

Testing the efficacy of a portion plate on reducing plate waste in a university dining hall

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Introduction

- Global Level:
 - Food fit for human consumption wasted annually is estimated to be **1.3 billion tons**, representing $\frac{1}{3}$ of **total food produced** for humans (Food and Agriculture Organization [FAO], 2018).
- National Level:
 - 30-40% food estimate to be wasted from general food supply in the United States (USDA, n.d.).
 - Estimated **133 billion pounds** of food wasted annually, worth \$161 billion (USDA, n.d.).

Introduction

- College and University Dining Facilities:
 - Generate **3.6 million tons** of waste annually, with **10-20%** estimated to be food waste (Whitehair & Shanklin, 2013).
- Foodservice managers are motivated to implement sustainability methods for both financial and environmental benefits (Kwon et al., 2012).
- University efforts to reduce waste:
 - Going trayless has reduced the amount of food taken and wasted by **25-30%** (Vogliano & Brown, 2016).
 - Educational messaging (Whitehair et al., 2013).

Introduction

- Prompt-like (simple, one-glance) messages contributed to a **15% reduction** in food waste (Whitehair et al., 2013).
- Decreased portion size of a single food item resulted in decreased production, consumption, and **waste** of that food item (Freedman & Brochado, 2010).
- Connection between the visual cue of a **portion plate** and **weight loss** due to decreased portions (Kesman et al., 2011; Pederson et al., 2007).
 - **However, there is limited research on the effect of portion plate usage on plate waste.**

The purpose of this study was to determine if introducing the option of a portion plate in a university dining facility would impact consumer plate waste in that facility.

Methodology

- Permission granted to use Geisert Dining Hall for data collection by the Director of Dining Services at Bradley University.
- The study was approved by the Institutional Review Board (IRB) at Bradley University.
- Survey instruments assessed participants' knowledge and beliefs regarding food/plate waste, sustainability, along with demographic information.
- Instruments pilot tested with 25 university students and modifications were made based on relevant feedback.
- Modifications included grammatical changes and inclusion of graduate students in demographics questions.

The objectives of this research study were:

- 1) To determine the effectiveness of a portion plate on reducing plate waste in a university dining facility.
- 2) Gain insight into potential contributors of plate waste from the consumer perspective.
- 3) Pilot test an implementation strategy for reducing waste in a university setting.

Methodology

- Participants
 - Convenience sample of Bradley University students 18 years of age or older who had a campus meal plan and dined at the residential dining halls.
- A sample size of 196 responses was desired, based on a population of 400 people (Dillman et al., 2014).
- Data was collected in two phases, 4 weeks apart.
- Phase 1
 - 375 total diners
 - **201 usable surveys** (53.6% of diners)
- Phase 2
 - 453 total diners
 - **278 usable surveys** (61.3% of diners)

Survey Participants

Table 1. Demographics Information	Phase 1	Phase 2
Characteristics of Participants	<i>n</i> = 201	<i>n</i> = 278
	<i>n</i> (%)	<i>n</i> (%)
<i>Gender</i>		
Female	112(56)	156(56)
Male	89(44)	122(44)
<i>University Level of Education</i>		
Freshman	119(59)	192(69)
Sophomore	52(26)	57(21)
Junior	15(7)	15(5)
Senior	12(6)	10(4)
Graduate Student	3(2)	4(1)
<i>Dining Frequency Per Week</i>		
1-2 times	34(17)	51(18)
3-4 times	60(30)	78(28)
5-6 times	55(27)	73(27)
7 or more times	52(26)	76(27)

Methodology

- Data was collected at **Geisert Dining Hall** on campus.
- Collected during the dinner hours of operation.
 - **5pm – 8pm**
- Two Phases
 - Phase 1 on a Wednesday in March.
 - Phase 2 on a Wednesday in April (4 weeks later).
- Geisert reruns their menu cycle every 28 days therefore the menu was identical for both days.

