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Investigating the Impacts of Behavioural-Change Interventions and COVID-19 on the Food-Waste-Generation Behaviours of Catered Students in the UK and India

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Abstract: A food-waste initiative was conducted at two university canteens in the UK and India to examine food-waste attitudes and opportunities for food-waste reduction. Interventions were carried out to reduce food waste in both canteens. In the Indian canteen, postintervention data also included COVID-19-related changes, such as a change from self-service to table service, as well as reduced menu choices and an improved estimation of the number of students requiring meals. Surveys and focus groups were conducted with students to better understand their food-waste-related attitudes, while interviews were carried out with university staff to better understand food-waste management. The study in the UK university canteen found that introducing table cards, posters, and signs led to food-waste reductions of 13%. Meanwhile, the study in the Indian university canteen found that the interventions and COVID-19 impacts led to food-waste reductions of 50%. Concerning food-waste-related differences between the UK and India, culture and food preferences were key reasons for food waste in India, with 40.5% more participants in India stating that they wasted food because the 'food didn't taste good'. Students in India were more concerned about social issues and food poverty related to food waste, with around 9% more participants stating that the 'food could be used by others'. Meanwhile, students in the UK were more bothered by the economic and environmental impacts of food waste, with around 31% more participants stating food waste is 'a waste of money', and is 'bad for the environment' when compared to India. Key opportunities for both countries included adopting food-sharing initiatives, informed menu choices, and meal planning, as well as student-led engagement projects.

Keywords: food waste (FW); university canteens; behavioural change; COVID-19; interventions; waste reduction

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1. Introduction

1.1. Background

There has been an ever-increasing interest in the management of food waste (FW) due to the enormous environmental, social, and economic impacts resulting from food being wasted. Currently, around 50% of all food produced around the world is not consumed by humans [1]. Vast quantities of food waste are generated at university canteens around the world due to students taking more food than they can eat, or the canteens making more food than is required, contributing to the global FW problem, which creates significant climate-change impacts and financial losses [2,3]. There is little consensus, however, as to the best FW-reduction strategies to implement, as FW-generation behaviour is little understood. At the same time, FW-generation attitudes and behaviours, as well as opportunities and challenges in FW management, vary significantly in different types of eateries in different

countries, with differing levels of economic development and contrasting cultures [4,5]. There has been a lack of successful large-scale FW-reduction interventions that have been published, with significant knowledge gaps regarding what affects people's FW behaviour and what can effectively change FW-generation behaviour [2,6]. Concerning FW reduction at university canteens, there is a dichotomy, as students expect their meal portions to reflect the amount of money they are paying for their catering, especially if they have to pay in advance for set meals, and consequently, some of the more orthodox FW-reduction measures may be seen to decrease student satisfaction and the quality of the service provided. For example, if university canteens are seen to reduce portion sizes, then students and parents may complain, therefore the canteens have to persuade students to reduce FW through other means [7,8].

1.2. Previous Food-Waste-Generation Behavior Studies

A limited number of studies have been conducted to understand how and why FW is generated and what behavioural-change interventions and infrastructural changes can be undertaken in order to reduce FW generation.

1.2.1. Food-Waste-Related Surveys

A number of surveys have been carried out concerning FW-generation behaviours [9], helping to offer insights into: where food gets wasted, how it gets wasted, why it gets wasted, and what can be done to reduce the waste [10], as well as the effects of FW interventions [11,12]. These surveys showed that interventions can result in an increased awareness of FW-related issues and lead to reductions in FW generation [13,14]; however, there is a lack of studies assessing how FW-generation behavior differed among different cultures.

1.2.2. Food-Waste-Related Interviews and Focus Groups

Many FW-themed interviews and focus groups have also been conducted, greatly increasing our depth of understanding into why FW issues persist, what motivates individuals and organisations to try to mitigate FW-related issues, and what barriers limit improvements in doing so [13,15,16]. They found that ethical concerns and a desire to conduct good practices regarding FW-generation behaviour helped motivate individuals and organisations to make related improvements, while having the appropriate infrastructure helped facilitate those improvements [17]. Key barriers, however, resulted from individuals wanting to show their generosity by offering guests more food than they could eat. A lack of knowledge and skills regarding FW reduction, combined with the perceived inconveniences related to trying to minimise FW, limited the levels of improvements that could be sought [18]. Again, there was a lack of literature concerning how different infrastructural and cultural settings in different countries influenced FW generation behavior.

1.2.3. Behavioural-Change Interventions to Reduce Food Waste

A range of studies from various countries quantifying FW reduction [9,19] with behavioural-change interventions have been carried out, heralding varying levels of success. Educational prompts in canteens resulted in FW decreases of between 4% [11] and 20% [19], while the use of salient signs in buffet restaurants led to a reduction in FW by around 20% [20]. These studies presented techniques that can be used to reduce FW in canteens and cafeterias; however, the impact of the interventions appeared to vary due to differences in the study sites and participant attributes. There is an absence of studies investigating the impact that cultural and infrastructural differences among different studied groups may have on FW-reduction levels.

1.2.4. Infrastructural Interventions to Reduce Food Waste

It is also possible to reduce FW significantly through making changes to the infrastructure of a canteen and the general way that it is run. Studies found that reducing plate and

utensil sizes for self-service cuisines led to large FW reductions of between 20 and 60% in buffet restaurants [20,21], while canteens going trayless led to FW levels falling by between 25 and 30% in university canteens [22]. In addition, improved estimation of food demand led to reductions in surplus food remaining at the end of the day by almost 65% in a buffet setting [23]. Refining and standardising menus was found to reduce FW by between 15 and 28% in schools in the US [24,25]. It also was found that FW-generation levels could be very dependent on the canteen's style, with self-service buffet canteens potentially generating up to three times more FW per customer than set meals with table service, and 8.5 times more FW per customer than counter-served, pay-as-you-eat food halls [3]. It is clear, therefore, that changing the infrastructural aspects of canteens such as plate sizes, quantities of food produced, menu options, and catering styles can help significantly reduce FW generation.

