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**Social Media Campaign and Food Waste Challenge Raises Awareness and
Reduces Food Waste in the Home**

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Abstract

It is estimated that nearly 40% of the food produced in America is wasted. Households comprise the largest contributor to this total food waste, with retail and food service coming in a close second. The goal of this study was to explore awareness about the issue of food waste in an effort to reduce food waste in the home. A social media campaign and 30-day challenge was developed. A pre- and post-survey was developed and administered to observe the attitudes and awareness of the issue of food waste. There was 1167 pre-survey responses, 17 post-survey responses, and 15 individuals participated in the 30-day challenge. There was a slight decrease in preventable food waste observed when comparing baseline to challenge weeks. Overall most participants believed the social media posts were informative and reported they learned strategies they can use to reduce food waste. Further research and education is needed to teach mindful shopping, storage, and cooking techniques to minimize food waste in the home. Due to the magnitude of the food waste issue in the U.S., there is a need for dietitians and other food and nutrition professionals to educate others, implement food waste reduction strategies in their place of work, and advocate for policy change that limits food waste from farm to landfill.

Social Media Campaign and Food Waste Challenge Creates Awareness and Reduces Food Waste in the Home

Food waste occurs from farm to table and includes crops going unharvested, food damaged in transport, produce rejected at the retail level due to blemishes, consumers buying more food than they can eat, and food thrown away simply due to its use-by, sell-by, and best-by dates. The Natural Resources Defense Council estimates the United States wastes 40% of all the food it produces (Ganders & Bloom, 2017). Many tend to blame grocery stores and the food service industry for the majority of this food waste, but household food waste actually contributes the largest percent of any sector. Households contribute 43% of total food waste, 40% of total food waste comes from consumer-facing business (grocery stores, restaurants, and institutional food service), 10% from agriculture, and 2% from manufactures (ReFED, 2016). It is estimated consumer food waste accounts for 90 billion pounds per year (Buzby, Wells, & Hyman, 2014). As a visual representation, 90 billion pounds of food waste is about the equivalent to 123 times the weight of the Empire State building (USDA, 2018). Therefore, while innovating farming and retail practices are important, consumer-level changes have the potential to make the largest impact on decreasing in total food waste.

For most consumers, food waste is a daily occurrence. In the United States it is estimated anywhere from 0.6-0.9 pounds of food is thrown away per person per day (Thyberg, Tonjes, & Gurevitch, 2015; Conrad et al., 2018). Though not likely intentional, it tends to be dismissed as “not that big of a deal”. Most consumers are not aware of the multi-factored concern with throwing away a half-eaten sandwich, or a bag of spoiled lettuce. To the consumer, the money spent on the wasted food is the most noticeable impact to them personally. It is estimated food

waste costs \$370 per person per year or \$1500 per year for the average family of four (USDA, 2018; Save the Food, 2018). Food waste in the U.S. alone is estimated to cost \$218 billion a year (ReFED, 2016). For perspective, the U.S. spent \$60.6 billion to support the Supplemental Nutrition Assistance Program, formerly known as food stamps in 2018 (USA Facts, 2019). If food waste was better managed that \$218 billion a year could go a long way to provide for food insecure Americans and other sustainable agriculture programs. Estimates suggest food wasted globally could feed 2 billion people (Conrad et al., 2018). This food could be diverted to the 814 million people who go hungry in the world, including the 42 million food insecure Americans in the U.S. (FAO, n.d.; Hunger, n.d.). The logistics of getting the surplus food to those in need is a major barrier, but a barrier that could be tackled with the correct policies in place.

Environmental Impacts

Wasted food not only has a financial burden, but negatively impacts the environment, including wasted natural resources used to farm, transport, and process food, which is ultimately wasted. Wasted food drains the resources used to produce the uneaten food including cropland, water, fertilizers, and pesticides to name a few. Research on the relationship between food waste, diet quality, and environmental sustainability reported over 60% of land used to produce fruit and 56% of land used to produce vegetables grew produce that was ultimately uneaten (Conrad et al., 2018). Further, the water used to irrigate those wasted crops amounted to 4.2 trillion gallons (Conrad et al., 2018). To put this in perspective, one wasted chicken egg is estimated to waste 55 gallons of water (Save The Food, 2018).

According to the USDA and the Environmental Protection Agency, food is the single largest component, by weight, entering municipal landfills today (“Advancing,” 2018). When organic material such as food waste decomposes anaerobically in the landfill it releases methane gas. Methane is a greenhouse gas that is harmful to the ozone layer and a contributor to climate change. Landfills produce approximately 14% of human-related methane emissions in the U.S. and is the 3rd largest human-related producer of methane gas (LMOP, 2019). Alternatively, composting food waste allows food to decompose in a process which results in very little methane gas being released. Decreasing food waste and composting the remaining food waste, including fruit and vegetable scraps, can greatly decrease these harmful emissions. Currently only about 5% of food waste is composted (“Advancing,” 2018).

Food Waste in U.S. History

Food waste in the U.S. has been a part of public health promotion in the past. During World War I, the U.S. Food Administration produced the poster found in Figure 1 to emphasize the importance of reducing food waste (Hayden-Smith, 2019). This poster recirculated again during World War II (Hayden-Smith, 2019). During both of these times, the nation was facing hardship and food scarcity. Since that time, food waste has not been widely publicized as a major concern in public health until recently. This is likely due to the perception that the United States has an overabundance of food, though 42 million Americans are food insecure (Hunger, n.d.). The United States Department of Agriculture is highlighting this issue and is emphasizing the economic and environmental concerns with wasted food (“Food Loss and Waste,” n.d.). In September 2015, for the first time in U.S. history, the USDA along with the EPA set a goal to reduce food waste by 50% by 2030 (“Food Loss and Waste,” n.d.). This goal is an important step

for creating awareness about the issue of food waste and arguably more importantly about creating policy change to reduce wasted food. There will need to be much change to our food industry policies and in the mindset of Americans in the next 10 years if they plan to meet this goal. Awareness campaigns like in this study will be important in spreading knowledge about the issue of food waste and educating the public on how they can do their part.



Figure 1. Poster on food waste from the U.S. Food Administration originally produced in 1917 (Hayden-Smith, 2019).

Types of food waste at home

For this study, two categories of food waste, non-edible and preventable food waste were examined. Non-edible food waste was defined as components of food not usually eaten.

Preventable food waste was defined as food that could have been eaten, but for some reason it was thrown out. See Table 1 for examples of the types of food waste.

Preventable Food Waste Examples:	Non-edible Food Waste Examples:
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<ul style="list-style-type: none"> ● Food that spoils before we use it: <ul style="list-style-type: none"> ○ Leftovers ○ Wilted vegetables ○ Moldy fruit ○ Moldy or stale bread ○ Sour dairy products ● Edible skins like potatoes and apple peels we choose not to eat 	<ul style="list-style-type: none"> ● Egg shells ● Used coffee grounds ● Banana peels ● Stems ● Avocado peels ● Apple core ● Grape vines
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Table 1. Examples of food waste by category of preventable and non-edible. This information was provided to participants in the food waste challenge.