Phase 1 Methodology

- Phase 1 data was collected under the normal conditions of Geisert Dining Hall.
- Regular plateware were utilized by students.
- Surveys administered to students as they dined.
- Surveys collected as students exited the dining hall.
- Waste was collected and measured from plates only, with food from bowls and cups omitted. This was to determine if the implementation of the portion plate in Phase 2 would alter the amount of plate waste generated.

Phase 1 Methodology

- Plate waste for all diners (*n* = 375) was collected and discarded into one of two bins in the dishroom:
 - **Bin 1: Edible waste**
 - All food scraps from plates.
 - **Bin 2: Inedible waste**
 - All napkins, straw wrappers, and fruit peels/cores.
- Bins were periodically weighed and data were recorded.
- Edible, inedible, and aggregate waste reported.





Regular Geisert
dinner plate:
10¼ inch diameter



Optional Substituted
Chinet Portion Plate:
10¼ inch diameter

Phase 1

Phase 2

Phase 2 Methodology

- Normal conditions of Geisert still in place.
- Regular serviceware was still available for patrons.
- Research assistants stood at entrance and handed out portion plates and surveys to students who wanted to participate.
- Did not replace all the plates with portion plates due to ethical and customer satisfaction concerns.
- Waste was collected and measured from plates only, with food from bowls and cups omitted.
- Used portion plates were discarded separately, and the weight of the used portion plates was not included in the data analysis as inedible waste.

Phase 2 Methodology

- Plate waste for all diners ($n = 453$) was collected and discarded into one of two bins in the dishroom:
 - **Bin 1: Edible waste**
 - All food scraps from plates.
 - **Bin 2: Inedible waste**
 - All napkins, straw wrappers, and fruit peels/cores.
- Bins were periodically weighed and data were recorded.
- Edible, inedible, and aggregate waste reported.



Data Analysis

- Data were analyzed using the SPSS Statistics version 25 (International Business Machines [IBM] Corporation, Armonk, New York).
- Statistical tests used included descriptive statistics and One Way Analysis of Variance (ANOVA) for the survey instruments.
- Chi-Square tests were used to measure differences in demographic data.
- Statistical significance was measured at the $p \leq .05$ level.

Results

- There were no significant differences between the demographics of students in Phase 1 and Phase 2. Identical percentages of female and male students were identified in Phase 1 and Phase 2, $c^2(1, N = 479) = 0.01, p = .93$.
- Likewise, the percentages of each education level were markedly similar, $c^2(4, N = 479) = 5.45, p = .24$, along with frequency of dining, $c^2(3, N = 479) = 0.41, p = .94$, concluding that there were no significant differences in demographics of participants in either phase of the study.

Results

Phase 1 ($n = 201$)

- Gender vs. frequency of dining
 - Males more likely to eat at the dining halls than females $F(1, 199) = 13.91, p < .001$.
 - 5-6 times per week for males, 3-4 times per week for females.
- Gender vs. typically finishing food
 - Males more likely to typically finish all the food on plate than females, $F(1, 199) = 15.63, p < .001$.

Results

Phase 2 ($n = 278$)

- Gender vs. frequency of dining
 - Males more likely to eat at the dining halls than females $F(1, 276) = 6.05, p < .015$.
 - 5-6 times per week for males, 3-4 times per week for females.
- Gender vs. typically finishing food
 - Males more likely to typically finish all the food on plate than females, $F(1, 276) = 9.09, p < .003$.