1.2.5. COVID-19 Impacts on Food Waste Generation Behaviour

With the emergence of COVID-19, it is important to understand what role the pandemic could have on influencing FW-generation behaviours and infrastructural changes. It has been reported that COVID-19 has led to an increased awareness of the ethical implications and environmental consequences of FW, leading institutions to exhibit more FW-reduction behavior, which could lead to increased opportunities for behavioural change and FW reduction in canteens [26,27]. Furthermore, COVID-19 has made both catering businesses and individuals more adaptable to changes, due to the diversity of changes occurring since the start of the pandemic [28,29]; this in turn could lead to significant opportunities for adopting infrastructural changes in canteens to reduce FW generation, as canteen staff and customers would be more adaptable to such changes. There is, however, a lack of studies assessing the specific quantitative impacts of COVID-19 on FW generation in the catering setting.

1.3. Research Objectives and Summary

University canteens were chosen for case studies, as they have specific challenges that contribute to FW management based on their meal structures, as mentioned above, while they also have specific opportunities related to academic expertise, student volunteer groups, and willingness to engage with research projects [9]. Universities in the UK and India were chosen in order to compare FW generation and attitudes in a developed country and a developing country with very different social, cultural, infrastructural, and economic landscapes [30,31].

When considering the research gaps outlined in Sections 1.1 and 1.2 of the Introduction, and building upon the literature mentioned in Section 1.2, the first objective of this study was to greater understand FW-generation behaviour and FW management among UK and Indian university students. This was done by carrying out surveys and focus groups with students, as well as semistructured interviews of canteen staff at both universities. Through this, the study improved upon the literature by examining FW-generation-related behavioural and attitudinal differences, and infrastructural differences among students at universities in the UK and India. The second objective was to assess the impact of introducing informative and prompt printed information on FW generation at university canteens in the UK and India by assessing changes in FW generation after introducing the interventions and conducting focus groups and postintervention surveys to understand the behavioural and attitudinal impacts. This built upon the existing literature by examining the impact of informative and prompt printed interventions on FW-generation levels, while adding additional novelty by assessing the implications that the sociocultural and infrastructural differences associated with the different countries had on the effectiveness of the interventions.

The effects of the COVID-19 pandemic emerged during the research, after the entire UK case study had been conducted, but before the impact of the interventions on FW generation in the Indian university canteen could be assessed. Therefore, the Indian case study evaluated not just the impact of the FW-reduction interventions, but also the im-

pacts of COVID-19 and related changes on FW generation. As a consequence, a further COVID-19-related objective was created. The third objective was to assess the impact of COVID-19-induced changes on FW generation at an Indian university canteen by measuring FW-generation changes after the emergence of COVID-19 and after gaining anecdotal information from canteen staff at the Indian university. This means that the paper adds to cutting-edge research on COVID-19 impacts on FW by showing quantitative impacts of COVID-19-induced canteen and behavioural impacts on FW-generation levels. Furthermore, an easily replicable research framework methodology was created based on the research methods used in this study.

Following the introduction, the paper outlines the experimental design of the study, then the qualitative and quantitative results gained are presented, and the results are then discussed, including differences between the UK and Indian universities. Finally, the work is concluded by detailing recommendations for university canteens, limitations of the research, and suggestions for future research.

2. Materials and Methods

In the UK, the research was carried out at a university hall of residence canteen in Yorkshire, UK. The catered students in the UK received two meals per day (breakfast and dinner), seven days per week, with a set meal served by staff, a number of meal choices and a chance for seconds at the end of service, and a buffet-style salad bar. This site was chosen because it represented a typical format for a UK university residence canteen [32].

In India, the research was conducted in a university canteen in Maharashtra, India. The canteen typically serves three "all-you-can-eat" buffet style meals per day, six days per week (excluding Sundays); however, post-COVID, table service was introduced for all meals. This site was chosen because it represented a typical format for a male-only Indian university canteen [33].

2.1. Survey

A 20-question survey was developed and carried out to ascertain FW-generation behavior [S-1]. The survey was adapted from a study by WRAP [34] that examined FW-related attitudes and behaviours in UK households, and was revised based on feedback after pilot testing. It involved three sections. Section 1 involved shopping habits. Here, we assessed how frequently individuals went shopping, including weekly and top-up shopping. Section 2 involved shopping habits and routines; the respondents were assessed for their shopping habits and FW-minimisation skills. Section 3 involved cooking and eating habits in the home, which helped us understand their household behaviours and attitudes related to FW. This included how much they wasted and what caused them to waste food. Sections 2 and 3 helped us identify why food was being wasted and what more could be done to reduce FW.

Finally, there were some questions regarding sociodemographics that were adapted from a study by Bernstad et al. [35] that examined the impact of providing educational information on FW-related attitudes. The preintervention surveys were conducted in person at the canteen, while the postintervention surveys were carried out online on JISC, an online survey tool designed for academic research, for both the UK and Indian universities, as conducting surveys in person was not possible due to COVID-19 social-distancing rules.

2.2. Semistructured Interviews and Focus Groups

A focus group lasting approximately an hour was conducted with six students at the UK catered residence, and with five students at the Indian canteen. The questions were aimed at a deeper exploration of the survey questions, in order to better understand why the students wasted food, what motivated them to reduce FW, what opportunities there were to reduce FW at the canteen, and what impacts the interventions had on them [S-2]. The first part of the focus-group session concerned the participants' general attitudes regarding FW. The second part discussed FW-reduction strategies and the impacts of the related

interventions. The final part inquired about their views on the FW-management strategy that was in place in their university. Student representatives engaged in sustainability at both of the studied UK and Indian university canteens selected students from varied backgrounds to represent the diversity of students that use the canteens.

