioritizing food and health-related concerns, as well as dietary habits and role-modelling healthy behaviour for children (Zhang et al., 2023). There is seemingly a lack of behavioural interventions that encourage anti-food waste actions without targeting dietary choices or habits. The literature consistently determines positively framed interventions to be more effective; however, these outcomes rely on the relationship between the message and social norms (Zheng et al., 2023). When studying this relationship, Zheng et al. determined there was less psychological resistance when participants encountered positive messages that described behaviours related to the masses (2023). Our team aimed to expand on positive-framed messaging by implementing an anthropomorphic character alongside our positive message and descriptive statistics. While it is known that positive, written messaging has an effect, few studies observe the implementation of positive imagery in the form of an anthropomorphic character, ascribing human characteristics to

a non-human figure, to associate positive affective responses with sustainable behaviour for the collective (Cooremans et al., 2019; Pandey et al., 2023).

This study aimed to draw Gather patrons' attention to the issue of post-consumer plate waste, utilizing descriptive statistics related to the dining hall, a simplistic slogan, and a positive character to maximize warm feelings, with the goal of influencing their engagement in the prosocial behaviour of reducing food waste (Putnam-Farr et al., 2023).

## Research Question and Hypothesis

Aiming to fill in existing knowledge gaps uncovered in our literature review, the team questioned how posters with an anthropomorphic figure and positive focus influence food waste production in a residence dining hall. We hypothesized that the presence of a poster displaying a smiling earth, the benefits of reducing food waste, and relevant statistics would lead to an overall reduction in the amount of food waste produced in a residence dining hall in comparison to a baseline that makes no changes to the environment.

# Methods

## Participants

Based on a power analysis assuming a minimum effect size = 0.2, alpha = 0.05, and power = 0.80, a minimum of 394 participants per condition was required, indicating a total need for 788 participants. 14,066 card swipes were recorded from student diners at Gather, recorded for kilogram data collection, and 1341 observed diners. Due to low inter-rater reliability, one day of data collection was excluded, resulting in N= 1241 observations. UBC Food Services, who provided our kilogram data, only recorded card swipes from individuals with UBC cards, leading to the exclusion of staff or other patrons contributing to plate waste. Our team did not limit observations to students but observed all individuals disposing of food waste, excluding those who only returned cups or disposed of wrappers. To be considered a participant, the individual needed to dispose of waste from plates or bowls. There was no demographic information collected. The total number of usable participants (N = 15,307) far exceeded the minimum requirement.

## Conditions

This study was a two-condition between-subjects design, with the independent variable being the presence or absence of a poster raising awareness of the benefits of food waste reduction. The baseline condition (N = 641) made no alterations to the environment and ran for seven days. The team conducted observations and received food waste data from UBC Food Services to establish food waste patterns. The intervention (N = 700) included over 90 posters of various sizes throughout the hall for seven days. Initially, these posters were placed on each dining table, dining hall walls, and walls in the entryway; however, due to miscommunication with Gather staff, the posters on the tables were removed after one day. The poster included an anthropomorphic earth figure holding a clean plate with the slogan “Clean Plates Zero Waste” surrounding it and food waste statistics at the bottom. The poster also contained a list of three positive outcomes of food waste reduction, reinforcing the positive aim. The statistics on the poster shared that there was 259,997 kg of food waste produced in Gather, with 29,638 kg resulting from plate waste from September 1, 2023 - December 15, 2023, representing the previous semester as per the data provided by the Food Services team [refer to Appendix A].

## Measures

The dependent variable in our study is the amount of food waste produced by diners, measured in two ways. The first measure was a scale created to record the amount of food waste produced. To create the scale, photos of a plate with different amounts of food were compiled, assigning each a value between 0-5 [refer to Appendix B]. A score of 0 included plates that were completely empty as well as ones containing unavoidable food waste. Each rating session involved two raters to ensure a meaningful degree of inter-rater reliability. A hands-on approach to scale creation allowed the team to be precise in our definitions of each rating and ensure



consistency. The second measure was the weight of plate waste in kilograms produced in Gather during the 4:00 to 10:00 pm dinner shift. UBC Food Services provided this information at the end of our intervention period. The kilogram data was divided by the number of card swipes to determine kilogram waste per person for each day. As the card swipes only include student diners, this measure examines a slightly different demographic than the observations which included all diners.