Results

Phase 2 ($n = 278$)

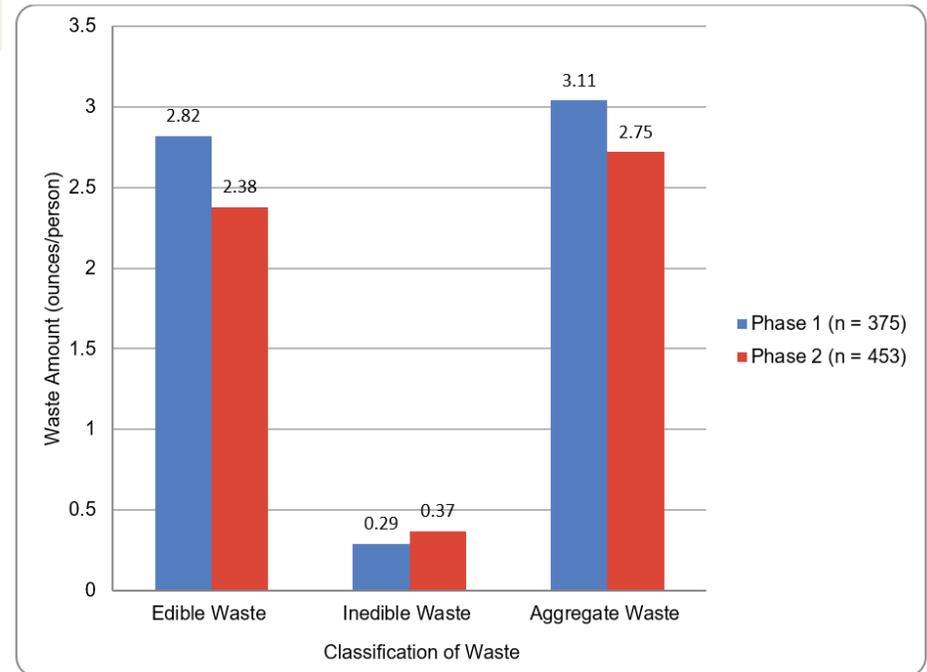
- Of the 278 survey respondents that used the portion plate:
- About **46%** of the respondents ($n = 128$) indicated **increased awareness of food choices**.
- About **45%** ($n = 124$) indicated they **chose less food**.
- Of the 128 respondents who indicated increased awareness of food choices, about **66% chose less food**.



Discussion

- The mean amount of edible waste per person **decreased** from 2.82 oz. per person in Phase 1 to 2.38 oz. per person in Phase 2.
- There was a very small increase (0.08 oz.) in the mean inedible waste from Phase 1 to Phase 2 from 0.29 oz. per person to 0.37 oz. per person.
- The mean amount of aggregate waste per person **decreased** from 3.11 oz. per person in Phase 1 to 2.75 oz. per person in Phase 2, indicating a reduction in total waste as a result of the portion plate intervention.

Figure 1: Comparison of edible, inedible, and aggregate waste per person of diners in a residential dining hall.



Discussion

- There was a very small increase (0.08 oz.) in the mean inedible waste from Phase 1 to Phase 2 from 0.29 oz. per person to 0.37 oz. per person.
- A possible explanation is that this could have been attributed to slight variances in the foodservice system inputs, transformations, or outputs during Phase 1 and Phase 2.
- For example, providing cut cantaloupe with or without the rinds removed, differences in condiment packaging, or the availability of seasonal fresh fruit.

Conclusion

- The purpose of this study was to determine if introducing the option of a portion plate in a university dining facility would impact consumer plate waste in that facility.
- The use of a portion plate in a university dining facility may have some benefits in reducing the amount of plate waste per consumer.
- The results from this study found that in general, the amount of edible food waste per person decreased when using the portion plate.
- Consumer awareness of food choices increased and consumers made more deliberate food choices while using the portion plate.

Conclusion

Limitations

- Limitations of the study included a sample collected in one mid-sized private Midwestern university, therefore the results from the intervention cannot necessarily be generalized to a larger setting.
- The data were collected at only two points in time; therefore, the lack of replications was a limitation.

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Conclusion

Future research recommendations

- Future studies focused on the use of a portion plate could attempt to implement the portion plate intervention in other types of foodservice operations or in other geographic locations with larger sample sizes.
- Additionally, long-term effects of the use of portion plates could be researched by increasing the number of intervention replications, coupled with an extended data collection time period of six months or longer.

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