Semistructured interviews lasting approximately 45 min each were also conducted in the UK with the head caterer at the residence canteen, and in India with the mess secretary, in order to gain insights into how each canteen was run. Questions were adapted from studies by Papargyropoulou et al. [36] and Ofei et al. [37], and aimed to ascertain similar information about FW management at institutions, such as the rationale for current FW-management strategies, key motivations to improve FW management, as well as opportunities and barriers to such improvements [S-3]. The semistructured interviews were carried out with the head caterer at the UK hall of residence being researched, as well as with the mess manager at the Indian university canteen. The interviews involved inquiring about the participants' roles at the universities, the specific challenges and opportunities they face in their particular jobs, their key drivers regarding sustainable FW management, and the rationale behind FW-related practices at the canteens.

Interviews and focus groups were conducted with the informed consent of the participants and in accordance with data protection after ethical approval was granted. They were conducted in person and on site by one researcher, and were recorded using a dictaphone. They were then transcribed, analysed, and coded into themes on Nvivo, before being written up and discussed with the use of illustrative quotes.

2.3. Food-Waste Data Collection

At the UK university residence, both catered and self-catered FW were combined at the source and weighed all together by the waste contractors in kilograms per week (kg/week). For assessing catered FW changes, total FW weights were collected for February 2019 and February 2020. The interventions were introduced at the end of January, after the final FW monthly collection. FW levels were then compared with figures for the previous year. As 2020 was a leap year, average daily FW figures (kg/day) were calculated, with FW quantities for February 2020 being divided by 29 days and February 2019 being divided by 28. When attempting to isolate the catered FW reduction specifically (excluding self-catered FW), 180 kg was subtracted from the FW figures for February 2019 and 2020, based on the increase from February 2018 (when self-catered FW was not segregated) to February 2019 (when self-catered FW was segregated). As there were 260 catered students when the data were collected, the daily FW generation was divided by 260 to obtain the daily per capita FW-generation figure (kg/capita/day).

At the Indian university canteen, the FW was weighed at the end of each day to obtain the daily FW-generation figures (kg/day). FW figures were collected from 6 January 2020 to 5 February 2020. The interventions were introduced on 5 February 2020 after a month-long baseline figure had been obtained for FW generation. While postintervention data were being collected, rising COVID-19 cases led to the sudden closure of the university, making a comparison impossible at that time. In December 2020, the university began to reopen with the canteen running at reduced capacity, serving 150 students as opposed to 375 pre-COVID-19. The FW-generation data were then collected for the duration of a month (19 December 2020 to 18 January 2021) showing postintervention, post-COVID-19 FW generation. The daily FW-generation figures (kg/day) were then divided by the number of students being served (375 pre-COVID-19 and 150 post-COVID-19) to gain the daily per capita FW-generation levels (kg/capita/day).

2.4. Food-Waste-Reduction Interventions

A number of interventions were carried out to attempt to reduce the amount of FW generated at both the UK and Indian university canteens, with specific aims to ascertain the extent to which FW interventions could reduce FW in canteens, and which of the interventions were the most effective.

The interventions included the use of informative place cards, salient signs, and poster prompts, as well as posters providing group feedback, and were carried out together. The differences between the baseline and experimental FW-generation quantities showed the extent to which the interventions affected FW generation at the canteen. The postintervention survey asked the participants which of the interventions they noticed and which they found most effective, with an aim to identify which of the interventions was the most successful.

Four informative table cards were placed on each table in the canteens to reduce FW, as based on a study conducted by Manomaivibool et al. [19]. Salient signs telling students to not overfill their plates were placed by the serving tables and FW, as based on a study by Kallbekken and Saelen [20]. In addition, a mixture of A3 and A2 prompt posters telling students to reduce their FW and posters with group feedback on quantities of FW generated in the canteens with relatable environmental and social impacts were displayed throughout the canteens to reduce FW, as based on a study conducted by Whitehair et al. [9].

At the Indian university canteen, as the postintervention data were collected post-COVID-19, infrastructural changes related to the running of the canteen were also introduced due to COVID-19, and were reported by canteen staff to have had an impact on FW generation. The following changes occurred due to COVID-19: a change from self-service to table service, with portion control by serving staff and increased ease in refilling plates; limited food items on the menu due to temporary staff reductions; increased FW awareness due to the COVID-19 situation; improved food-demand estimations due to COVID-19 and an exact account of student numbers and dining requirements, as students were required to inform the university daily of their whereabouts, and whether they were going to enter or leave the campus, in advance, including exiting temporarily at meal times; and reduced outside catering options, leading to fewer students opting for external catering. These changes were reported to have led to a reduction in FW generation at the canteen.

2.5. Research Methodology Framework

A research methodology framework (Figure 1) was created to illustrate how the aims and objectives matched with the methodology, and how the overall research methodology used in this paper could be adopted and replicated to increase the understanding of FW reduction among dissimilar sample groups. Waste-reduction methods, such as those used in this research, can be utilised to create quantitative data that can be analysed to calculate the extent to which these methods can reduce FW. Coinciding with this, attitude and behavioural methods such as surveys and interviews can be used to derive quantitative and qualitative data, respectively, which can then be analysed to better understand how and why there are dissimilarities among different sample groups, and what implications these differences may have on improving FW minimisation in the various settings. An arrow between the outcomes is used to symbolise how the methods can be used in conjunction with each other to create more diverse and complete findings.