Target Audience

This research focused on creating awareness about food waste at the consumer level. The message of reducing food waste is important for all generations, but this project specifically targeted the millennial generation through the use of social media. Millennials at the time of writing this paper are 22-34 years old. Millennials are the fastest growing consumer generation and have decades ahead of them to make an impact on the issue of food waste (Bucuta, 2015). Many millennials support social causes, are well educated, and tech savvy (Bucuta, 2015). These characteristics make them an appropriate target audience for a social media campaign designed to decrease food waste. Research suggests millennials like to use social media and text messaging as their preferred method of communication and use social media as a tool to help them make decisions (Bucuta, 2015).

There are multiple social media outlets available including Facebook, Instagram, Snapchat, Pinterest, Twitter, and LinkedIn. Facebook continues to be used by the most people, but Instagram and Snapchat are growing at a faster rate over the last two years especially with younger adults (Smith & Anderson, 2018). Instagram and Facebook were used for this project;

these platforms allowed the researcher to quickly capture individuals' attention through pictures, graphics, and short videos.

Methods

The Iowa State University Institutional Review Board approved all study procedures. The purpose of this study was to examine awareness about food waste and to decrease food waste in the home with a social media campaign. The campaign used Facebook and Instagram and educated individuals on how to decrease their food waste in their home. This included tips on buying, preparing, storing, and disposing food. This research project gathered data from three parts: the pre-survey (Appendix A), the 30-day challenge, and post-survey (Appendix B).

Pre- and Post-Survey Methods and Materials

Your Food Waste Matters Pre-survey examined the awareness and attitudes about food waste in the home. Questions were adapted and or used from previous studies conducted on this topic (Exodus Market Research, 2007; Qi & Roe, 2016; Visschers, Wickli, & Siegrist, 2016). Survey respondents were asked to report demographic data, share their views of the topic of food waste, and prompted to join the food waste challenge portion of the study. The survey was administered using Qualtrics, an online survey software program, which is able to gather electronic responses anonymously (Qualtrics, Provo, Utah and Seattle, Washington). Subjects were recruited to take part in the study by using the Iowa State University email list for faculty, staff, and students. The email list was obtained through the University's Registrar Office and Human Resources. An email was sent to the ISU email listing with a brief overview of the study and a link to the pre-survey. Subjects were also recruited through the "Your Food Waste

Matters” social media accounts. The survey was promoted on the “Your Food Waste Matters” Instagram and Facebook pages with a link followers could click to take the survey. To increase followers of the social media accounts, the researcher’s personal contacts were invited to follow and to take part in the study. The researcher also used hashtags within the posts to increase the visibility of the accounts to viewers outside personal contacts. Some of the hashtags included: #zerowaste, #savethefood, #foodwaste, #lovefoodnotwaste, and #compost. Any adults (18 years of age or older) were allowed to participate in the surveys and the Your Food Waste Matters 30-Day Challenge.

Your Food Waste Matters Post-Challenge survey was administered using Qualtrics online survey software, and examined awareness and attitudes about food waste after following the “Your Food Waste Matters” social media campaign and/or participating in the Your Food Waste Matters 30-Day Challenge. The post-challenge survey link was sent to the participants of the challenge. It was also sent to individuals whom completed the pre-survey and expressed an interest in the challenge by emailing the researcher, but ultimately did not take part in tracking their food waste for the research study. The link to the survey was also posted on the Your Food Waste Matters social media pages for those following Your Food Waste Matters, but not officially part of the research study to capture those individuals as well.

Food Waste Challenge Methods and Materials

Through the pre-survey, participants were encouraged to follow the Your Food Waste Matters social media accounts and provided with links to both the Facebook page and the Instagram account. The pre-survey also asked if they would be willing to participate in the Your

Food Waste Matters 30-Day Challenge. If they did wish to learn more, they were asked to email the researcher for more information on the challenge.

Participants of the Your Food Waste Matters 30-Day Challenge were asked to establish a baseline of their household food waste by measuring their food waste for two weeks. Non-edible and preventable food waste was measured separately. The total volume for each category was reported and sent to the researcher. Participants were instructed on how to measure their food waste through an email attachment (Appendix C) and video posted to the social media pages. Participants used a Food Waste Tracking Form (Appendix D) to track their food waste for the duration of the study. An email was sent with directions on how to complete the form and a video explaining the form was also posted to the social media pages. The form had space for participants to record the types of daily food waste, as well as space to record the total volume per week for both non-edible and preventable food waste. The form also requested the participants indicate the number of people in their household, the last four digits of their phone number for pre/post analysis, and indicate the week they were documenting. These forms were submitted to the researcher via email.

Once the two baseline weeks were complete participants received a brief outline of strategies to decrease food waste (Appendix E) via email. They were also encouraged to follow on social media for daily posts developed by the researcher highlighting various strategies to decrease food waste in the home. They were asked to implement these strategies to reduce their food waste and measure their food waste during the challenge. The Food Waste Tracking Forms for these four weeks were also submitted to the researcher.

Participants of the 30-Day Challenge were provided an incentive to participate. Those who signed up for the 30-Day Challenge were eligible for a free 30-day trial of Compost Ninja. Compost Ninja is an Iowa-based curbside composting company. Eligibility for the free trial depended on the participant's location and was limited to the first 30 eligible individuals who signed up. Those eligible were able to use this service during the challenge.

Statistical analysis

The surveys were administered online using Qualtrics, which allows participants to be able to answer survey questions anonymously. Statistical analysis of the pre-survey results was completed using Statistical Package for Social Sciences (SPSS; version 24.0, IBM Corporation, 2017). Non-parametric statistics, Independent-samples Kruskal-Wallis tests and Chi-Square analyses were used to examine survey responses by demographics (i.e. gender, age, residence) on the survey data.

Total volume of food waste was recorded for each week and entered into an Excel spreadsheet for analysis. Due to the small sample size for the food waste tracking data and post survey responses, only descriptive statistics analysis are reported.

Results

Pre-Survey Results

A total of 1167 pre-survey responses were received. Over half (52%) were 18-29 years old, 23% were 30-49 years old, 22% were 50-64 years old, and 3% were 65+ years old. Thirty percent of the respondents were male, 70% female and 0.1% other. Participants were asked to

report the number of people in their household: 49% reported 1-2 people, 41% reported 3-4, 10% reported 5+ people.

When asked about their awareness with the issue of food waste, 69% of survey participants responded having read, seen, or heard something about the issue of food waste in the last year. Of the participants completing the challenge, 86% reported having read, seen, or heard something on the topic in the last year.

