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Impact of COVID-19 on food waste behaviour of families: Results from household waste composition audits

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ABSTRACT

Objective: The COVID-19 pandemic changed consumers’ purchasing and cooking behaviours, which may have resulted in changes in food waste. This study aimed to assess the impact of COVID-19 on household food waste, as well as on purchasing, cooking, and food waste-related perceptions and behaviours among 19 households in Guelph, ON, Canada.

Methods: Four-week food waste audits and online surveys were conducted in February–March 2020 (pre-COVID-19) and in July–August 2020 (post-COVID-19). Qualitative interviews were also conducted post-COVID-19 to explore participants’ perceptions of household food changes due to COVID-19. Food waste results were analyzed using paired t-test, while survey results pre- and post-COVID-19 were analyzed using the Wilcoxon signed-rank test.

Results: While per capita food waste did not significantly change (mean pre = 1.076 kg per week, mean post = 1.080 kg per week), total per capita unavoidable food waste (mean pre = 0.388 kg per week, mean post = 0.614 kg per week) and pre capita unavoidable fruit and vegetable (mean pre = 0.289 kg per week, mean post = 0.427 kg per week) waste significantly increased (p < 0.01) at post-COVID-19. Total per capita avoidable other waste decreased (mean pre = 0.385 kg per week, mean post = 0.179 kg per week, p < 0.05). The increase in unavoidable food waste may relate to households cooking more often at home, as reported in interviews, or shopping less frequently and buying more per trip, as identified in the surveys. The decrease in avoidable food waste could be related to the increase in serving of leftovers (p < 0.01), as identified in the surveys, or an increase in meal planning and inventory management, as reported in interviews.

Conclusion: Future studies should investigate whether food waste-related changes in behaviour remain after the pandemic as well as any factors associated with maintaining of these behaviours. Interventions may be an opportunity to help households maintain these changes.

1. Introduction

The COVID-19 pandemic had a profound impact on household food procurement and production and eating habits of families in Canada. On March 17th, 2020, Ontario, the province where this study was conducted, declared a state of emergency due to COVID-19, which required that all schools, restaurants and bars be closed, as well as requiring all non-essential workers to work from home and implementing a limit to store capacity [1]. Compared to grocery sales over the same period in 2019, grocery store purchases increased by 40% in March 2020; this increase was sustained in April 2020 with a 19% increase in grocery purchases as compared to the same time period in 2019 [2]. Restaurant sales plummeted by nearly 70% early in the pandemic and, while they increased in later months, restaurant spending in June 2020 remained approximately 30% below restaurant spending for the same time period in 2019 [2]. Our own research examining changes to eating habits and household food production due to COVID-19 found similar results with families reporting eating less restaurant and take-out foods since COVID-19 physical restrictions were implemented [3]. Our research also found that over 50% of families reported that their household meal routines had changed since COVID-19 with the most commonly reported changes including making more meals from scratch and spending more
These substantial changes to household food production and meal routines have been hypothesized to impact the amount of food waste produced at the household level [4]. However, the direction of how these changes may influence level of household waste is not clear. While some early survey research indicated that the economic downturn associated with the pandemic may lead to reduced levels of household food waste [5], other self-report data and interview data suggest household food waste may be higher than pre-pandemic levels [6–9]. More recent studies in Italy, Tunisia, and the US, found a decrease in food waste levels [10–12]. However, these studies used self-report to retrospectively assess changes in food waste, which can be biased [13, 14].

Building on this limited existing research, our study aimed to elucidate how the COVID-19 pandemic has impacted household food waste, as assessed using a composition waste audit. As part of a pilot evaluation of an intervention designed to promote home meal preparation and reduce household food waste, our team completed baseline assessments immediately before COVID-19 restrictions were implemented [15]. We then conducted assessments on week 19 week of the COVID-19 restrictions, as well as qualitative interviews at week 35 of the restrictions. These data provide us with a unique opportunity to explore the impact of COVID-19 on household waste using composition waste audits. This analysis can be used to inform strategies to help reduce household food waste in our post-COVID-19 context.