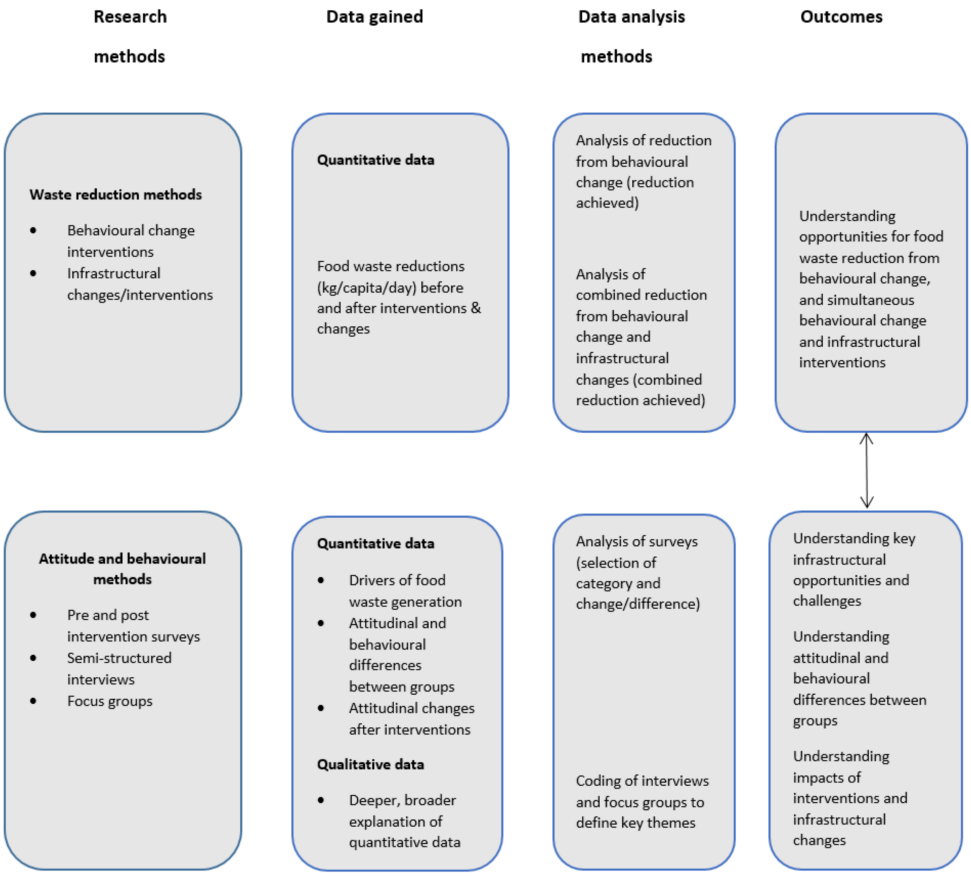

Figure 1. Research methodology framework.

A framework for conducting food-waste interventions in canteens (Figure 2) was also created to illustrate how the different food-waste-reduction interventions could be carried out, so that policymakers could use the outcome of this study to conduct necessary interventions to tackle FW in the canteen setting. It detailed how FW signs, posters, and table cards could be created for different canteen settings and introduced to reduce FW generation, with the steps detailing the actions that should be carried out shown in descending order.

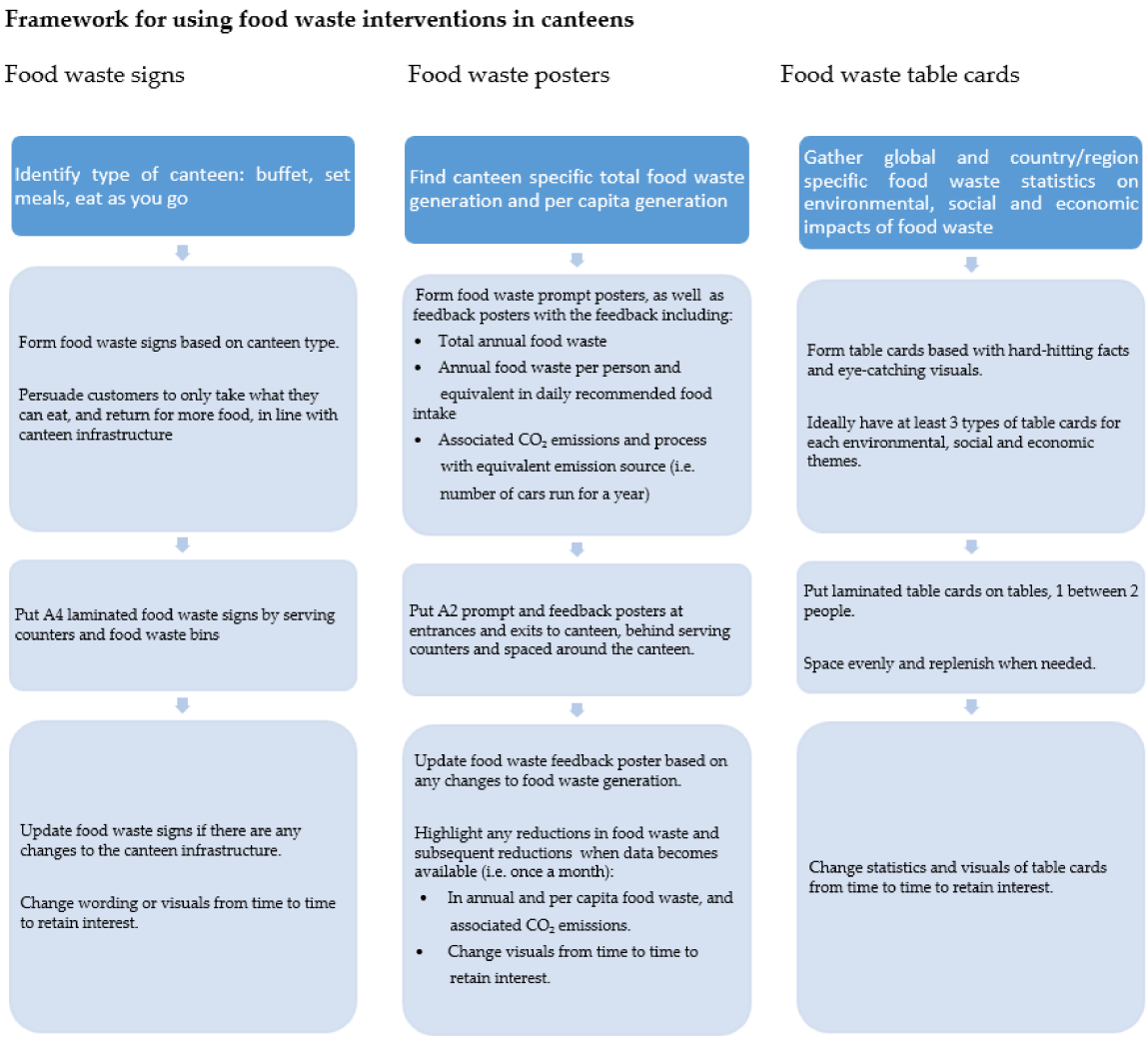

Figure 2. Framework for using food-waste interventions in canteens.

