Cafeteria Customers' Preferences between Disposable Containers and Utensils Versus Reusable Alternatives

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Abstract

Waste management, particularly plastics in the waste stream pose serious threats to the environment, economy, and human health. Of particular concern is the persistence of plastics in the environment due to their incredibly long shelf life, which may be in the thousands of years. Due to the rise in plastics production and plastic waste, it is important not only to recycle plastics but to reduce their use altogether. Half of all plastics produced are discarded after just a single use even when reusable alternatives exit. This study assessed what proportion of disposable materials were used by cafeteria patrons as opposed to their alternatives. The results showed that an overwhelming majority of customers selected biodegradable food containers, paper cups, and plastic utensils instead of glassware, coffee mugs, and metal cutlery. These results reveal that there is ample opportunity to divert and minimize disposable materials use from entering the waste stream in a corporate catering setting.

Introduction

Waste management is an issue that touches every person and institution on a daily basis to some degree. According to the US EPA's Report on the Environment (2016), solid waste generated per person in the United States grew consistently from 2.7 pounds per day in 1960 to a peak of 4.6 pounds per day in 1990 and has held steady since. Waste management has come a long way since the US EPA was established in 1970 when it primarily involved either transporting waste to landfills or burning it to make room for more. Since then, emphasis shifted from merely disposing of waste to a holistic approach known as Sustainable Materials Management (SMM) which focuses on conservation of resources, minimizing waste, and promoting reuse and recycling of materials with disposal serving as a last resort (US EPA, 2018).

In 1960, just 6 percent of waste was recycled while the remaining 94 percent headed for the landfill and in 2014 these rates were 26 and 53 percent, respectively (the remaining 21 percent was either composted or combusted) (US EPA, 2016). While the rise in recycling rates and corresponding fall in landfilling is commendable, new and innovative solutions need to be explored to further decrease the percentage of waste that ends up in landfills. Of particular concern are plastics in the waste stream because these are recycled at the lowest rate (9.1 percent in 2015) when compared to other material types in municipal solid waste (US EPA, 2018).

Plastic production has grown exponentially since the 1950s and, as of 2017, a cumulative total of 8.3 billion metric tons (MT) was produced worldwide (Brooks, Wang, & Jambeck, 2018). Of that cumulative total, an astounding 6.3 billion MT are attributable to plastic packaging and disposable items (Brooks, Wang, & Jambeck, 2018). Half of the plastics produced were thrown out after only a single use (Schnurr et. al., 2018). Considering that plastics are

estimated to last for hundreds to thousands of years, the incredibly high percentage of plastics that are landfilled (75.4 percent) annually is cause for alarm (Xanthos & Walker, 2017; US EPA, 2018).

To boot, even the most advanced biodegradable plastics can persist from 1 month to 33 years in soil and 18 months to *never degrading* in water depending on the plastic composition (Narancic et. al., 2018). Importantly, studies highlight that the environmental effects of biodegradable plastics need to be studied more in depth as ecological benefits derived from these products may possibly be negated if production proves to be a resource drain or simply relocates waste to earlier in the product life cycle (Russell, 2014).

Plastics pose a unique threat to the marine environment and can have adverse economic effects on tourism, cause damage to shipping vessels, and negatively affect human health. As Xanthos & Walker (2017) summarized in their review of international policies, starting in the 1990s many countries recognized this concern and have been enacting policies (in varying degrees of success) to reduce plastic marine debris through actions such as banning, restricting, or taxing plastic bag use, microbeads, and single-use plastics (SUP). In a later publication, the same authors urgently called for a total SUP ban in Canada in an effort to move toward zero plastic waste (Walker & Xanthos, 2018).

China passed the National Sword policy, effective January 2018, which bans plastic waste from being imported for environmental reasons (Watson, 2018). Because of the Chinese ban, the US and other nations are forced to send waste to countries that are ill-equipped to take on the waste that is displaced by the ban. It is estimated that 111 million metric tons of plastic waste will be displaced by 2030 (Brooks, Wang, & Jambeck, 2018).

Legislative actions such as those taken by China are important and effective steps towards reducing overall plastics and general solid waste. However, as noted by Schnurr et. al. (2018), self-imposed waste interventions employed by private individuals have the potential to fill and augment the gaps in legislative strategies. In order to assess how big of an impact individual actions can have on the plastics waste issue, it is important to learn how often disposable items are used when reusable alternatives are available.