Respondents were queried if they felt guilty throwing away food. Seventy percent of participants responded yes, 25% reported feeling kind of guilty, and 5% reported they do not feel guilty. Examination of the pre-survey responses for individuals who participated in the challenge, revealed similar results with 71% reported feeling guilty, 21% reported kind of feeling guilty, and 7% reported not feeling guilty.

Approximately 35% of all pre-survey participants reported they waste about the same amount of food as other households of their size, 57% reported they waste less, and 8% reported they waste more. Examination of the pre-survey responses for individuals who participated in the challenge suggests similar responses: 36% about the same, 57% less, and 7% waste more.

In 1-2 person households, 27% reported they waste the same, 65% reported they waste less, and 8% reported they waste more. Households with 3-4 people, 42% indicated they waste the same, 50% indicated they waste less, and 7% indicated they waste more. In households with 5+, 41% indicated they waste the same, 45% indicated they waste less, and 14% indicated they waste more (Figure 2) ($p < 0.05$).

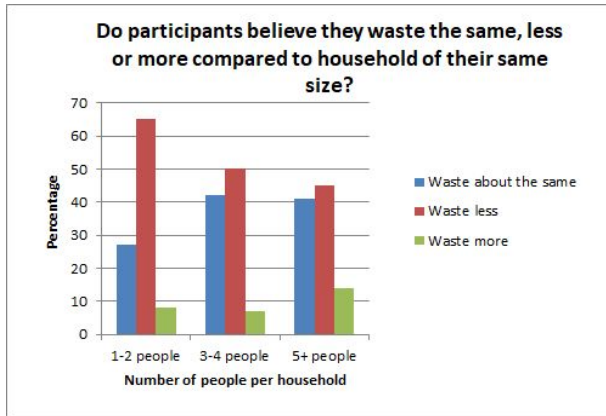


Figure 2. Comparing answers for those with 1-2 people vs 3-4 people vs 5+ people in their household when asked if they believe they waste about the same, less, or more than other households of their same size. ($p < 0.05$)

There were a number of significant differences by age group of the respondents. Overall, 54% of respondents indicated information on cost of food thrown away would be helpful. However, the perceived usefulness of this information was significantly different by age group ($p < 0.05$); 64% of 18-29 year olds responded it would be helpful, in comparison to 45% of 30-49 y.o., 39% of 50-64 y.o., and 25% of 65+ (Figure 3). Thus, perceived usefulness of this information declined with increasing age of the respondent. Among those participating in the challenge, 93% indicated the information would be helpful.

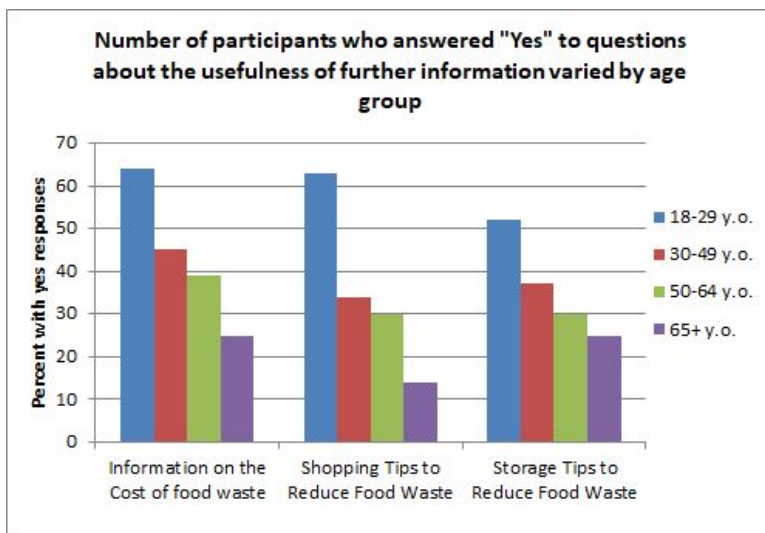


Figure 3. Percent of participants that responded “yes” more information on these topics would be beneficial to reduce food waste. ($p < 0.05$)

Overall, 48% responded shopping tips for reducing food waste helpful. When analyzing by age group 63% of 18-29 y.o. indicated it would be useful, in comparison to 34% of 30-49 y.o., 30% of 50-64 y.o. and 14% of 65+ indicating it would be useful (Figure 3) ($p < 0.05$). An examination of responses in the pre-survey by those that eventually participated in the challenge, found 57% believed it would be useful.

Overall, 43% thought information on how to store food properly would be helpful. When analyzing for age group 52% of 18-29 y.o. said it would be useful, 37% of 30-49 y.o., 30% of 50-64 y.o. and 25% of 65+ year olds (Figure 3) ($p < 0.05$). Overall 32% found it difficult to prepare leftovers. When analyzing for age group 20% of 18-29 y.o. said it is difficult to use leftovers, 8% of 30-49 y.o., 13% of 50-64 y.o. and 4% of 65+ ($p < 0.05$) (Figure 4).

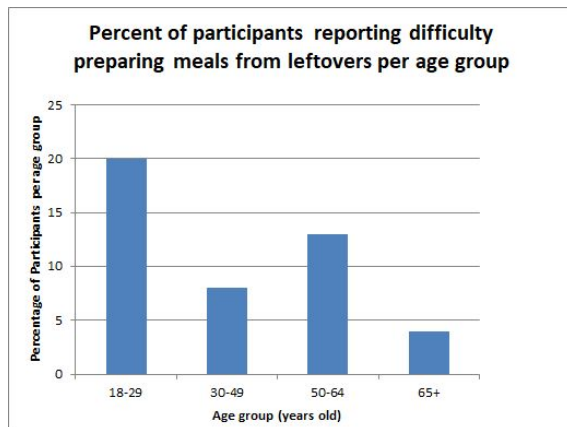


Figure 4. Percent of participants reporting difficulty preparing meals from leftovers per age group. ($p < 0.05$)

Overall, more than half (61%) of the respondents believed information on the environmental impact of food waste would encourage them to reduce waste. Perceived usefulness of this information also differed significantly depending on the age group ($p < 0.05$)

(Figure 5); 71% of 18-29 y.o. responded the information would be helpful, whereas 50% of 30-49 y.o., 51% of 50-64 y.o. and 42% of 65+ indicated the information would be useful.

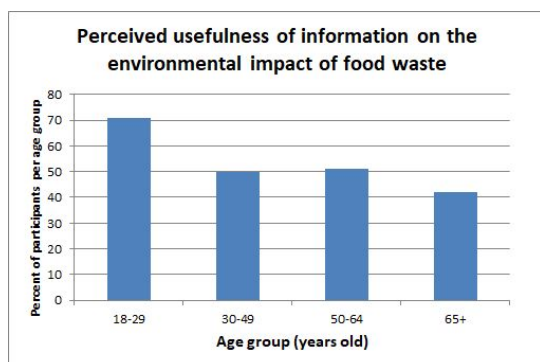


Figure 5. Percent of participants reporting information on the environmental impacts of food waste would help them decrease their food waste per age group. ($p < 0.05$).