## Procedure

During the seven-day baseline period, two group members sat in the Gather dining hall and observed patrons as they disposed of plate waste in the designated compost bins. The members independently recorded their observations, averaging rating discrepancies. Observations for both conditions occurred between 5:00 to 7:00 pm during weekdays. The kilogram data accounted for the entire dinner period from 4:00 to 10:00 pm. Posters were placed at various approved locations throughout Gather, which included several poster boards and walls near the waste bins and tables. Observations continued during the intervention period in the same way as the baseline. Kilogram data was also provided for this period. The team faced a variety of challenges during data collection. The scale created was designed to observe plate waste and did not accurately capture food discarded from bowls. Raters did not have a good vantage point, as the bins were stationed against a wall causing diners to turn their backs to raters, obscuring our ability to see the food being disposed of. As the study progressed, diners began to notice the team members and it was evident that this influenced their behaviour.

## Results

All statistical calculations were done using JASP. The baseline condition for the observations included 641 participants, with 100 being discarded due to an inter-rater reliability of only 53%. This left a total of 541 participants who were observed in the baseline condition ( $M = 1.28$ ,  $SD = 1.21$ ,  $SE = 0.052$ ) and 700 participants in the intervention condition ( $M = 1.09$ ,  $SD = 0.97$ ,  $SE = 0.037$ ). The kilogram data collected for the baseline condition, six days total, was divided by the number of card swipes, 6652, to obtain kg/person data for each day ( $M = 0.24$  kg,  $SD = 0.10$ ,  $SE = 0.04$ ). The intervention condition included 7414 swipes over seven days ( $M = 0.25$  kg,  $SD = 0.07$ ,  $SE = 0.026$ ).

Percent agreement was used to calculate the inter-rater reliability used for the plate waste ratings taken by two group members evaluating the same set of data. Daily observation data aimed for at least 70% agreement, with an ideal percentage of 80% agreement and a final overall agreement of 81% across conditions. Higher inter-rater reliability of data limited the risks of biases in rater judgment, such as lenient or strict judgment of plate waste. When disagreement between raters occurred, the average of their scores was used.

The data collected violated the normality assumption, determining our data set was not normally distributed. Therefore, a non-parametric Mann-Whitney U test was conducted for both the plate waste observations and kilogram data. The plate waste observations showed marginally significant results and a very small effect size ( $U = 201,265.00$ ,  $p = .05$ ,  $r_{rb} = 0.063$ ), and the kilogram data showed a non-significant difference that indicated an increase in waste from the baseline to intervention ( $U = 20.00$ ,  $p = .95$ ,  $r_{rb} = -0.048$ ). The results indicate that the hypothesis was partially supported. Refer to Appendix B for visualization.

## Discussion

Our results display a marginally significant effect, indicating that a poster with positive messaging and simplified information may be a useful tool to nudge food waste reduction. Students commented on the poster, unprompted, suggesting that it was notable enough to grab the attention of hungry and distracted diners. It is no easy feat to deliver a message in a high-traffic environment and we speculate that our poster's vividness, alignment with popular aesthetics, and simplicity helped draw attention. Unlike previous studies that highlight personal health benefits or dietary habits (Zhang et al., 2023), our poster was designed to elicit positive emotions through a slogan and anthropomorphic figure (Pandey et al., 2023, Zhang et al., 2023). Many posters displayed on UBC campus contain a higher volume of informative text and are more emotionally neutral than the poster we created. Our results indicate that it is worth exploring the impact of a positive emotional component and humanoid figures.

There were several limitations that influenced our results. It is important to note that the kilogram data does not include everyone who eats in the dining hall, as the card swipes only represent students. The result could potentially differ if the data was to be divided among all dining patrons. The scale used in this experiment is highly subjective and obtaining an agreement rate of 80% was difficult. The inclusion of unavoidable food waste on our scale was a key challenge, as team members likely misinterpreted unavoidable waste as avoidable and vice versa. Our view of the disposal area was also highly obstructed. The rightmost compost bin is situated next to a wall which almost entirely blocked our view. Most diners dispose of their waste in this bin, making differentiating between types of waste difficult. A second difficulty encountered was determining the contents of bowls. Our scale was based on an average-sized plate of food, and it was challenging to generalize this to tall bowls, small side plates, or cups. As diners became increasingly aware of our presence, napkins were often used to cover plate waste, creating an unanticipated challenge for raters. Various other factors, such as passersby obstructing the view, could contribute to some of the issues faced while trying to accurately track waste disposal behaviours. Diners were often conscious of the on-site observations happening and would occasionally resort to using their bodies to block our view. Others, on the other hand, made direct eye contact and would openly display what they were discarding. The challenges the team had visualizing waste was a significant hindrance to the study. Potential solutions could involve using mirrors above the bins for improved monitoring of disposal activities. Mirrors would be able to reflect the blind spots of the compost bins, while cameras could be used as a playback device for more accurate data collection.