2. Measurement of food waste

Estimates of household food waste can be generated from food waste auditors or from secondary data sources [16], such as food availability data [17], self-report surveys [14], or interviews [11]. Estimates from survey data and interviews rely on people accurately remembering their waste behaviour and are limited by both recall and social desirability bias; evidence suggests that such methods tend to underestimate household food waste [18].

Using audits to directly measure household waste can provide more accurate and unbiased estimates of food waste generation [19]. We are unaware of any existing studies that have used audit data to examine how COVID-19 has impacted level of household food waste in Canada, and we believe that our household waste compositional audit data collected pre and post COVID-19 provides a novel opportunity to explore this important and policy-relevant research question.

3. Materials and methods

This study took place in the city of Guelph, Ontario, and was conducted in accordance with the University of Guelph’s Research Ethics Board protocols (REB# 19-11-003). This study was carried out as part of the Weeknight Supper Savers study, which is a single-arm pilot trial of an intervention that aimed to promote home meal preparation and reduce household food waste. Eligibility for this study required that families have at least one child between 9 and 12 years of age and that parents have no prior nutrition or food training and could respond to surveys in English. Recruitment strategies included social media posts, as well as posters and in-person recruitment at community centres and programs that serve families.

The timeline of the study including the intervention depicted in Fig. 1. The initial data collection period (pre-COVID-19), which comprised of a 4-week waste audit and online survey completed by parents, occurred from February 15, 2020–March 13, 2020. Due to the COVID-19 pandemic, the intervention delivery was postponed and a post-COVID data collection, which included a 4-week waste audit and an online survey occurred from July 14, 2020 to August 7, 2020. Audit data were collected from 19 households at both time points and 18 parents completed both the pre- and post-COVID-19 surveys. Parents from 14 households also participated in a qualitative interview in November.

![Timeline of the Weeknight Supper Savers study](image)

**Fig. 1.** Timeline of the Weeknight Supper Savers study recruitment and data collection. Recruitment was from January 15th, 2020 to February 14th, 2020. Initial assessment was from February 15th, 2020 to March 13th, 2020 then COVID-19 restrictions began on March 17th, 2020. Post-COVID-19 assessment was from July 14th, 2020 to September 4th, 2020. Post-COVID-19 surveys were from July 14th, 2020 to August 2nd, 2020 and waste assessment was from August 7th, 2020 to September 4th, 2020. Not shown: November 6th, 2020 to 4 December 4th, 2020 post-intervention interviews were conducted, which included questions about the impact of COVID-19 on family food procurement, preparation, and waste behaviours.

At the pre- and post-COVID-19 data collection, parents completed an online survey assessing their food purchasing, meal routines, fruit and vegetable intake, food waste behaviours, and demographics; survey items were adapted from existing, published surveys [20–28]. The post-COVID-19 survey also included questions that assessed specific changes in grocery shopping, meal preparation and waste behaviours since COVID-19. At both time points, families also participated in household waste audits where all three streams of their waste were collected and analyzed once a week over 4 weeks. The three streams of waste include organic waste (food and non-food organic waste), recycling, and garbage. Food items were separated into categories and weighed. The food categories were fruit and vegetable avoidable (could have been eaten, such as pieces of an apple), fruit and vegetable unavoidable (usually cannot be eaten, such as banana peels), others avoidable (could have been eaten, such as meats and grains), others unavoidable (usually cannot be eaten, such as animal bones). In addition, non-food organics (such as flowers), recycling, and contamination (relative to the waste stream, such as food in recycling stream or recycling in organic stream) were categorized and weighed.

During the post-COVID-19 data collection, using an online platform, parents participated in semi-structured interviews that included questions that explored parents’ perceptions of changes in their shopping, cooking, and food waste behaviours due to the COVID-19 restrictions. These interviews were transcribed verbatim by MB.