A cafeteria provides a good starting point for analysis as waste tends be limited to a fewer types of materials thrown out as compared to general trash. Additionally, a study of school cafeteria waste revealed that plastics account for up to 18 percent of total waste, which is 5 percent higher than total plastic waste generated (13.1 percent) in 2015 in the US (Wilkie, Graunke, & Cornejo, 2015; US EPA, 2018). This suggests that a change in cafeteria waste patterns can have a notable effect on overall plastics waste. To that end, this study explores what is the difference in the proportion of cafeteria customers who opt to use disposable containers and utensils and those who choose reusable alternatives? Based on anecdotal evidence, the author anticipates that cafeteria patrons will overwhelmingly opt to use disposable items like paper or plastic containers for food and drink instead of glassware and plastic utensils instead of metal cutlery.

Methods

Background on Sampling Site

The Federal Reserve Bank of Chicago (FRBC) building is home to about 1,600 Federal Reserve System employees along with several hundred employees from about a dozen tenant

companies renting office space. Bistro 230 is a food hall style cafeteria catered by Sodexo inside the FRBC building that provides subsidized breakfast, lunch, snacks, and drinks. The café is accessible only to employees of FRBC and the employees of the tenant companies. Due to the cost savings and convenient location, many of the people who work in the building tend to pick up, both, breakfast and lunch from Bistro 230 in addition to the occasional snacks or coffee runs.

The flow of customer traffic starts at the main entrance to Bistro 230, where customers can stop at one of several cook-to-order meal stations or some food is ready for self-serve. There is also a minimart section which sells canned and bottled drinks, chips, candy, and other general snacks.

At each station, customers have the option to use disposable containers such as plastic clamshell containers for fruit and salad or biodegradable containers for most other foods. Alternatively, they may opt to use plates and bowls (glassware) which are made from shatterproof plastic and can be returned to the café kitchen to be washed and reused repeatedly. Some foods, like breakfast sandwiches, are pre-wrapped in paper and do not require containers or plates for transport. The drinks station also offers customers the choice between paper cups, shatterproof mugs, or customers can bring in their own 16 oz. cup for a $0.10 discount on their drink of choice.

At the end of the café, customers pass through one of four cash registers where they pay for their meals or drinks before moving on to the utensils and condiments stations. The utensils available are either disposable black plastic or metal which, like the glassware, can be returned to the kitchen for washing and reuse. The fact that the plastic utensils available at Bistro 230 are made of black plastic is significant and should serve as good reason to reduce their use because

black plastic is particularly problematic. Studies revealed that black plastics are largely produced from recycled waste electronic and electrical equipment which results in potentially harmful chemicals making their way into newly produced black plastic products including those intended for food handling (Turner, 2018).

Lastly, customers can either stay on the same floor as the cafeteria at one of many booths and tables or they may take their meals back to their office. Most customers tend to take their meals either back to their desks or to their office lounge rather than eating at Bistro 230.

Data Collection

In order to assess customers' preference between disposable and reusable materials, customers' purchases were observed at the cash register and their choice of utensil, if any, was marked after they paid for their meals. The observations were carried out during breakfast time, around 8:00AM CST, and again during lunch, around 12:00PM CST, on each day Tuesday through Thursday. These days and times were selected because that is when there are the most employees in the FRBC building. Since flexible work arrangements are a benefit offered to FRBC employees and other tenant companies in the building, there tend to be fewer employees in the office on Mondays and Fridays. Thirty (30) customers were observed and recorded during each observation period for a total of 180 observed customers over the course of six (6) observation sessions.

A data collection sheet, as shown in Figure 1, was used to quickly check off which items were used by the customer including their gender, choice of food container (biodegradable container, plastic clamshell, or glassware), utensil (disposable plastic or metal), drink (bottled or

canned, paper cup, or shatterproof mug), and other food (prepackaged foods or whole fruit). For ease of recording information, the day of week and time of day was pre-filled each day before beginning the observation period. Then, as each customer checked out, a check mark was placed next to the item that customer used.

The observation did not include recording how many of each item was used. For example, if a customer had two plastic containers as part of their purchase, only a single check mark was used to indicate the use of plastic containers.

Statistical Analysis

Once the raw data was collected, the information was transferred from printed data collection sheets to a Microsoft Excel workbook where each check mark was noted as a "1" and blank space noted as "0" for ease of calculations and analysis. Table 1 shows the transferred entries for the first five customers observed as visual reference.