A number of unanticipated items were seen being thrown out and may have affected our results. Plates, cutlery, bowls, and cups were periodically being dropped into the food waste bins. In most cases, diners failed to notify staff or remove the dinnerware. There is a possibility that people were made nervous by our presence, leading them to drop items. Additionally, diners often dispose of outside, and potentially non-organic, waste into the mix including plastic wrappers, tags, and small papers, in the dining hall waste station. This added weight would have had a significant impact on our kilogram data. Diners changing their behaviour due to our presence could also account for the increase we saw in the kilogram data. A similar result was observed in a study conducted on the influence of nudges on traffic accidents, finding that a highly salient nudge aimed at reducing accidents led to an increase in accidents (Hall & Madsen,

2022). Taking into consideration the vibrancy of our poster and our obvious presence as observers, the salience of our study could have been too distracting and reduced the ability of participants to make accurate disposal decisions. A second explanation could be the Hawthorne Effect, when people change their behaviour due to being observed, which could have accounted for them disposing of less food during observation periods but maintaining higher waste during the other hours (McCambridge et al., 2014).

Other miscellaneous features of our study should be considered to provide a comprehensive examination. The team initially placed posters on all tables in the dining hall but removed them after one day due to a request from the dining hall manager. This change, due to a miscommunication, may have affected the strength of our results as the quantity of posters was not consistent across all seven days. Along with this, the short duration of the study is a noteworthy consideration and extending the observation period could potentially yield a more significant data set. Future studies should examine the influence of a poster across all mealtimes, and for more extensive periods than a daily two-hour observation, in order to strengthen results and reduce the likelihood of achieving marginal significance. A final significant factor is that our poster was designed to target students, but we observed a high number of staff members and visitors eating in the dining hall. Staff members were often observed throwing out a higher volume of food waste than students after finishing their meals. Consequently, food waste tactics should be targeted towards any potential patron, creating interventions which target a more diverse range of people. It is also pertinent that future studies examine why there is such a noticeable difference in behaviour between staff and student diners.

## Recommendations

Using a poster with an anthropomorphic figure and positive focus, we observed a marginal reduction of food waste in Gather. We suggest that residence dining halls consider putting up posters based on the ideas of nudge influence, with a positive focus relating to the reduction of food waste. These posters should target the general public, as not only students eat in residence dining halls. Anthropomorphic figures may aid in this by eliciting further positive affective responses to the messages being presented. As per the results from Hall & Madsen (2022) and inflated kilogram data, the team recommends that the client attempt to find a balance between messaging that is not noticed at all and messaging that is too salient. This is a delicate balance to strike, but necessary to prevent any boomerang effect in the results. It may be useful in future studies to observe the students in a more subtle fashion to decrease the possibility of a Hawthorne Effect or overt salience. Another possible solution would be to explore variations of our poster that utilize a slightly more muted colour scheme.

One observation the team made was the volume of burgers, burger buns, and cakes being thrown out. Generally, students were quite minimal in their food waste production, but these items were tossed with significant frequency. This behaviour perplexed the team. One student did tell us that they would “reduce their food waste if the food was better,” but observations generally suggested that students were eating the majority of their food as our mean ratings for both the intervention and baseline conditions were below two. Therefore, a future study needs to be conducted to understand why students are so frequently tossing these specific items. There are strong sustainability implications here as beef is the largest food greenhouse gas emitter (Ritchie et al., 2022). Future studies need to focus on understanding this behaviour as it is detrimental to the climate. For example, putting QR code stands on tables asking for diners’ feedback or ratings of quality for the food stations provided. Student feedback could allow the residence dining hall to make necessary adjustments to the menu, reducing potential food waste. Understanding motivation, as opposed to simply what they do or do not like, could be useful as dietary-based motivation or taste-based motivation require different solutions.