4. Analysis

The statistical analysis of the waste audit and survey data was performed using SPSS (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp). For each family, weight of total food waste and the categories described earlier were averaged over the four weeks and then divided by the total number of individuals in the household to determine per capita food waste. Paired t-tests were used to test the difference in the average per capita of total household food waste and the types of food waste as categorized during the waste audit between the two time points (pre- and post-COVID-19). Wilcoxon signed-rank tests were used to examine differences in the
distributions in responses to the survey items between the two time-points. A p-value of less than 0.05 was considered statistically significant. Responses to the interview questions regarding changes due to COVID-19 were reviewed and key themes and representative quotes were identified.

5. Results

5.1. Demographics

Demographic variables of households are presented in Table 1. Most households were two-parent households (79%), have 2 or more children (89%), and income, in Canadian dollars (CAD), between 100,000–149,000 CAD (32%) followed by 80,000–99,999 CAD (26%). In August, most parents, who completed the surveys, were employed (84%); nine (47%) were working remotely from home. Average household size was 4.3 individuals.

A summary of the pre- and post-COVID-19 per capita waste audit data from all three streams in the audit (organics, recycling, and garbage) are presented in Table 2. Survey and interview results are used throughout this section to contextualize the waste audit results.

We note that there was no significant difference in the rates of contamination in the different streams before and after the audits which means that when weights changed, they changed in equal proportions across all three streams. Thus, there does not appear to have been a change in household’s waste sorting behaviour before and after the pandemic isolation measures were implemented.

The per capita mean weight of the recycling increased by 0.183 kg per week, but this increase was not statistically significant. While one might hypothesize that an increase in at-home eating might generate a higher volume of recyclable food packaging, we did not characterize the recycling and it could also have reflected an increase in cardboard and other packaging from online ordering of non-food items.

The per capita mean weight of the garbage generated increased by 0.193 kg per week, but this increase was also not statistically significant. Again, one might hypothesize that the garbage generated would increase with families spending more time at home, but the effect was not statistically significant (p = 0.180).

The mean total weight of food waste before and after COVID-19 was unchanged (mean_{pre} = 4.82 kg per week, mean_{post} = 4.85 kg per week; data not shown). Similar results were found for the per capita total food waste (Table 2). Interestingly, many participants (44%) reported on the post-COVID-19 survey that they thought they were wasting less food since COVID-19. It is worth highlighting that the weight of total food waste was unchanged despite higher purchases (56% reported buying more food per grocery shopping trip) and eating more meals at home. This suggests that the food waste generated per meal in these households decreased.

Table 2

| Mean, difference and percent change in per capita household waste from pre- and post-COVID waste audits (n = 19). |
|---------------------------------------------|
| Pre- COVID-19 | Post- COVID-19 | Difference (kg per week) | Percentage Change |
|----------------|---------------|--------------------------|------------------|
| Total Food Waste | 1.076 | 1.080 | 0.004 | 0.37% |
| Total Avoidable | 0.688 | 0.466 | -0.222 | -32.27% |
| Total Avoidable Food and Vegetables | 0.302 | 0.287 | -0.015 | -4.97% |
| Total Unavoidable | 0.385 | 0.179 | -0.206** | -53.51% |
| Total Unavoidable Other | 0.388 | 0.614 | 0.226*** | 58.25% |
| Fruit and Vegetables | 0.289 | 0.427 | 0.138** | 47.75% |
| Total Unavoidable Other | 0.099 | 0.187 | 0.088*** | 88.89% |
| Total Avoidable | 0.035 | 0.118 | 0.083 | 19.57% |
| Total Garbage | 0.859 | 1.052 | 0.193 | 22.47% |

*p < 0.10, **p < 0.05, ***p < 0.01.  
13 decimal places are reported to show changes by gram.

There were differences in both avoidable and unavoidable food waste. The mean per capita unavoidable food waste weight increased significantly post-COVID-19 (0.226 kg, p = 0.002; Table 3). Both unavoidable fruits and vegetable waste (0.138 kg, p = 0.02) and unavoidable other waste (0.088 kg, p = 0.005) increased significantly. This is consistent with what one would expect given the closure of all food service establishments early in the COVID-19 restrictions, which would limit consumption of food outside the home. While some restaurants reopened for takeout, families reported eating more meals at home. If the volume of food consumed at home increases, the unavoidable food waste associated with food preparation would also be expected to increase.