The survey also explored the type of food wasted by respondents (Figure 6). Vegetables came in the highest at 32%, 25% fruit, 17% dairy, 15% bread, 8% meat/poultry/fish, 4% other.

Within the “other” category leftovers was the most common response.

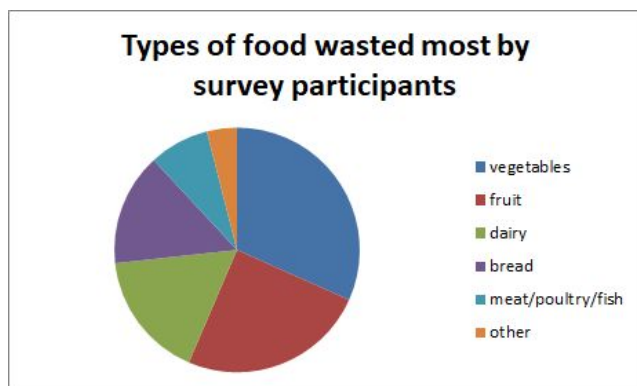


Figure 6. Types of food reportedly wasted the most by the pre-survey participants.

Challenge Results

A total of 15 individuals participated in the 30-Day Food Waste Challenge. The challenge started mid-February and all participants lived in the state of Iowa. Two participants dropped out after completing the baseline data collection and were deleted from the final data. There were

five participants missing 1-2 weeks of data, but included in data analysis. Due to the small sample, statistical analysis was limited to descriptive statistics.

Average total food waste per person appears in Figure 7. The average total food waste per person per week was 10.94 cups during baseline week 1 and 12.36 cups during baseline week 2. The average total food waste per person during the challenge weeks was 8.51 cups during week one, 7.60 cup during week two, 9.78 cups during week three, and 10.2 cups during week 4.

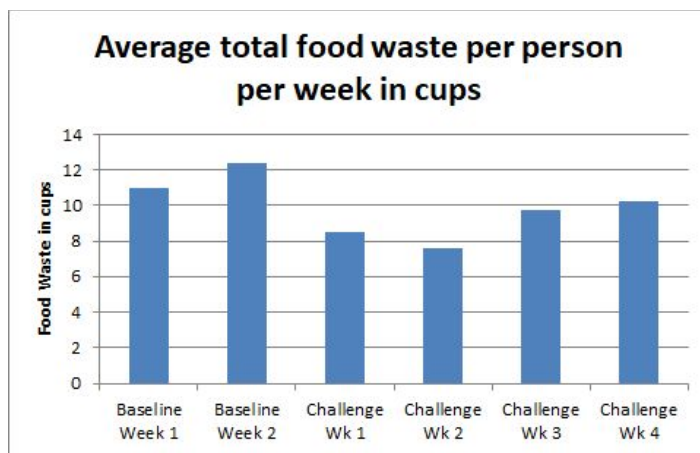


Figure 7. Average total food waste per person per week in cups.

An examination of non-edible and preventable food waste separately appears in Figure 8. Non-edible food waste during baseline week 1 was 6.137 cups, while preventable was 4.80 cups. During baseline week 2, the average was 5.33 cups of non-edible and 7.03 cups of preventable. Challenge week one had an average of 6.30 cup non-edible food waste and 2.20 cup of preventable, week two with 5.50 cups non-edible and 2.10 cup preventable, week three with 6.53 cups of non-edible and 3.25 cup of preventable, and week four with 6.95 cups of non-edible and 3.33 cups of preventable.

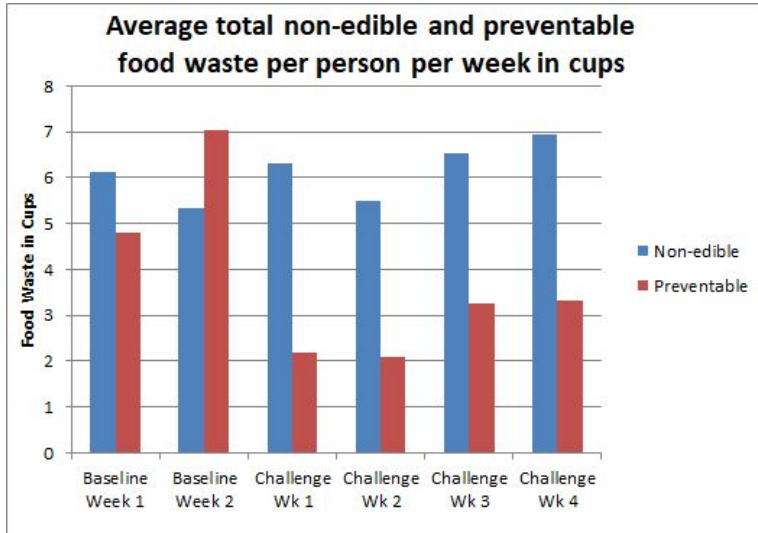


Figure 8. Average total non-edible and preventable food waste per person per week.

Average food waste including both baseline weeks was 5.73 cups per person per week of non-edible food waste and 5.92 cups of preventable food waste (Figure 9). During challenge weeks the average non-edible food waste per person per week was 6.32 cups and preventable was 2.72 cups.

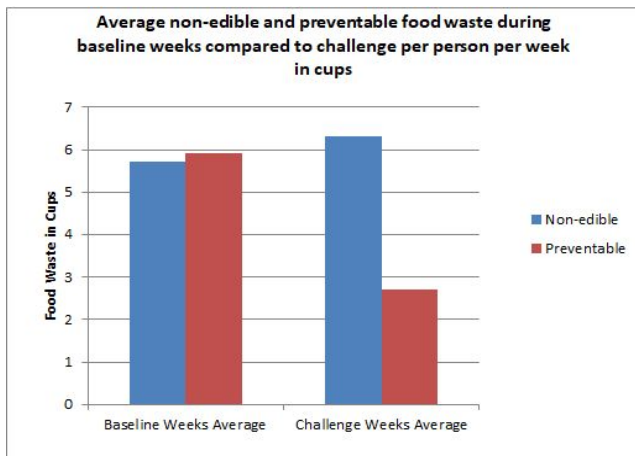


Figure 9. The average non-edible and preventable food waste during baseline weeks compared to challenge weeks per person per week.

A comparison of the reported average number of days cooking with perishable ingredients per week, suggests greater losses when cooking 3-4 days per week when compared to cooking 1-2 days or 5-7 days (Figure 10).



Figure 10. Reported food waste totals based on the reported average number of days cooking with perishable food per week.