The data was then summed up by groupings of gender, time of day, and day of the week and subsequently tested for normal distribution. The distribution of the data determined which test was used to assess whether statistically significant differences among sample groups exist. Data that was not normally distributed was analyzed using the Mann-Whitney U-test. An ANOVA analysis was performed on the data that was normally distributed to test whether statistical differences exist among the samples. This analysis was then followed by a post-hoc Tukey Honest Significant Difference (HSD) test to identify among which sample groups statistically significant differences exist. The test compared variances between males and females for the type of item used for each major category: food containers (biodegradable vs plastic vs glassware), utensils (plastic vs metal), drinks (bottled/canned vs paper cup vs mug), and other

(prepackaged foods vs whole fruit). Table 3 shows the sample comparisons and their Tukey HSD results in detail.

Results

Looking at the raw data, as visualized in Figure 2, it is apparent that disposable containers, utensils, and cups dominate customer's purchases over reusable alternatives like glassware and metal utensils. The combined totals indicate that customers overwhelmingly chose biodegradable containers, plastic utensils, and paper cups. The results are further summarized, including p-values and means for males and females, in Table 2. As noted in Table 2, the data was normally distributed for all sampled groups with the exception for the use of the shatterproof coffee mugs.

The Tukey HSD test indicated that statistically significantly more biodegradable containers (ANOVA, $F=18.7419$, $p=1.97x10^{-08}$) were used by both males and females than plastic containers and glassware. However, there were no significant differences between males' and females' choices among the food containers as well as between the use of plastic containers versus glassware.

Significantly more plastic utensils were used by both men and women (ANOVA, $F=37.7426$, $p=2.00x10^{-08}$) than metal utensils. Indeed, of the 150 purchases where utensils were used 136, or nearly 91 percent, of customers chose plastic utensils. There was no difference between genders in their preference among utensil types.

Significantly more paper cups were used by females compared to bottled or canned drinks (ANOVA, $F=5.0775$, $p=0.0089$). Additionally, more paper cups were used by men than

bottled/canned drinks purchased by women. However, there was no significant difference in men's choice between bottled/canned drinks versus paper cups.

Since the results for coffee mugs were not normally distributed, a Mann-Whitney U test was performed separately to compare data between males and females for this item. The U-value calculated for coffee mugs was 14.5. At a significance level of $p<0.05$ the critical U-value is 7; therefore, there was no significant difference in preference for coffee mugs between men and women (Mann-Whitney U test, $U=14.5$, $p<0.05$). However, looking at the overall data for drink options, coffee mugs clearly constituted the smallest percentage of the options available. Of the total 91 observed drink purchases, just 4 used the provided coffee mugs in lieu of paper cups or bottled/canned drinks.

Lastly, there were no significant differences in preference between prepackaged foods and whole fruit (ANOVA, $F=3.6049$, $p=0.0314$); likewise, there was no difference among the genders when choosing between whole prepackaged foods and whole fruit.

The results of the Tukey HSD are completely summed up for all tested pairs in Table 3.

Discussion & Future Actions

Study Findings

The total amount of solid waste generated in the US has been in excess of and held somewhat steady at approximately 245 MT of waste annually since 1999 (US EPA, 2016). Meanwhile, plastics production has grown exponentially due to its low cost to produce and durability. As a result, the marine environment in particular suffers as discarded SUPs enter waterways and oceans with little hope of ever disintegrating. Studies indicate that although

countries are recognizing the threat that plastics in particular pose and have been implementing policies in an effort to curb plastic pollution, it will be the actions of private individuals and institutions to fill the gaps where policies come short or fail altogether (Schnurr, 2018).

The goal of this inquiry was to explore exactly what proportion of cafeteria customers choose disposable materials even though they generally do not leave the building to eat and have glassware readily available as an alternative. The glassware can conveniently be returned to the kitchen for washing and reuse and customers can even receive a small discount ($0.10) on drinks if they bring their own cups. Observation of customers at breakfast and lunch over the course of three days supported the author's hypothesis that the vast majority of customers opt for the disposable options despite reusable options being readily available.

As noted earlier, plastic waste from cafeterias, on average, was higher than overall plastic waste in the waste stream (Wilkie, Graunke, & Cornejo, 2015; US EPA, 2018). The results of the study performed in Bistro 230 reveal that there is a clear opportunity to not only encourage proper recycling of plastics but, more importantly, to reduce the use of plastics and other disposable items altogether. This implication can even potentially result in a financial incentive for Bistro 230 to encourage use of reusable materials as that would mean expenses for supplies, such as plastic utensils, would likely fall.