The mean per capita weight of avoidable food waste decreased post-COVID-19 (0.222 kg, p = 0.124; Table 2), but this was not statistically significant. Per capita avoidable “other” food waste decreased significantly (0.206 kg, p = 0.012) while mean per capita avoidable fruit and vegetable waste decreased approximately 5% on average (0.015 kg), but the decrease was not statistically significant. We note that 74% of households had a decrease in avoidable fruit and vegetable waste while the remaining 26% had an increase. This could be due to differences in managing fresh and vegetable inventory or differences in standards for discarding fruits and vegetables. Fruits and vegetables are more perishable than some of the other category foods. The survey data indicate that frequency of serving vegetables and leftovers at meals increased significantly post-COVID-19 (Table 3). Both of these behaviours could have contributed to the observed decrease in avoidable food waste. It is also worth noting that nearly half of the families reported stockpiling food (Table 4). This could have contributed to an increase in avoidable food waste in these households.

Findings from the qualitative interviews help provide further insight into the observed changes in household food waste. Many households suggested they were more mindful of their inventories because shopping was less frequent and more purposeful. They seemed to value the product more:

“We also were definitely more careful with what we got grocery shopping.” Female interviewee 1.
This finding is consistent with post-COVID-19 survey results indicating that 11 (61%) families worried about going to the store too often (Table 4).

Families also often felt like they were more aware of what they had in inventory and, as such they were less likely to lose track of products:

“Okay, what’s in the fridge. We’re not going out till next week and to go through what was in there.” Female interviewee 2.

There was also a suggestion that households were doing a better job planning both meals and shopping trips so that there were fewer impulse buys which led to less waste:

“We were being much more mindful in terms of what we were purchasing. So, in a sense, we were forced to kind of plan because there wasn’t that random shopping when we were in the grocery store.” Female interviewee 3.

Similar results were observed in the pre- and post-COVID-19 surveys; 56% of families reported always making a list before shopping post-COVID-19 compared to 39% pre-COVID-19 (Table 3).

Families felt like they had more time to cook and were, therefore, more conscious of using the things that they had in their inventory:

“… paying attention, had the time to cook, and we’re keeping track of food.” Female interviewee 4.

They also suggested that their lives slowed down somewhat which gave them time to think about meals and to prepare them. Children’s outside activities were curtailed and parents were working from home so commuting time was saved:

“The one thing that I found, because I was working from home with the girls is we did a lot more baking and looking up recipes, watching shows on TV and trying to emulate what they were doing. And that motivated us to cook a lot more as well.” Male Interviewee 1.