Commonly recorded food waste items in the non-edible category included: coffee grounds, apple core, egg shells, banana peels, avocado, onion skins, green pepper core, broccoli stems, orange peel, and teabags. Commonly recorded food waste items in the preventable category included: celery stalks, spinach, leftovers, lettuce, rotten fruit, spoiled veggies, salad greens, bread, and pizza.

Post-Survey Results

The post-challenge survey data includes 17 participants who indicated they viewed the social media posts on Facebook and/or Instagram. Of those participants, 15 were female and 2 were male and the average household size was 2.12 people. Forty-one percent were 18-29 year olds, 35% were 30-49 years old, and 23% were 50-64 years old. Fifty-three percent viewed the

Your Food Waste Matters post on Facebook, 18% viewed them on Instagram, and 29% viewed them on both social media platforms. Only 12% reported they viewed the social media posts daily, 53% a couple times a week, and 35% reported viewing a few times throughout the study. The post-survey respondents indicated the number of meals cooked per week, 53% reported 5-7 days, 41% reported 3-4 days, and 6% reported 1-2 days.

Post-survey respondents overwhelmingly (94%) indicated feeling guilty when throwing away food. By comparison, 71% reported yes, 21% reported kind of feeling guilty, and 7% reported not feeling guilty in the pre-survey.

Respondent's perception of the amount of food they threw away compared to other households of their size, suggests 18% about the same, 71% less and 12% more. Examining this same question in pre-survey among individuals who participated in the challenge suggests 36% about the same, 57% less, and 7% more.

Overall, 76% of the respondents indicated they found the posts informative and 24% report the posts were somewhat informative. Seventy-six percent said they learned about the cost of throwing away food, 82% said they learned about the environmental impacts of food waste, 82% said they learned shopping tips they can use to reduce their food waste, and 59% learned better storage tips to reduce food waste. Overall, 76% felt they reduced their food waste during the challenge.

During the study, 70% of the respondents reported they compost; 35% initiated composting during the study. An additional 18% reported they did not compost but were thinking about it, and 12% reported they do not plan to compost. Residential pick up for

composting was used by 37% of the respondents and 31% were doing backyard composting during this study.

Discussion

What was learned from the Pre-Survey

The Your Food Waste Matters Pre-survey was used to assess the awareness and attitudes about food waste and look at the need for further resources on reducing food waste. Overall, 69% of survey participants had read, seen, or heard something about the issue of food waste in the last year. Given almost 40% of food is wasted, costing an estimated \$218 billion a year, it is important that the American public be aware and take action (ReFED, 2016). The Natural Resources Defense Council has developed Save the Food, which has a website with food waste reduction resources and is also using billboards, other advertising, and has a presence on social media in order to spread the word about food waste (Save the Food, 2018). More awareness and attention should be focused on this issue and this project was a step in reaching more individuals.

Approximately 70% of the participants in the pre-survey and 85% of the challenge participants were female. Traditionally in the U.S. women are primarily responsible for family meals. While men are starting to take more of a role in food purchasing and preparation, women still disproportionately take on more responsibility for family meals (Taillie, 2018; Hamrick, 2016). This could have been a factor in the higher percent of female participants. It is important that education on food waste is still targeted towards men and women as the role in the kitchen is continually becoming more evenly distributed between men and women.

When participants in the pre-survey were asked if they felt guilty about throwing food away, 70% of the participants report they feel guilty, 25% reported they feel kind of guilty, and

5% reported they did not feel guilty. A larger study on the awareness and attitudes of food waste found 55% strongly agree and 22% somewhat agree that they feel guilty about throwing away food (Qi & Roe, 2016). Factors that may contribute to individuals not feeling guilty about wasting food may include the rise in obesity and the message expressed to be mindful and not to overeat. Some individuals have even been educated to leave a few bites left on your plate to encourage decreased intake of overall calories. While Americans' growing waistline is a very important public health concern, focusing on meal planning, proper portion size, shopping and storage tips can help to reduce obesity while being mindful of food waste.

Another health issue that may deter people from feeling guilty about food waste is food safety and risk of foodborne illness. Approximately, 90% of participants in our survey reported they worry about eating food past its use by date. Use-by, sell-by, and best-by dates are a significant contributor to food waste as the public uses them as a rule, when in fact they typically reflect quality rather than a food safety issue. The Food Recovery Act of 2017 included language to standardize date labeling as well as other policies to reduce food waste, but unfortunately the bill died in committee and has not yet been reintroduced at the time of writing this paper (H.R. 3444, 2017). Ideally the food industry would voluntarily make changes in labeling practices, which would help alleviate this problem (ReFED, 2016). Realistically though without incentive or legislation, industry wide standardized date labeling will likely remain unchanged. This is an area that could improve the food waste statistics if individuals advocate for policy change regarding these ambiguous dates. Until this is changed educating the public on how to interpret use-by, sell-by, and best-by dates can help decrease some of the food from being wasted.

About 57% who completed the pre-survey reported they waste less and 35% reported they waste about the same as other households of their size. The remaining 8% reported they believe they waste more than other households their size. This implies individuals believe they are doing better than, or at least not any worse than families of the same size. Particularly in households with 1-2 people. Responses from 1-2 person households were most likely to report they believe they waste less than other households their same size compared to larger households. In a study by Qi and Roe (2016), 51% believed it would be difficult to reduce their household food waste any further. Though it does not seem like individually we are wasting an excessive amount, approximately 0.6-0.9 pounds per day, this equals up to 90 billion pounds a year (Thyberg et al., 2015; Conrad et al., 2018; Buzby et al., 2014). These statistics once again show there is room for education and improvement in reducing food waste in the home despite individuals' perceptions of their own food waste habits. Tracking food waste could be useful to give individuals a visual of their food waste which may elicit change in behavior.

Another interesting result from the Qi and Roe (2016) study was 59% reported they strongly or somewhat agree some food waste is necessary to make sure meals taste fresh and good. This re-emphasizes the need for further awareness and education on reducing food waste in the home. Emphasizing ways to keep food fresh, use it in a timely fashion, and repurposing leftovers are some of the key topics for food waste education. While this question was not explored in the current study, information was gathered on what respondents considered useful topics.

There were significant differences for multiple questions when factoring in age group. Over 50% of individuals in the 18-29 year old age group indicated information on cost of food

thrown away, shopping tips, and food storage information would be helpful. For all other age categories less than 50% thought this information would be helpful. An explanation for these results may be related to the life experiences relative to age for these activities. Individuals 18-29 years old have fewer years of experience buying, storing, and preparing food for themselves and their families. Many of these individuals are living on their own for the first time and have to determine how to best use their time and money to purchase and prepare food efficiently. It is likely the other age groups still care about these topics, but over the years they have found ways that work for their family.