3. Results

3.1. Survey

In the UK, catered students included a mixture of male, female, and nonbinary students, as well as a range of UK, EU, and non-EU nationals; the sociodemographics of the samples are shown in Table 1. This section focuses on the preintervention surveys, as the postintervention surveys only had five participants (under the 31 required to be statistically viable).

Table 1. Sociodemographics of catered students in the UK surveyed.

Sociodemographics	Preintervention (%)	Postintervention (%)	Preintervention (%)	Postintervention (%)
Sample size	31	5	32	12
Gender				
Male (%)	48.5	20	100	100
Female (%)	45	80		
Nonbinary (%)	6.5	0		
Nationality				
UK (%)	48.5	20	Indian (%) 100	100
EU (%)	31	40	Non-Indian (%) 0	0
Non-EU (other than UK) (%)	20.5	40		

In India, catered students were surveyed at a male-only university canteen and consisted solely of male Indian undergraduate students; the sociodemographics of the sample are also shown in Table 1. This section focuses on the preintervention survey, as the postintervention surveys only had 12 participants (under the 31 required to be statistically viable).

Regarding self-perceived FW generation before the intervention, most catered students in the UK believed that they wasted small amounts, hardly any, or no food at all (81%), as shown in Table 2. This showed that the vast majority of the students did not consider themselves to be wasteful.

Table 2. Catered students in the UK—the causes of FW and self-perceived generation.

How Much Uneaten Food—Overall—Would You Say You Throw Away in General?		
	UK (%)	**India (%)**
Quite a lot	3	3
A reasonable amount	3	19
Some	9.5	12.5
A small amount	22	40.5
Hardly any	56.5	22
None	3	3
Which of these, if any, would you say is the main reason why you throw away food?		
	UK (%)	**India (%)**
Food didn't taste good	16	56.5
Made too much food	9	22
Not enough time	13	6.5
Plans change in the week/can't plan	28	3
Took too much food	0	9.5
Food spoilt	0	9.5
Don't know	34	9.5

When considering the main causes of FW for the catered students in the UK preintervention, the main issue was being unable to account for plans changing in the week (selected by 28% of participants); this was followed by the food not tasting good (16%), not having enough time (13%), and making too much food (9%), as shown in Table 2. Additionally, 34% were not sure about the main reason why they wasted food preintervention, signalling that the students lacked knowledge and awareness concerning FW preintervention.

Regarding self-perceived FW generation preintervention, most catered students believed that they wasted small amounts, hardly any, or no food at all (66%), as shown in Table 2. This showed that the majority of them did not consider themselves to be wasteful.

When considering the main causes of FW preintervention for the Indian catered students, the main issue resulting in FW was the food not tasting good (56%), followed by making too much food (22%), as shown in Table 2. In addition, only 9.5% of the students stated that they did not know why they wasted food, signalling that those surveyed had a relatively high awareness of FW issues even before the interventions.

When considering the extent to which the catered students in the UK were bothered by FW, the majority of those surveyed preintervention were bothered a great deal or a fair amount (77%), as displayed in Table 3.

When asked why the participants were bothered about FW, they stated wasting money was the main concern (72% of all those surveyed), as shown in Table 3. Feelings of guilt (59%), concerns about wasting 'good food' (56%), and considerations of the environmental impact (53%) were the second-, third-, and fourth-most selected issues with FW, respectively, and were selected by a much higher number of students than the other categories. Overall,

the results signified that the students were most bothered about economic, environmental, and ethical concerns related to FW.

Table 3. Catered students in the UK- The extent to which students care about FW and why.

When You Have to Throw Uneaten Food Items Away, To What Extent, if at All, Does It Bother You?		
	UK (%)	**India (%)**
A great deal	33.5	40.5
A fair amount	43.5	37.5
A little	10	19
Not very much	13.5	3
Not at all	0	0
Why does throwing away food bother you?		
	UK (%)	**India (%)**
It's a waste of my money	72	40.5
It's bad for the environment	53	22
It makes me feel guilty	59.5	72
It's dirty/makes the bin smell	12.5	9.5
It makes me feel that I haven't planned very well	25	22
I can't afford to throw away food	25	15.5
It makes me feel like I've wasted my time	15.5	9.5
It's a waste of good food	56	40.5
Food could be used by others	3	12.5
Don't know	0	6.5
How much effort do you make to minimise the amount of uneaten food you throw away?		
	UK (%)	**India (%)**
A great deal	19.5	31.5
A fair amount	48.5	40.5
A little	19.5	25
Not very much	13	3
None at all	0	0

Regarding the amount of effort catered students in the UK made to minimise the quantity of FW they generated preintervention, the majority made either a great deal or a fair amount of effort (68%), as displayed in Table 3.

When considering the extent to which the Indian catered students were bothered by FW, the majority of those surveyed preintervention were bothered a great deal or a fair amount (78%), as displayed in Table 3.

When asked why the participants were bothered about FW, the most selected issue was feeling guilty (72% of all those surveyed), as shown in Table 3. Following this, concerns related to wasting money, as well as 'good food' (both 41%), were the joint second-most selected concerns. Overall, the results signified that FW made them feel very guilty, while they were also concerned about social and economic issues related to FW.

Regarding the amount of effort Indian catered students made preintervention to minimise the amount of FW they produced, the majority made either a great deal or a fair amount of effort (72%), as displayed in Table 3.

3.2. Interview and Focus Group

Focus groups and semistructured interviews were carried out at the UK and Indian university canteens, as described in Section 2.2. The characteristics of the participants and themes identified are displayed in Table 4. The themes are discussed below. Where appropriate, postintervention survey results are mentioned to support the findings of the interviews and focus group.

Table 4. Key characteristics of participants and key themes identified.