### Table 3
Frequencies and Wilcoxon Signed-rank test of changes in pre- and post-COVID-19 survey responses (n = 18).

| Variable                      | Response options | Time 1 (pre-COVID-19), n (%) | Time 2 (post-COVID-19), n (%) | Wilcoxon Z |
|-------------------------------|------------------|-------------------------------|-------------------------------|------------|
| Made food from scratch       |                  |                              |                               | -0.38      |
| Never                        |                  | 0 (0%)                        | 1 (6%)                        |            |
| 1 time                       |                  | 3 (17%)                       | 4 (22%)                       |            |
| 2 times                      |                  | 4 (22%)                       | 2 (11%)                       |            |
| 3 times                      |                  | 2 (11%)                       | 1 (6%)                        |            |
| 4 or more times              |                  | 13 (72%)                      | 14 (78%)                      |            |
| Purchased fast food or take out\(^1\) |      |                              |                               | -0.79      |
| Never                        |                  | 3 (17%)                       | 5 (28%)                       |            |
| 1 time                       |                  | 10 (56%)                      | 7 (39%)                       |            |
| 2 times                      |                  | 4 (22%)                       | 2 (11%)                       |            |
| 3 times                      |                  | 1 (6%)                        | 1 (6%)                        |            |
| 4 times                      |                  | 1 (6%)                        | 1 (6%)                        |            |
| 5 or more times              |                  | 1 (6%)                        | 1 (6%)                        |            |
| Served leftovers for family meal |              |                              |                               | -2.75***   |
| Never                        |                  | 3 (17%)                       | 1 (6%)                        |            |
| 1 time                       |                  | 5 (28%)                       | 2 (11%)                       |            |
| 2 times                      |                  | 7 (39%)                       | 4 (22%)                       |            |
| 3 times                      |                  | 2 (11%)                       | 7 (39%)                       |            |
| 4 times                      |                  | 1 (6%)                        | 2 (11%)                       |            |
| 5 or more times              |                  | 2 (11%)                       | 2 (11%)                       |            |
| Served vegetables at the family meal | |                              |                               | -2.53***   |
| Never                        |                  | 0 (0%)                        | 1 (6%)                        |            |
| 1 time                       |                  | 1 (6%)                        | 1 (6%)                        |            |
| 2 times                      |                  | 4 (22%)                       | 4 (22%)                       |            |
| 3 times                      |                  | 3 (17%)                       | 6 (33%)                       |            |
| 4 times                      |                  | 10 (56%)                      | 12 (67%)                      |            |
| Plan meals ahead of time     |                  |                              |                               | -0.71      |
| Never                        |                  | 0 (0%)                        | 1 (6%)                        |            |
| Sometimes                    |                  | 11 (61%)                      | 11 (61%)                      |            |
| Most of the time             |                  | 6 (33%)                       | 5 (28%)                       |            |
| Always                       |                  | 1 (6%)                        | 1 (6%)                        |            |
| Made a list before shopping  |                  |                              |                               | -1.51      |
| Never                        |                  | 0 (0%)                        | 1 (6%)                        |            |
| Sometimes                    |                  | 5 (28%)                       | 3 (17%)                       |            |
| Most of the time             |                  | 6 (33%)                       | 5 (28%)                       |            |
| Always                       |                  | 7 (39%)                       | 10 (56%)                      |            |
| Felt confident about cooking a variety of healthy meals | |                              |                               | -1.90      |
| Never                        |                  | 0 (0%)                        | 1 (6%)                        |            |
| Sometimes                    |                  | 7 (39%)                       | 3 (17%)                       |            |
| Most of the time             |                  | 8 (44%)                       | 10 (56%)                      |            |
| Always                       |                  | 3 (17%)                       | 5 (28%)                       |            |
| Tried a new recipe           |                  |                              |                               | -0.26      |
| Never                        |                  | 2 (11%)                       | 2 (11%)                       |            |
| Sometimes                    |                  | 13 (72%)                      | 12 (67%)                      |            |
| Most of the time             |                  | 2 (1%)                        | 3 (17%)                       |            |
| Always                       |                  | 1 (6%)                        | 1 (6%)                        |            |

\(^*p < 0.1\), \(^*p < 0.05\), \(^*p < 0.01\).
\(^1\)1 participant did not respond post-COVID-19.

### Table 4
Frequencies of selected variables from the post-COVID-19 survey (n = 18).

| Variable                              | Response options | Time 2 (post-COVID-19), n (%) |
|---------------------------------------|------------------|-------------------------------|
| Buying more at once per shopping trip |                  |                               |
| Strongly disagree                     | 2 (11%)          |
| Disagree                              | 1 (6%)           |
| Neither agree or disagree             | 11 (61%)         |
| Agree                                 | Strongly agree   |
| 4 (22%)                               |
| Stockpiling up on supplies more than before |            |
| Strongly disagree                     | 1 (6%)           |
| Disagree                              | 4 (22%)          |
| Neither agree or disagree             | 4 (22%)          |
| Agree                                 | Strongly agree   |
| 5 (28%)                               |
| Worrying about the availability of food in stores |            |
| Strongly disagree                     | 7 (39%)          |
| Disagree                              | 4 (22%)          |
| Neither agree or disagree             | 6 (33%)          |
| Agree                                 | Strongly agree   |
| 1 (6%)                                |
| Worrying about going to the store too often |              |
| Strongly disagree                     | 1 (6%)           |
| Disagree                              | 6 (33%)          |
| Neither agree or disagree             | 5 (28%)          |
| Agree                                 | Strongly agree   |
| 6 (33%)                               |

\(^*p < 0.1\), \(^*p < 0.05\), \(^*p < 0.01\).
An important factor that most families highlighted is that they were eating out less than they were beforehand. This is particularly important for last-minute unplanned restaurant food which could displace a planned meal or reduce the use of inventories that would be subsequently discarded.