The older age groups are more likely to have been taught these skills by their parents and in school, whereas the younger generation may not have grown up being taught or observing these skills. In a little over a decade the number of students taking family and consumer sciences classes, formerly home economics, has decreased 38% (Danovich, 2018). This is a concern that younger generations will not be confident in their skills for planning, purchasing, cooking and storing food. Without the confidence and knowledge in this area, food waste will likely continue to increase. Luckily as shown in this study, the youngest group is showing interest in learning these skills. In order to substantially reduce our food waste in the home, continued education on basic aspects of food procurement, preparation, and storage will be necessary, especially in young adults and children.

The youngest age group (18-29 year olds) were also most interested in the environmental impacts of food waste with 71% reporting knowledge of the environmental impacts of food waste would help them reduce their food waste. For the other age groups, 51% or less agree this information impact their food waste habits. Millennials (currently aged 22-36 years old) tend to

receive more publicity for being interested in social causes and protecting the environment. Research by the Pew Research Center (2019) reported younger adults view stricter environmental laws are 'worth the cost' but older age groups do share similar beliefs (71% of 18-29 y.o., 64% of 30-49 y.o., 62% of 50-64 y.o., and 57% of 65+ y.o) (Davie & Oliphant, 2019). Research is also showing the older adults believe their behaviors about protecting the environment have increased since they were in their 20s (Coughlin, 2018). This may explain while 41% of the 30-day challenge participants were 18-29 year olds, 30-49 year olds comprised 35% of the participants, and 23% of the participants were 50-64 year olds.

What was learned from the 30-day Food waste challenge

The sample size for the food waste challenge was small, but some observations could be made from the data. Overall, total food waste did not decrease when comparing the baseline weeks to the challenge weeks. However, when separating preventable food waste and non-edible food waste there did appear to be a decrease in preventable food waste in baseline weeks compared to the challenge weeks. Non-edible waste remained the same throughout the baseline and challenge weeks.

This study tracked both non-edible and preventable food waste because each category is influenced by many factors. For example, non-edible food waste volume would not be impacted much even when implementing food waste reduction strategies outlined in this challenge. There would still be a degree of food waste in the form of fruit and vegetable scraps and animal bones. Non-edible food waste will also vary greatly depending on what you cook that week. For example, if you purchase more fresh versus processed produce (frozen, canned or pre-cut), as well as how often you cook at home. An important topic for non-edible food waste in the future

is to focus on showing ways to use some of these vegetable scraps as some of these less commonly used parts of fruits and vegetables are still edible. The chef Joel Gamoran has a TV show, *Scraps*, and a new cookbook, *Cooking Scrappy*, that focuses on ways to use all parts of produce and can be a good resource for this topic in the future (Gamoran, n.d.). Composting plays a major role in reducing food wastes' effects on the environment by diverting these produce scraps from the landfill.

Participants cooking 3-4 days per week had slightly more food waste than people who reported cooking 1-2 days or 5-7 days per week. This increase could be due to wishful shopping. Individuals buying more groceries with the intention to cook most days, but end up wasting more food as their plans for the purchased food does not happen. Those cooking less (1-2 days a week) are likely more realistic when buying groceries, therefore having less food waste. Those cooking every day have more opportunities to “use it up” before food goes bad. This is why realistic meal planning is important, which was why it was addressed in a social media post during the first week of the challenge and one of the main strategies for reducing food waste.

What was learned from the Post-Survey

Seventy-six percent of challenge participants reported they felt they reduced their food waste during the challenge. The survey also showed 76% of participants found the social media posts informative and 24% found the posts “kind of” informative. Some barriers to participants not learning more about strategies to reduce food was many responded they did not check the social media pages every day as intended with the 30-day challenge. Only 12% reported they viewed the social media posts daily, 53% a couple times a week, and 35% reported viewing a few times throughout the study. Social media is an easy way to capture a large audience, but it

may not be the best choice for a project that requires daily checking. In the post-survey comments one participant suggested using text messages as they forgot to check social media daily. Text messages or email may be good options to reach participants daily. The idea of using social media was intended to create community engagement and interaction with participants; however, there was less interaction than expected in this study.

However, it appears feeling guilty about throwing food waste increased among those that participated in the challenge. In the pre-survey 71% had reported feeling guilty, 21% reported kind of feeling guilty, and 7% reported not feeling guilty. In the post survey those feeling guilty increased to 94%. Creating awareness about the issue of food waste, is apt to instill more negative feelings with the behavior of wasting food. The visual of a week's worth of food waste could also contribute to a change in feelings about food waste. Participants could visibly see their food waste pile up over the week. One participant commented they plan to continue keeping their food waste in a bucket on the counter every week as they found it made them be more mindful. The act of keeping food waste in a separate container, whether it will ultimately be disposed in the trash or composted, can serve as a visual reminder to individuals and hopefully elicit change in food habits.

As mentioned previously, composting plays an important role in diverting food waste from landfills. Thirty-five percent of participants reported they started composting during the study, 18% reported they were thinking about starting, and 35% said they were already composting. This is good news and showed an area that with further education more people may be willing to compost and help with the environmental burden of food waste. Of those that reported they were composting about half were doing backyard composting and the other half

were using a residential pick up service. A survey in 2017 on residential food waste collection programs in the U.S. showed there is a growing number of programs over the last 15 years (Streeter & Platt, 2017). A total of 148 programs throughout the country provide access to curbside composting for 5.1 million households (Streeter & Platt, 2017). This is up from 2013/2014 when there were only 79 programs which provided access for just 2.7 million households (Streeter & Platt, 2017). While backyard composting and vermicomposting are excellent options for composting, curbside compost is likely the path with the least resistance to increase the composting rates in the U.S.

Types of food waste by survey and challenge participants

In the pre-survey and post-survey fruits and vegetables came in ranked highest for food wasted the most, then dairy, bread, and meat/poultry/fish. This was also documented on the food waste tracking forms as many of the preventable food waste items recorded included rotten or spoiled fruits and vegetables. This is also consistent with a larger study done looking at the types of food wasted in home, which reported 39% of food waste was fruits and vegetables, 17% was dairy foods, 14% was meat and mixed meat dishes, and 12% was grains (Conrad et al., 2018). Focusing on educating consumers on proper ways to shop, store, and prepare food for each food group is needed to decrease these numbers. Information on food waste reduction strategies and tips used for this research study can still be viewed on Your Food Waste Matters on Instagram and Facebook. Appendix F also contains resources for individuals wanting to decrease their food waste and for researchers developing further studies on this topic.