## References

- All Access Dining FAQ* – FOOD AT UBC VANCOUVER. (n.d.). <https://food.ubc.ca/all-access-dining-faq/>
- Batra, R., Seifert, C., & Brei, D. (Eds.). (2015). *The Psychology of Design: Creating Consumer Appeal* (1st ed.). Routledge. <https://doi.org/10.4324/9781315714806>
- Cooremans, K., & Geuens, M. (2019). Same but Different: Using Anthropomorphism in the Battle Against Food Waste. *Journal of Public Policy & Marketing*, 38(2), 232-245. <https://doi.org/10.1177/0743915619827941>
- Hall, J. D., & Madsen J.M. (2022). Can behavioral interventions be too salient? Evidence from traffic safety messages. *Science*, 376(6591), [10.1126/science.abm3427](https://doi.org/10.1126/science.abm3427)
- Hanada, M. (2017). Correspondence analysis of color-emotions associations. *Color Research and Application*, 42(2), 224-237. [224-237doi.org/10.1002/col.22171](https://doi.org/10.1002/col.22171)
- Luo, Y., Li, A., Soman, D., & Zhao, J. (2023). A meta-analytic cognitive framework of nudge and sludge. *R. Soc. Open Sci.* 10(11), <https://doi.org/10.1098/rsos.230053>
- McCambridge, J., Witton, J., & Elbourne, D. R. (2014). Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. *Journal of clinical epidemiology*, 67(3), 267–277. <https://doi.org/10.1016/j.jclinepi.2013.08.015>
- Pandey, S., Olsen, A., Perez-Cueto, F. J. A., & Thomsen, M. (2023). Nudging toward sustainable food consumption at university canteens: A systematic review and meta-analysis. *Journal of Nutrition Education and Behavior*, 55(12), 894-904. <https://doi.org/10.1016/j.jneb.2023.09.006>
- Putnam-Farr, E., Dhar, R., Gorlin, M., Upritchard, J., Hatzis, M., & Bakker M. (2023). Forgot Your Bottle or Bag Again? How Well-Placed Reminder Cues Can Help Consumers Build Sustainable Habits. *Climate Change: Consumer Understanding, Response, and Interventions*, 8(3), 264-275. <https://doi.org/10.1086/725110>
- Ritchie H., Rosado, P. & Roser, M. (2022). Environmental Impacts of Food Production. *Ourworldindata*. <https://ourworldindata.org/environmental-impacts-of-food>
- Strömmer, S., Lawrence, W., Shaw, S., Correia Simao, S., Jenner, S., Barrett, M., Barker, M. (2020). Behaviour change interventions: getting in touch with individual differences, values and emotions. *Journal of Developmental Origins of Health and Disease*, 11(6), 589–598. <https://doi.org/10.1017/S2040174420000604>
- UBC Sustainability. (n.d.). *Climate Action Plan 2030*. UBC Vancouver Climate Action Plan 2030 | UBC Campus & Community Planning. <https://planning.ubc.ca/cap2030>

Zhang, J., Huang, Y., Zhu, J., & Zhao, L. (2023). A meta-analysis on the effectiveness of food-waste reducing nudges. *Food Policy*, 120(102480). <https://doi.org/10.1016/j.foodpol.2023.102480>

Zhao, Jiaying. (2024). *PSYC 421 SEEDS Projects 2024* [PDF]. University of British Columbia, PSYC 421.

Zheng, H., Chen, K., M, Z. (2023). Interactive effects of social norms and information framing on consumers' willingness of food waste reduction behavior. *Journal of Retailing and Consumer Services*, 75(103525). <https://doi.org/10.1016/j.jretconser.2023.103525>

## Appendices

### Appendix A: The Conditions

When creating the visual aspects of this poster, we focused on positive images and messaging to increase the chances of behavioural change in viewers (Strömmer, 2020). We used the representative image of a cute, round, anthropomorphic earth figure to attract attention and increase positive reactions to our message (Batra, 2015). Viewing cute images can elicit happiness, an emotion we hoped to focus on and bring diners to when viewing our poster (Batra, 2015). Thinking of the dining hall as a space filled with other messaging and signage, red was chosen as a standout colour. Red is a high-activity colour that has been shown to increase arousal (Hanada, 2017). After finalizing the poster with recent food waste statistics specific to Gather, and getting approval from the dining hall manager, we were able to move forward and print various sizes of our poster.