“… focus on what was available as opposed to you know, eating on the run. Eating last minute or ordering takeout.” Female Interviewee 1.

While the survey results suggest minimal change in frequency of purchasing fast food and take-out foods pre-to post-COVID-19, the interview data suggest families may have been more likely to plan when they purchased take-out post-COVID-19.

There was also an increased awareness of what the children were eating. Parents highlighted that when children took lunches to school, they often brought part of it home which was subsequently discarded. When children were home, parents saw and controlled what they ate which reduced the avoidable food waste:

“We tended to get a lot of lunches that come back or portions of lunches that come back that ended up going straight into the compost.” Female interviewee 5.

There were two other themes that emerged from the interviews that, while not directly related to the increase or decrease in food waste, could contextualize the results. Several households suggested that they had seen significant changes in behaviour immediately after the restrictions were implemented but had returned partly to more “normal” behaviours over time. They reported eating some take out, although this was usually less spontaneous than before COVID-19. They also reported that, while they were not shopping completely normally, they were more comfortable with going into grocery stores and doing so more frequently. It is also worth noting that many families reported trying online grocery orders, either pick up or delivery, to avoid the store. This change in shopping behaviour might mean less impulse buying. Most of those families, however, suggested that they had returned to shopping in the physical grocery store at the time of the audits. It is not clear what the moderation of the immediate post-COVID-19 behaviours means for food waste, but it could be that we would have found more significant impacts if we had audited or conducted our surveys closer to the imposition of restrictions.

6. Discussion

Among this sample of 19 households with children (average size = 4.3) our results found that families generated approximately 5 kg of total food waste/week pre- and post-COVID-19. This level of food waste is slightly higher than that found in larger studies with families in the same geographic area (4.2 kg/week in 2015) [25]. Our study also found that average per capita avoidable other waste decreased from pre-to post-COVID-19.

By using audits to directly measure household waste before and after COVID-19 restrictions were implemented, our results build on the existing research that has explored the impact of COVID-19 on household food waste. Two surveys studies have assessed consumers’ perceptions towards food waste during April 2020 [8,10]. The Waste and Resources Action Programme (WRAP) study found that compared to November 2019, 36% of consumers living in the United Kingdom reported that their food waste decreased [8]. Another survey study conducted in April using an Italian and a US adult sample found that, overall, 42% perceived their food waste to decrease during the pandemic [10]. More recent studies have shown similar results [10–12, 30]. Specifically, a US study conducted in October 2020, found that 51% of participants reported a decrease in food waste; overall, self-reported food waste decreased from 20% to 10% [12]. These results are similar to our study, which found that 44% of families perceived their food waste to decrease post-COVID-19. While our waste audit results showed no change in total food waste, avoidable waste did decrease significantly. Thus, households’ perception of their level of food waste may be based on their perception of their avoidable food waste.

Several changes to family’s routines due to the COVID-19 pandemic could be driving the observed reduction in avoidable food waste. For example, previous results from food waste audits in Guelph surprised that families with busy schedules often had higher levels of food waste relative to other households [25]. The COVID-19 caused most community, sporting and child activities to be cancelled. Thus, as they described in their interviews, families were less busy post-COVID-19, which resulted in more time to think about and prepare foods. The COVID-19 restrictions also led to more adults working from home; in Canada, the COVID-19 pandemic caused an increase, up to 29%, in the number of Canadians working from home [29]. In the current study, 50% of participants reported that they were working remotely in August. Working from home may have led to the improved food-management behaviours we observed in our survey data, such as increased planning grocery purchases and using leftovers, which could explain the overall decrease in avoidable waste post-COVID-19. An Italian study, which found that during COVID-19 restrictions, adults reported better time management, more organized cooking habits, and greater use of “smart food delivery”, supports this hypothesis [30].