Conclusion

This study's overall goal was to bring to light the concern with food wasted in the home. While the country is wasting almost 40% of the food it produces, it is estimated households make up a large majority of that, with retail and food service coming in a close second. The public's perception of food waste along with food, agriculture, and retail policies need to change in order to reduce America's food waste. In the meantime, individuals have the potential to make a meaningful impact on the food waste statistics. Overall a slight decrease in the preventable food waste category from baseline to the challenge weeks in those participating in the challenge was noted. Further research and education is needed to teach younger generations mindful shopping, storage, and cooking techniques to minimize food waste in the home. Dietitians and other professionals working in the food industry need to be called to action to educate others, implement food waste reduction strategies in their place of work, and advocate for policy change that limits food waste from farm to landfill.

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Appendix A

Your Food Waste Matters Pre-Survey

Your Food Waste Matters!

We are interested in understanding your awareness and attitudes about food waste. You have been invited to participate in this study because you are either an Iowa State University faculty, staff or student or you have heard about this study on “Your Food Waste Matters” social media sites.

If you decide to participate in the study you will be asked to complete a survey that should take less than 5 minutes to complete. Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. You can skip any questions you do not wish to answer. After completing this survey, you will have the option to continue with the second part of the study, which is a 30 day “Your Food Waste Matters Challenge”. If you choose to sign up for the challenge, you will be eligible for a free trial of Compost Ninja (a curbside composting service), depending on your location. We hope by completing this survey you will become more aware of the issue of food waste. We encourage you to follow “Your Food Waste Matters” on Instagram or Facebook to learn more about why your food waste matters.

All responses collected through the secure online survey will be anonymous to the researchers and stored in a secure, password protected file. Only group level results of the study will be reported. You will be asked to provide the last four digits of your cell phone number, only to link pre- and post-responses. Information collected will not be used or distributed for future research studies. You may print a copy of this form for your files. Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device. This study is being conducted by Amy Lodes, graduate student at Iowa State University. The study is overseen by supervising investigator, Dr. Ruth Litchfield. You are encouraged to ask questions at any time during this study. For further information about the study, contact Amy Lodes at amk@iastate.edu or Ruth Litchfield at litch@iastate.edu.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011. By clicking the button below, you acknowledge your participation in the study is voluntary, you are 18 years of age or older, and you are aware you may choose to terminate your participation in the study at any time and for any reason.

- I certify that I am 18 years of age or over and agree to participate in this research study.
- I do not consent, I do not wish to participate

Q1 What is the last four digit of your phone number?

- XXXX _____

Q2 What is your current age?

- 18-29 years old
- 30-49 years old
- 50-64 years old
- 65+ years old

Q3 What is your gender?

- Male
- Female
- Other

Q4 Including yourself, how many people are there living in your household?

- 1
- 2
- 3
- 4
- 5+

Q5 What is your total annual household income from all sources, before taxes?

- Less than \$50,000
- \$50,000 but less than \$100,000
- \$100,000 but less than \$200,000
- \$200,000 or less

Q6 Which best describes the area where do you live?

- Metro
- Suburban
- Small town
- Rural

Q7 In the last 12 months, have you read, seen or heard anything about the amount of food that is wasted or ways to decrease food waste?

- Yes.
- No

Q8 I feel guilty when I throw away food.

- Yes
- Kind of
- No

Q9 My household has about the same amount of food waste as other households of my size.

- Agree
- No, we probably waste less.
- No, we probably waste more.

Q10 If I had information on the cost of the food that I throw away, I would probably make an effort to throw away less.

- Yes
- Maybe
- No

Q11 If I had information on the environmental impact of food waste, I would probably make an effort to throw away less.

- Yes
- Maybe
- No

Q12 I worry about eating food past it's use-by date.

- Yes
- Sometimes
- No

Q13 If I had information on how to do food shopping more effectively, I would probably end up throwing away less.

- Yes
- Maybe
- No

Q14 I find it difficult to prepare a new meal from leftovers.

- Yes

- Sometimes
- No

Q15 If I had information on how to best store food I would probably end up throwing away less.

- Yes
- Maybe
- No

Q16 If you waste food, what types of food do you waste the most? Please select 1-3 answers.

- Vegetables
- Fruit
- Bread
- Meat, Poultry, and Fish
- Dairy Products
- Other, please specify _____

Q17 Would you be willing to compost your food waste?

- Definitely yes
- Probably yes
- Probably not
- Definitely not

Q18 Would you like to follow Your Food Waste Matters on Instagram and/or Facebook to learn more about the importance of decreasing your food waste?

If yes, feel free to follow the account on Instagram or Facebook by searching Your Food Waste Matters.

- Yes
- No

Q19 Would you be willing to participate in a 30 day challenge to decrease your food waste? If yes, please email amk@iastate.edu.

- Yes
- No

Q20 Please feel free to share any comments:

Appendix B

Your Food Waste Matters Post-Survey

We are interested in understanding your awareness and attitude about food waste after viewing "Your Food Waste Matters" on social media and/or participating in the 30 Day Your Food Waste Matters Challenge. You have been invited to participate in this study because you have viewed the "Your Food Waste Matters" social media accounts, you have completed the 30 day Challenge, or you are an Iowa State University faculty, staff or student.

If you decide to participate in the study you will be asked to complete a survey that should take you less than 5 minutes to complete. Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. You can skip any questions you do not wish to answer. We hope by completing this survey you will become more aware of the issue of food waste. All responses collected through the secure online survey will be anonymous to the researchers and stored in a secure, password protected file. Only group level results of the study will be reported. You will be asked to provide the last four digits of your cell phone number, to link pre- and post- survey responses and food waste tracking forms. Information collected will not be used or distributed for future research studies. You may print a copy of this form for your files. Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device. This study is being conducted by Amy Lodes, graduate student at Iowa State University. The study is overseen by supervising investigator, Dr. Ruth Litchfield. You are encouraged to ask questions at any time during this study. For further information about the study, contact Amy Lodes at amk@iastate.edu or Ruth Litchfield at litch@iastate.edu.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011. By clicking the button below, you acknowledge your participation in the study is voluntary, you are 18 years of age or older, and you are aware you may choose to terminate your participation in the study at any time and for any reason.

- I certify that I am 18 years of age or over and agree to participate in this research study.
- I do not consent, I do not wish to participate

Q1 What is the last four digit of you phone number?

- XXXX _____

Q2 Could you please tell me if you are ...?

- 18-29 years old

- 30-49 years old
- 50-64 years old
- 65+ years old

Q3 What is your gender?

- Male
- Female
- Other

Q4 Including yourself, how many people are there living in your household?

- 1
- 2
- 3
- 4
- 5+

Q5 What is your total annual household income from all sources, and before taxes?

- Less than \$50,000
- \$50,000 but less than \$100,000
- \$100,000 but less than \$200,000
- \$200,000 or more

Q6 Which best describes the area where do you live?

- Metro
- Suburban
- Small town
- Rural

Q7 Did you participate in the Your Food Waste Matters Challenge and track your food waste?

- Yes
- No

Q8 Did you view the posts on "Your Food Waste Matters" on Instagram and/or Facebook?