Theme		**Description**		
(1) Reasons for FW		Concerns regarding how FW is generated, where it is generated, and why.		
(2) Motivations to tackle FW issues		Considers regarding why residents and responsible staff at the universities see FW as a problem, and what they hope to gain by actively trying to tackle FW issues.		
(3) Key opportunities to mitigate FW issues		Identifies ways in which FW management could be improved at the organisations.		
(4) Effect of behavioural change interventions on FW reduction		Explores the impact of FW interventions on FW-generation behaviour.		
Number	Country	Organisation	Role	Format
1	UK	University-catered residence	Students	Focus group
2	UK	University canteen	Residences' head caterer	Semistructured interview
3	India	University-catered residence	Students	Focus group
4	India	University canteen	Mess secretary	Semistructured interview

After conducting the semistructured interviews and focus groups at the UK and Indian universities, a great deal could be inferred that helped in understanding what FW-related issues there were at the universities, what the reasons were for these FW issues, and what could be done to improve the situation.

3.2.1. UK Interview and Focus Group

It seemed apparent that there were strong concerns about FW and motivations to reduce FW among the students. Financial savings and climate-change mitigation appeared to be the dominant drivers in reducing FW among the students in the UK.

1: *"On a personal scale I definitely think most about the economic issues."*

There were also strong FW-prevention practices carried out at the UK university that helped to mitigate FW issues, such as adapting menus based on student feedback.

2: *"There's no point in redoing that meal if they're not eating it."*

There was a major opportunity identified to reduce FW through food sharing, with surplus catered food being diverted to local food charities and establishment of a system for residents to share their surplus food to avoid it going bad, be it a specific system for the residences, or using existing apps such as OLIO [38].

1: *"We should have a common scheme for food that you don't want that could be shared."*

The focus groups also helped us to understand how and why the FW interventions worked, to what extent they worked, and what limitations they had. The canteen interventions appeared to be effective, especially the more informative information such as table cards and feedback posters about the impacts of FW, with the postintervention surveys also indicating that the table cards had the greatest impact on FW-generation behaviours.

1: *"It was really interesting to learn more about it, to put it all into context."*

3.2.2. UK Interview and Focus Group

It seemed apparent that there were strong concerns about FW and motivations to reduce FW among the students in India.

The consequences of FW on food security were considered particularly important at the Indian university.

3: *"In our country many people don't get to eat their daily food. I consider it a very big problem. We should reduce food waste as much as we can."*

One of the most significant FW-related issues at the Indian university canteen was estimating how much food to produce in at the canteen.

4: *"The main constraint is unpredictability of students eating in the mess."*

Moreover, there were significant issues related to cultural taste preferences and FW, which are inherent at universities in India due to India's cultural diversity.

3: *"Here in the mess the food made is mostly Marathi cuisine, so if someone is from Delhi, they will probably not like the Marathi food."*

In addition, there were issues of students overfilling their plates and wasting food because they took more than they could eat, or took large quantities of food items that they disliked after tasting them. They mentioned how this FW could be reduced by taking smaller quantities and returning for seconds.

3: *"Take a little bit of food, taste it and if you like it you can take a bit more."*

Perhaps the main opportunity that was identified to reduce FW at the university was food sharing, with surplus catered food being diverted to local food charities.

3: *"If there is food left over, we could transport it to food shelters or take it to NGOs to redistribute the food. There are NGOs who take this."*

The focus groups also helped us to understand how and why the FW interventions worked, to what extent they worked, and what limitations they had. Canteen interventions appeared to be highly effective at the Indian university, with FW signs making students feel guilty about wasting food, and the statistical information that was displayed having a particularly significant impact. The postintervention surveys also indicated that the table cards and feedback posters had the greatest impact on FW-generation behaviours.

3: *"The sign was very effective because I saw it when I was throwing away my food and I found it very disturbing to see."*

3.2.3. Food-Waste Reduction

The UK university canteen typically served around 260 catered students, and generated around 35.7 kg/day of FW. Total FW was reduced by 11.4% (from 35.71 kg/day to 32.07 kg/day), while the daily per capita catered FW was reduced by 13.2% (from 0.1127 kg/capita/day to 0.0995 kg/capita/day). Figure 3 shows examples of the FW interventions used, including FW posters (a prompt poster at the top left and a feedback poster at the top right), an FW sign in the centre, and table cards at the bottom, shown in clockwise order and in descending order from top to bottom. FW was reduced at the canteen, meaning that the interventions impacted FW-reduction behaviours. The FW reduction will result in an annual savings of approximately 5 tonnes of CO_2eq [39] and GBP 11,680 [40], as the environmental impacts and financial outlays associated with producing the avoided FW will have been mitigated. This indicated that the interventions appear to have been effective in reducing FW.

The Indian university canteen typically served around 375 students and generated approximately 45 kg/day before the COVID-19 pandemic, and during the time in which the interventions were initially introduced. Data on FW generation directly after the interventions were introduced were unattainable due to a COVID-19-related university shutdown and citywide lockdown. Attempts were made to acquire the data once the lockdown was eased, and in December 2020 it was finally possible to obtain this data; however, as mentioned previously, the data showed the joint impacts of the FW interventions and COVID-19-related changes, including a reduction in student numbers to around 150 post-COVID and in total FW generation to approximately 9 kg. The combined impacts of the interventions and COVID-19 changes led to a 50.2% reduction in per capita FW generation at the Indian university canteen (from around 0.12 kg/capita/day to 0.06 kg/capita/day).

The total FW reduction will result in annual savings of approximately 36 tonnes of CO2eq [39], and INR 125,000 [41], as the environmental impacts and financial outlays associated with producing the avoided FW will have been mitigated. It seemed apparent that the interventions were highly effective in reducing FW, while the changes associated with COVID-19 had a very significant impact on FW reduction.

Figure 3. Examples of food-waste interventions used in canteens.

4. Discussion

According to the results, it seemed likely that the interventions changed the behaviours of the students by making them reduce their FW, while any related FW reductions will bring about wide-ranging environmental, social, and economic benefits. It was vital to assess how the results of the research differed between the UK and Indian universities to understand how regional, cultural, and infrastructural differences between the countries, as well as COVID-19 impacts, could influence FW-reduction opportunities. It was also important to compare the results with those of previous studies to find where the literature supported our research results, where the findings differed, and what the reasons for the differences may have been. It was imperative to then use this analysis to see how it could improve our understanding of enacting effective FW-generation behavioural change, and what implications this could have on the wider context of improving institutional FW management, as well as the benefits these improvements could bring.