Figure 1. Intervention Poster

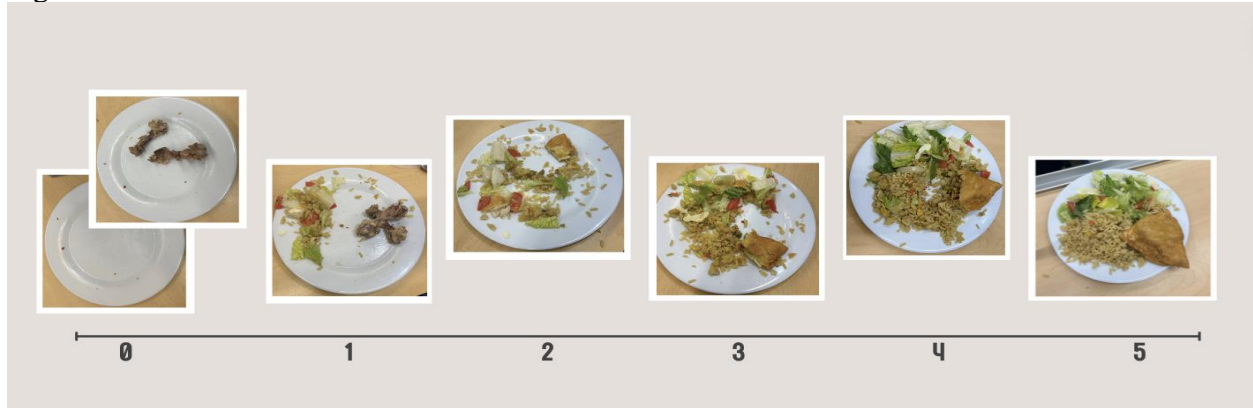




## Appendix B: Methods & Results

### Methods

Figure 2.



The team created the scale by taking 20 photos and selecting the ones that felt most representative of each number. A 0 is a plate with nothing on it or only containing unavoidable food waste. Unavoidable food waste consists of anything that would be unreasonable or impossible for an individual to eat. Bones, peels, and eggshells are examples of anticipated unavoidable food waste. The opposite end of the scale, 5, is represented by a completely untouched plate. The group elected only to score whole numbers in order to maintain inter-rater reliability, as the discrepancies became too large when attempting to incorporate rational numbers. To maintain inter-rater reliability, groups of two will observe diners' behaviour simultaneously, allowing us to determine the average rating of food waste. We will further measure the percentage of agreement between ordered ranking with the aim of an 80% agreement, averaging the remaining values.

## Results

Figure 3a. Plate Waste Observations

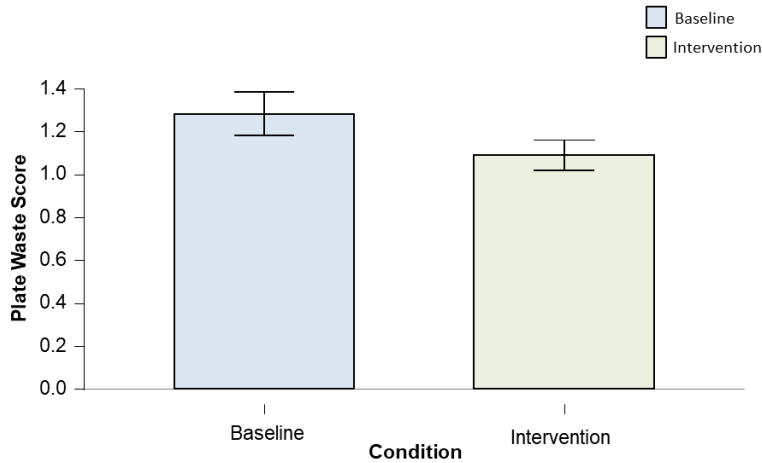


Figure 3a. shows a marginally significant difference between baseline and intervention conditions (95% CI [-0.02, 0.13]).

Figure 3b. Kilogram Waste per Person

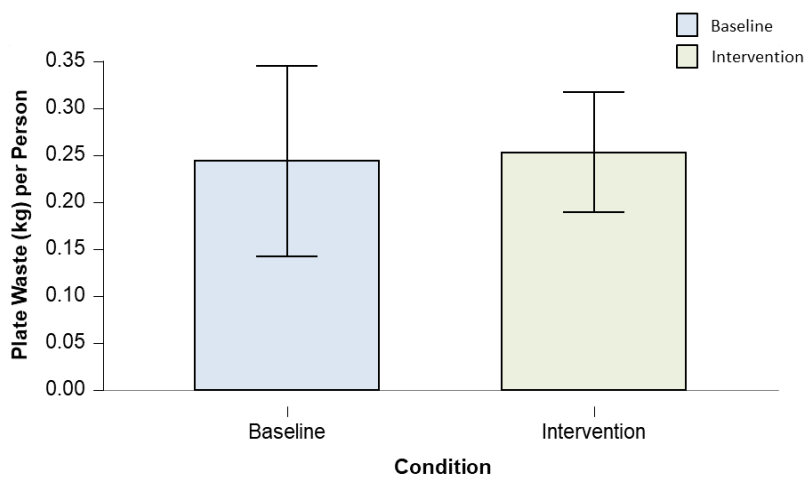


Figure 3b. Demonstrates that no significant difference was observed between conditions, with the intervention showing a higher weight (95% CI [-0.66, 0.47]).