Our findings that families used online grocery shopping more, purchased more groceries per shopping trip, and made fewer trips to the grocery store likely stems from a concern of coming into contact with others [3]. Carroll et al. [3] hypothesized that this shift in grocery shopping behaviour would result in more food waste. However, our results show that households in our sample were able to maintain the same level of household food waste levels, while reporting that they buy more per trip. As described in the previous paragraph, the increase in time available to manage household food procurement and preparation may explain why total food waste remained unchanged despite changes in the grocery purchasing behaviour.

Another explanation could be related to specific cooking perceptions and behaviours. Our interview results suggest that, since the pandemic began, families have been cooking more often at home and spending more time cooking. In addition, our survey results show that families are feeling more confident with their cooking skills. Previous studies indicate that the frequency of cooking from home is positively associated with unavailable food waste, whereas time spent preparing meals, meal planning, and confidence in cooking skills are negatively associated with avoidable food waste [31–33]. The changes in food behaviour and perceptions towards cooking reported in our study, therefore, may explain our observed increase in unavoidable food waste and the decrease in avoidable food waste.

Furthermore, compared to pre-COVID-19, significantly more families reported serving leftovers at the family meal post COVID-19. A previous survey study conducted by the authors on adults’ perceptions towards food waste reduction found that only 5% of adults in the Guelph-area suggested eating leftovers as a way to reduce household food waste [25]. Related to the COVID-19 pandemic, a survey study conducted in March–April 2020, reported that “most of the respondents have set up a strategy of saving, storing and eating leftovers” [10]. Taken together, these findings suggest that COVID-19 restrictions may have raised awareness of using leftovers as a food management strategy.

7. Strengths and limitations

Our use of audits to directly measure household waste is a key strength of this research, as this study is the first to use objective measures to assess the impact of COVID-19 on food waste. This research also triangulates our audit results with both survey and interview data, which provides a rich interpretation of the audit findings.

There are also limitations to this study that should be considered when interpreting our results. The voluntary nature of participation in this study and the food-based focus of the original intervention may...
have resulted in self-selection bias. Although our recruitment materials for the intervention study did not specifically mention food waste (recruitment focused on helping families make mealtimes easier), it is likely that families who chose to participate had a pre-existing interest in food. Additionally, this study was time-intensive, requiring families to withhold their waste for collection by the study team for four weeks at two different time points. This may have biased our sample toward families who are more organized and, as a result, may produce lower levels of food waste. In our study, participants were aware that their waste was being audited, which could have led to changes in waste behaviors. However, we collected all streams of waste over a 4-week period, which would limit families’ ability to hide back or attempt to hide their food waste. Another limitation is based in our small sample size of 19 households, which increases our risk of Type II error and limits the generalizability of our findings.

8. Conclusion

Our results indicate that, compared to pre-COVID-19, total household food waste did not change, avoidable food waste decreased, and unavoidable food waste increased among our sample of families with school-aged children. These changes likely stem from changes due to the COVID-19-related pandemic restrictions and concerns, which have prompted parents to shop for groceries less frequently and in larger quantities, and adopt improved food-managing behaviours, such as serving leftovers more often. Because families perceived that their food waste behaviour may have changed throughout the COVID-19 pandemic, continued assessment of food waste is key to identify how food waste behaviour of households may change across different stages of the pandemic. Despite favourable changes in avoidable and unavoidable food waste, whether these shifts in behaviour will be sustained after returning to normalcy is an important research question to investigate. Interventions targeting food waste through cooking and eating habits may be able to capitalize on this opportunity by reinforcing these pandemic-related changes to ensure they last beyond the pandemic.

9. Data sharing

The datasets for this manuscript are not publicly available because of restrictions related to our Research Ethics Board requirements. Requests to access the datasets should be directed to AL at alaila@uoguelph.ca.

Authors’ statement

All authors (Amar Laila, Mike Von Massow, Maggie Bain, Kate Parizeau, and Jess Haines) have seen and approved the final version of the manuscript. We also warrant that the article is the authors’ original work, has not received prior publication and is not under consideration for publication elsewhere.

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Declaration of competing interests statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
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