Study Limitations & Potential Improvements

While the author's hypothesis was supported by the data gathered in this study, a few study limitations and areas for improvement should be acknowledged. First, the data collected in this study was strictly binary, meaning data collected only indicated that a customer used a

particular item but did not account for the number of items used. For example, if a customer use two separate plastic containers for their food, the study only recorded the use of the container and not how many of each item customers used. Such an accounting for the number of items used per customer would likely result in more accurate data. It is also important to note that observations were performed over the course of only three days; a longer observation period may also have resulted in more accurate data collection by increasing sample sizes for statistical analysis.

Additionally, an improvement to this study would be to perform a proper waste audit of Bistro 230 and receptacles found throughout the FRBC building like that performed by Wilkie, Graunke, and Cornejo (2015). By sorting out all waste into major category types, the study would better reveal how many of the SUPs end up in the trash as opposed to recycling bins. An audit would also allow for an assessment of what proportion of recyclable materials are erroneously thrown out with general trash. This approach would reveal a more complete picture of the waste stream and likely would identify other major sources of plastic waste than utensils and food containers.

In addition to the aforementioned suggestion for making this inquiry more robust through waste audits, there are opportunities to build upon the results from this study through future surveys and studies.

Future Inquiries

Based on the research gathered and the results of this study, the below are some possible inquiries to explore:

(1) *What motivators, if any, would encourage cafeteria customers to choose reusable dishes and utensils over disposable options? Are there differences in motivations between men and women?*

For example, would making the return of dishes to the kitchen more convenient, financial incentives (like meal discounts), reminders throughout the cafeteria, or some other motivators improve the rates of using sustainable options? Lakhan performed a study in 2016 on the recycling habits of residents in multi-residential buildings in Ontario and found that, surprisingly, making recycling more convenient did not have a notable effect on recycling rates, rather putting up posters that reminded people to recycle had the more notable positive effect. These results suggest making the return of glassware and mugs to the Bistro 230 kitchen more convenient would likely not make much difference in cafeteria customers an investigative questionnaire may still be worth exploring as separating recyclables may not be fully comparable to returning dirty dishes to the Bistro 230 kitchen.

(2) *Would implementing a "by request" policy for single use plastics reduce the proportion of customers who choose disposable containers and utensils over reusable alternatives?*

(3) *How would educating customers about the benefits of choosing sustainable cafeteria items affect the proportion of customers who opt to use disposable containers and utensils and those who choose reusable alternatives?*

A study of workplace recycling behaviors revealed that when recycling intervention educated and empowered employees, they were more likely to connect their intent to the environment and thus more likely to recycle regularly (Prugsamatz Ofstad, Tobolova, Nayum, & Klöckner, 2017). An improved study would marry the results of the aforementioned studies and

the present study by putting up signs around Bistro 230 to educate and encourage customers to choose reusable dishes and utensils. Next, the study would follow up with another observation period to assess whether the proportion of customers who use disposable items has shifted at all. The ultimate result would hopefully be an overall reduction in the use of disposable items and those that are used would be properly separated for recycling with only a fraction of Bistro 230 waste ending up in the landfill.

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Appendix

Figures 1-2

#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Way of Week (T/W/R)	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Time of Day (B/L)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Male	x														
Female		x													
Biodegradable container	x														
Plastic Container		x													
Plate or Bowl															
Plastic Utensils	x														
Metal Utensils															
Bottled or Canned Drink															
Paper Cup	x														
Coffee Mug															
Pre-packaged Food		x													
Whole Fruit															

Figure 1. Sample of data collection sheet. First two entries are actual data collected at breakfast time on Tuesday.