When comparing the behaviours and attitudes of UK and Indian catered students, it seemed that the students in the UK perceived themselves to be more wasteful than the students in India, with 81% of the students in the UK believing that they wasted small amounts, hardly any, or no food at all, when compared to 66% of students in India. On the other hand, it was apparent that students in India had a greater concern than the

students in the UK regarding FW-related issues, as a slightly higher number of students stated that they were bothered 'a great deal' or 'a fair amount' than students in the UK did (78% compared to 77%), and more students in India stated they made 'a great deal' or 'a fair amount' of effort to minimise their FW when compared to students in the UK (72% compared to 68%). It could also be inferred from the surveys and focus groups that students in the UK were more concerned about economic and environmental concerns than students in India, whereas students in India were more bothered by social issues such as food security, and felt more guilt when wasting food. When comparing cultural and infrastructural differences between the UK and India, reasons for FW being generated at the university canteens, and opportunities to reduce FW, there were many similarities, but also key differences. While the UK university canteen maintained a well-informed menu selection through use of student surveys to understand food preferences, the Indian canteen had a less well-informed menu selection, as they did not obtain feedback to understand and adjust the menus based on what meals students did or did not like, leading to large levels of wastage of certain meals. Meanwhile, the caterers at both canteens experienced difficulties in estimating how much food to prepare. With this being said, the UK canteen caterers maintained very effective FW-prevention practices in the kitchen, such as using batch cooking and creative use of leftovers, meaning that surplus-food-related waste was minimised, something that could be adopted at the Indian university to help better mitigate FW issues. Due to the fact that the Indian university canteen was a self-service buffet, many students overfilled their plates and could not finish their food. On the other hand, at the UK university canteen, food was served by the canteen staff, so there tended to be better portion control, with less overfilling of plates. Moreover, the Indian university canteen had specific FW issues related to cultural taste preferences and FW, which are inherent to universities in India due to India's cultural diversity, but not very applicable to UK universities, as UK cuisine is less regionally diverse. It was found that FW related to diverse cultural preferences could be reduced by serving more standardised and plain meals. Perhaps the main opportunity for both universities that was identified to reduce FW was food sharing, with surplus catered food being diverted to local food charities and food-sharing systems being set up. Student engagement projects to educate people to reduce FW were also identified as a significant opportunity to reduce FW at both university canteens.

When comparing the impact that the interventions had on the catered students in the two countries, according to the focus groups and FW-generation data, the interventions appeared to have had a major impact in both countries, with table cards and posters appearing to be particularly effective. As the postintervention FW-generation data for the Indian university canteen also included COVID-19 impacts, it was impossible to make a true comparison of the impact of the FW reduction interventions between the UK and India. That being said, the interventions were found to be highly successful in reducing FW quantities at the UK university by reducing the per capita FW by over 13%, while combined postintervention and COVID-19 FW reduction at the Indian canteen was much higher, at over 50%. With a lack of statistically significant postintervention survey samples, and a lack of delineation between the FW generation changes that resulted from COVID-19 changes and behavioural-change interventions, it was difficult to speculate on the specific contribution of each FW-reduction measure.

Of the total 50% reduction in FW observed at the canteen, it is likely that some of the reduction observed could have resulted from the behavioural-change interventions, as there was a 13.2% reduction found at the UK university, and the postintervention surveys and focus groups indicated greater impacts of behavioural-change interventions among students in India. That being said, it was probable that the COVID-19-related changes at the Indian canteen had the biggest proportional impact on FW reduction at that canteen.

Regarding the impact of COVID-19 on FW generation, it seemed that the numerous infrastructural changes in the canteen led to most of the FW reduction. A change from self-service to table service at the canteen may have led to a reduction in plate scrapings by

tackling the reported issue of students taking too much food and overfilling their plates at the canteen. This was likely due to improved portion control by serving staff, as well as it becoming easier to get more food, because staff refilling plates meant students knew it was easier and less time-consuming to refill their plates, so they did not feel they had to overfill their plates for the first serving. Moreover, the introduction of a more limited menu due to a reduction in staff numbers on site caused by COVID-19 and staff returning to their hometowns appeared to have minimised FW arising from cultural taste preferences. This was reportedly because the limited food items offered were well known, standardised, and commonly liked foods, thus reducing plate scrapings resulting from taste-preference issues. Moreover, there was an issue with students eating at off-campus canteens instead of at the university canteen, leading to the university preparing too much food, which resulted in large food surpluses. The pandemic, however, led to the temporary closure of many easily accessible eateries outside the campus, reducing outside eating options, and therefore the ease of students in seeking alternative eating options to the university canteen. This in turn may have potentially been the key factor in reducing overall FW generation by reducing the amount of surplus food produced at the canteen. Additionally, COVID-19 and related safety concerns meant that there needed to be a better account of the whereabouts of students, and specifically the number of students on campus requiring food at any given time. This meant that an exact account of students who were expected to have meals was known, which may have led to improved food-demand estimation, further helping the canteen to reduce the amount of surplus unserved food left at the end of the day. It also was reported that COVID-19 led to an increased awareness of FW issues and an increased effort to minimise FW, which may have also contributed to the FW reduction witnessed.

As mentioned in the results section, the surveys found that the FW-reduction interventions such as the table cards and posters did have an impact on FW-generation behaviours among the catered students. Studies conducted by WRAP and the Women's Institute [10], Hampshire Country and Brook Lyndhurst [14], Whitehair et al. [9], Luecke [13], Schmidt [42], and Visschers et al. [43] all supported these findings, and used similar interventions to affect FW-generation behaviour and pre- and postintervention surveys, supporting the findings of the survey in the research. That being said, Ellison et al. [11] found that after using educational interventions at a university canteen, students did not have significantly improved FW-generation behaviours. This meant that such interventions were not always found to be effective in improving participants' FW-generation behaviours and attitudes.