- Yes, on Facebook
- Yes, on Instagram
- Yes, on both
- No

Q9 How often did you view "Your Food Waste Matters" on Instagram and/or Facebook?

- Daily
- Couple times a week
- Few times through out the study
- Never

Q10 Did you find the social media posts informative?

- Yes
- Kind of
- No

Q11 On average how many days a week do you cook a meal at home using perishable ingredients? (Including fresh fruits and vegetables, meat/poultry/fish, and/or dairy products)

- 1-2 days a week
- 3-4 days a week
- 5-7 days a week

Q12 On average how many meals a week do you go out to eat? (Meals brought from home to work/school would not be considered "out to eat" for this question.)

- 1-3
- 4-7
- 8-11
- 12+

Q13 I feel guilty when I throw away food.

- Yes
- Kind of
- No

Q14 My household has about the same amount of food waste as other households of my size.

- Agree
- No, we probably waste less.
- No, we probably waste more.

Q15 I know more about the cost of food thrown away.

- Yes
- Maybe
- No

Q16 I know more about the environmental impacts of food waste.

- Yes
- Maybe
- No

Q17 I worry about eating food past its use-by date.

- Yes
- Sometimes
- No

Q18 I have learned shopping tips I can use to avoid throwing food away.

- Yes
- Maybe
- No

Q19 I find it difficult to prepare a new meal from leftovers.

- Yes
- Sometimes
- No

Q20 I have learned storage tips I can use to avoid throwing food away.

- Yes
- Maybe
- No

Q21 If you waste food, what types of food do you waste the most? Please select 1-3 answers.

- Vegetables
- Fruit
- Bread
- Meat, Poultry, and Fish
- Dairy Products
- Leftover meals
- Other, please specify _____

Q22 Do you feel you reduced your household food waste during the challenge?

- Yes
- No

Q23 Do you plan to use the tips you learned to continue to make an effort to reduce your food waste?

- Definitely yes
- Probably yes
- Probably not
- Definitely not

Q24 Did you compost?

- Yes, I have been since before this study
- Yes, I just started composting
- No, but I am thinking about starting
- No, and I don't plan to at this time

Q25 If you compost which method do you use?

- Residential Pick up _____
- Backyard Composting
- Vermicompost
- Other _____
- I do not compost.

Q26 If you tracked your food waste for this challenge, please share any additional information about your food waste data you believe the researcher will find helpful.

Q27 Please share any other comments.

Appendix C

Tips on how to measure your food waste

1. Pick your container.

Plastic gallon bags or bucket with a lid (ice cream pails work great!) can be used to keep your food waste for the week. You will need two containers. *Alternatively, you can measure the volume of your food as you throw it out/compost it and add the total volume at the end of the week.* There will be a video posted on the Your Food Waste Matters social media sites in the upcoming week.

2. Preventable vs non-edible food waste. What’s the difference?

Preventable food waste is food you were once able to eat, but for some reason you decide to throw it out. *Non-edible food waste* is components of food that are not usually eaten. We will be measuring all *preventable food waste* and *non-edible food waste* separately.

Preventable Food Waste Examples:	Non-edible Food Waste Examples:
<ul style="list-style-type: none"> ● Food that spoils before we use it: <ul style="list-style-type: none"> ○ Leftovers ○ Wilted vegetables ○ Moldy fruit ○ Moldy or stale bread ○ Sour dairy products ● Edible skins like potatoes and apple peels we choose not to eat 	<ul style="list-style-type: none"> ● Egg shells ● Used coffee grounds ● Banana peels ● Stems ● Avocado peels ● Apple core ● Grape vines

3. Composting

- Composting is not a requirement of the research study. But this would be a great time to start learning about composting options at home, if you are not already. We will be sending out resources on backyard composting and vermicomposting.
- Those of you using Compost Ninja services, everything can go into your compost bin for pick up!

Appendix D
Food Waste Tracking Form

Food Waste Tracking Form

Check which week you are recording: Baseline Week 1 Baseline Week 2
 Challenge Week 1 Challenge Wk 2 Challenge Wk 3 Challenge Wk 4

Last four digits of phone #: _ _ _ _ *Number of people in your household:* _____

	<i>Non-Edible Food Waste</i> (coffee grounds, fruit core, non-edible skins)	<i>Preventable Food Waste</i> (spoiled food, restaurant leftovers)
Record each food waste item		
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		
Total:	_____ Cups	_____ Cups

Please send this form to amk@iastate.edu

Appendix E

Your Food Waste Matters 30-day Challenge Strategies

There are many ways to decrease your preventable food waste, so let's make it simple and narrow it down. For the next 30-days your challenge is to focus on these 5 strategies:

1. Shop with Meals in Mind
2. Keep it Fresh
3. Eat What you Buy
4. The "Choose Me" Shelf
5. Compost it

All of these topics will be discussed further in "Your Food Waste Matters" Facebook and Instagram posts throughout the challenge. Check them out for daily helpful tips!

1. Shop with Meals in Mind
 - a. Create a simple meal plan and shopping list before you head to the store.
 - b. Make the list at home, so you know what you already have on hand.
 - c. Know your schedule and time restraints. If you know you will only cook 5, 4, 3, or 2 nights a week, plan and buy accordingly.
2. Keep it Fresh
 - a. Store food properly by referring to the fruits and vegetables storage chart. Here is a great one:
https://www.seattle.gov/util/cs/groups/public/@spu/@conservation/documents/webcontent/1_037049.pdf
 - b. Utilize your freezer. Freeze it if you won't eat it before it spoils.
3. Eat What you Buy
 - a. Stick to your meal plan.
 - b. Get creative with leftovers instead of ordering take out.
4. The "Choose Me" Shelf
Designate a shelf/area in your fridge for foods that need to be eaten ASAP!
5. Compost it (Finding a method of composting that works for your household is encouraged, but not required to participate in the study). Here are some composting options:
 - a. Residential composting services through your city, university or private companies like, Compost Ninja.
 - b. Vermicomposting
 - c. Backyard composting
 - d. Email amk@iastate.edu for help to find composting options in your area.

Appendix F

Resources for food waste reduction in the home and for the development of future research

In addition to the literature listed in the reference page, this page contains other resources that the reader may find helpful:

Waste-Free Kitchen Handbook: A Guide to Eating Well and Saving Money By Wasting Less Food by Dana Gunders – September 29, 2015

Cooking Scrappy: 100 Recipes to Help You Stop Wasting Food, Save Money, and Love What You Eat by Joel Gamoran - October 9, 2018

Scraps. Video series. Available at <https://www.fyi.tv/shows/scraps/season-1>

Instagram and Facebook accounts on food waste:

- a. @yourfoodwastematters
- b. @zerowastechef
- c. @stopfoodwaste.ie
- d. @joelgamoran

The Natural Resources Defense website: SavetheFood.com