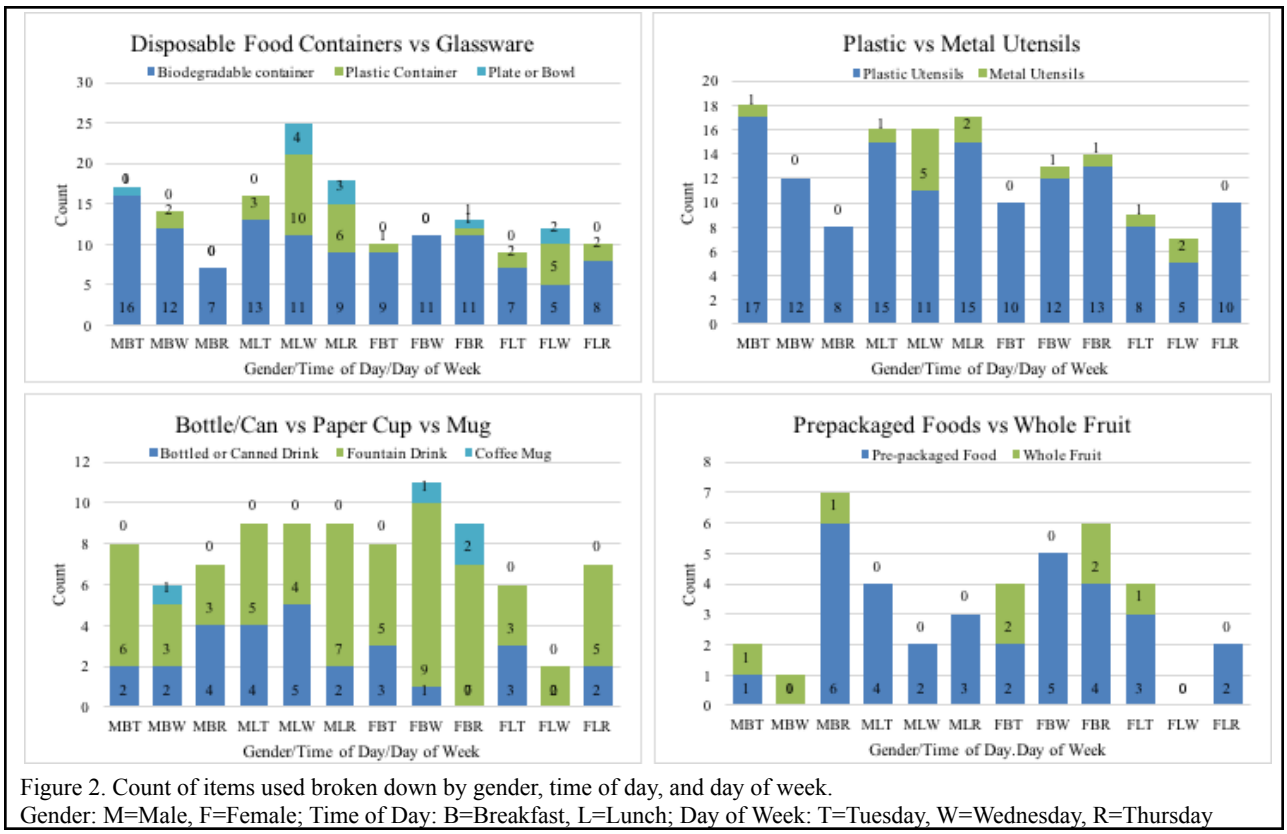

Figure 2. Count of items used broken down by gender, time of day, and day of week.
Gender: M=Male, F=Female; Time of Day: B=Breakfast, L=Lunch; Day of Week: T=Tuesday, W=Wednesday, R=Thursday

Tables 1-3

Table 1. Sample of data transferred for first 5 customers from observation sheet to Excel workbook.

#	Day of Week	Breakfast/ Lunch	Male/ Female	Biodegradable container	Plastic Container	Glass ware	Plastic Utensils	Metal Utensils	Bottled or Canned Drink	Paper Cup	Coffee Mug	Pre-packaged Food	Whole Fruit
1	Tues	B	M	1	0	0	1	0	0	1	0	0	0
2	Tues	B	F	0	1	0	0	0	0	0	0	1	0
3	Tues	B	F	0	0	0	1	0	1	0	0	0	0
4	Tues	B	M	1	0	0	1	0	0	0	0	0	0
5	Tues	B	F	1	0	0	1	0	0	0	0	0	0

Table 2. Summary items selected by customers and test for normal distribution

Gender	Time of Day	Day of Week	Biodegradable container	Plastic Container	Glassware	Plastic Utensils	Metal Utensils	Bottled or Canned Drink	Paper Cup	Coffee Mug	Pre-packaged Food	Whole Fruit
Male	Breakfast	Tue	16	0	1	17	1	2	6	0	1	1
Male	Breakfast	Wed	12	2	0	12	0	2	3	1	0	1
Male	Breakfast	Thu	7	0	0	8	0	4	3	0	6	1
Male	Lunch	Tue	13	3	0	15	1	4	5	0	4	0
Male	Lunch	Wed	11	10	4	11	5	5	4	0	2	0
Male	Lunch	Thu	9	6	3	15	2	2	7	0	3	0
Female	Breakfast	Tue	9	1	0	10	0	3	5	0	2	2
Female	Breakfast	Wed	11	0	0	12	1	1	9	1	5	0
Female	Breakfast	Thu	11	1	1	13	1	0	7	2	4	2
Female	Lunch	Tue	7	2	0	8	1	3	3	0	3	1
Female	Lunch	Wed	5	5	2	5	2	0	2	0	0	0
Female	Lunch	Thu	8	2	0	10	0	2	5	0	2	0
Combined Total			**119**	**32**	**11**	**136**	**14**	**28**	**59**	**4**	**32**	**8**
Male	P-Value		0.94465	0.36053	0.06723	0.64364	0.09034	0.06126	0.57277	<0.0005*	0.93392	0.00697*
Female	P-Value		0.66654	0.15093	0.00804*	0.65078	0.14284	0.28163	0.77804	0.00804*	0.81869	0.05331
Male	Mean		11.333	3.500	1.333	13.000	1.500	3.167	4.667	0.167	2.667	0.500
Female	Mean		8.500	1.833	0.500	9.667	0.833	1.500	5.167	0.500	2.667	0.833

*Data not normally distributed at $p<0.05$.

Table 3. Tukey HSD Test Results

Category	Pair	Q statistic	p-value	Inferfence
Food Containers	Male- Biodegradable Container vs Female- Biodegradable Container	2.7873	0.3829544	insignificant
	Male- Biodegradable Container vs Male- Plastic Container	7.7060	0.0010053	significant at p<0.01
	Male- Biodegradable Container vs Female- Plastic Container	9.3455	0.0010053	significant at p<0.01
	Male- Biodegradable Container vs Male- Glassware	9.8374	0.0010053	significant at p<0.01
	Male- Biodegradable Container vs Female- Glassware	10.6572	0.0010053	significant at p<0.01
	Female- Biodegradable Container vs Male- Plastic Container	4.9187	0.0177517	significant at p<0.05
	Female- Biodegradable Container vs Female- Plastic Container	6.5583	0.0010053	significant at p<0.01
	Female- Biodegradable Container vs Male- Glassware	7.0501	0.0010053	significant at p<0.01
	Female- Biodegradable Container vs Female- Glassware	7.8699	0.0010053	significant at p<0.01
	Male- Plastic Container vs Female- Plastic Container	1.6396	0.8348377	insignificant
	Male- Plastic Container vs Male- Glassware	2.1314	0.6433804	insignificant
	Male- Plastic Container vs Female- Glassware	2.9512	0.3207745	insignificant
	Female- Plastic Container vs Male- Glassware	0.4919	0.8999947	insignificant
	Female- Plastic Container vs Female- Glassware	1.3117	0.8999947	insignificant
	Male- Glassware vs Female- Glassware	0.8198	0.8999947	insignificant
Utensils	Male- Plastic Utensil vs Female Plastic Utensil	3.3952	0.1093142	insignificant
	Male- Plastic Utensil vs Male- Metal Utensil	11.7134	0.0010053	significant at p<0.01
	Male- Plastic Utensil vs Female- Metal Utensil	12.3925	0.0010053	significant at p<0.01
	Female- Plastic Utensil vs Male- Metal Utensil	8.3182	0.0010053	significant at p<0.01
	Female- Plastic Utensil vs Female- Metal Utensil	8.9973	0.0010053	significant at p<0.01
	Male- Metal Utensil vs Female- Metal Utensil	0.6790	0.8999947	insignificant
Drink	Male- Bottle/Can vs Female- Bottle/Can	2.2733	0.3982361	insignificant
	Male- Bottle/Can vs Male- Paper Cup	2.0460	0.4869884	insignificant
	Male- Bottle/Can vs Female- Paper Cup	2.7280	0.2480194	insignificant
	Female- Bottle/Can vs Male- Paper Cup	4.3193	0.0293691	significant at p<0.05
	Female- Bottle/Can vs Female- Paper Cup	5.0013	0.0102705	significant at p<0.05
	Male- Paper Cup vs Female- Paper Cup	0.6820	0.8999947	insignificant
Other	Male- Prepackaged Food vs Female- Prepackaged Food	0.0000	0.8999947	insignificant
	Male- Prepackaged Food vs Male- Whole Fruit	3.5382	0.0901191	insignificant
	Male- Prepackaged Food vs Female- Whole Fruit	2.9938	0.1818122	insignificant
	Female- Prepackaged Food vs Male- Whole Fruit	3.5382	0.0901191	insignificant
	Female- Prepackaged Food vs Female- Whole Fruit	2.9938	0.1818122	insignificant
	Male- Whole Fruit vs Female- Whole Fruit	0.5443	0.8999947	insignificant