As comparing FW-related attitudes between students in the UK and India was a novel topic area, there was a lack of literature with which to compare the findings. Previous research compared how FW-generation behaviours differed in different countries; however, Grainger et al. [44] found that survey respondents in EU countries with lower GDPs reported wasting greater levels of food; while in this study, the country with the lower GDP (India) reported wasting more food than the country with the higher GDP (the UK), thus supporting the findings. In addition, studies such as those by Jörissen et al. [45], which compared FW behaviours in Italy and Germany; and Heng and House [46], which compared FW behaviours in the USA, Canada, the UK, and France, both found significant differences in self-reported FW and causes of FW in the different countries. This showed that different countries could have clearly different FW-generation behaviours, as was found to be the case when comparing the UK and Indian students in this study. While all of the preintervention surveys had a statistically significant number of participants ($\geq$31, as calculated during a power calculation), the postintervention surveys all had a lack of participation, and were not statistically significant (<31) [47]. Regarding the preintervention surveys, it must be noted that while the UK university participants consisted of male, female, and nonbinary students, the Indian university sample included a male-only sample. The influence of gender on FW-related attitudes has been researched. Koivupuro et al. [44] and Silvennoinen et al. [48] found that women reported that they generated more FW than men; however, the survey in our research found that the male-only Indian university

sample recorded greater levels of self-reported FW than the mixed-gender UK university sample. Moreover, Cantaragiu [49] found that women tended to express greater concern than men about the social consequences of FW, such as impacts on equality; however, the surveys and focus groups in our research found that the male-only students in India were more concerned about the social impacts of FW than the mixed-gender students in the UK. In addition, Lyndhurst [50] and Sudershan [51] found that women felt more guilty about wasting food and more bothered by FW, respectively; however, the surveys in our research found that the male-only students in India felt more guilty about wasting food, and were more bothered by FW than the mixed-gender students in the UK. We concluded that gender influences could not explain the differences in FW-generation attitudes and behaviours observed between the studied Indian and UK students, due to the fact that, if the influences of cultural differences were excluded, all of the findings would contradict those found in the literature. With this in mind, it may have been the case that the cultural differences observed in our study could be widened even further if the surveys and focus groups were conducted with participants using the same gender mixes [52].

The interviews and focus groups found clear improvements in FW attitudes after the interventions were introduced due to increased awareness of FW issues and the benefits of trying to minimise personal FW contributions. This was also identified in a study by Luecke [13] that used similar interventions with catered university students. Concerning the comparison between the Indian and UK institutions, Indian canteen staff and students were more concerned about social issues with FW, whereas those from the UK were more concerned about environmental and economic issues, due to a greater prominence of food insecurity in India [53] and a greater awareness of environmental issues in the UK [54]. The UK–Indian comparisons were not supported by the literature due to the novelty of the research; however, the survey responses were in alignment with the interviews and focus groups. Adapting interventions based on country-specific FW concerns could help improve their effectiveness. Additionally, a targeted approach that makes informed menu choices based on students' preferences could represent a particularly significant opportunity for FW reduction at Indian university canteens, and the reduced menu choice may well have played a significant role in post-COVID-19 FW reduction at the canteen.

As seen in the Results section, the FW-reduction interventions were effective at both the UK and Indian university canteens. FW was reduced at the UK canteen by 13.2% when compared to the preintervention baseline figure, and the interventions were likely to have contributed to an even greater reduction in FW at the Indian canteen, given the survey and focus group responses. This FW-reduction figure was broadly similar to that seen in similar studies, with FW reductions of between 9 and 19% when using educational and feedback prompts as interventions in university canteens [9,19,55]. Additionally, Kallbekken and Saelen [20] found that FW was reduced in buffet restaurants by a comparable 20.5% when using salient sign interventions, thus supporting the findings of this study. Conversely, a study carried out by Ellison et al. [11] found a decrease in FW of only 4% with similar interventions, showing that there may not always be a large drop in FW generation. In addition, as the FW quantities at the canteen were combined at the source with the self-catered FW from the UK university residence hall, some changes in FW that were recorded may have resulted from fluctuations in the self-catered FW stream. That being said, catered FW represented the majority of the total FW stream at the residence (~71%), and there was an 11.4% reduction in total FW at the residence (including self-catered FW) postintervention. Considering this and the fact that the majority of studies found comparable outcomes using similar interventions, we inferred that the results of our study were reliable, and that a FW reduction of around 13% could be expected when carrying out the same interventions at other university canteens in the UK. From this, we gleaned that such interventions were an effective method for reducing FW and its related impacts. The interventions were highly cost-effective and would be very easy to replicate. That being said, there was a lack of long-term studies showing the effects of using informative printed interventions

on FW reduction over time, with one study expressing a belief that the impacts of such interventions may wane over time [56].

As mentioned in the Results section, it is likely that COVID-19 impacts contributed significantly to reducing FW at the Indian university canteen. The contributing factors may have included a move to table service, improved food-demand estimation, a scaled-down menu, and increased FW awareness due to COVID-19. A number of studies have examined the impact of similar infrastructural changes, as well as COVID-19-related attitudinal changes, on FW generation in the canteen setting. Papargyropoulou et al. [3] found that canteens with served meals may generate less than half of the amount of FW per capita than self-service buffets, as servers can instigate effective portion control, thus supporting the theory that a switch to table service reduced FW. On the other hand, Matzembacher et al. [8] found that self-service canteens generated less FW per capita due to customers having more autonomy to pick a portion size proportionate to their appetite. Meanwhile, improved food-demand estimation was reported at the Indian canteen since COVID-19, due to the canteen having a better ability to know how many students to serve on a given day. Leverenz et al. [23] reported that improved food-demand estimation allowed for more suitable food-production levels for hotel breakfast buffets, allowing for a reduction in end-of-service food surpluses by almost two-thirds, thus showing that improved food estimation can bring about significant FW reductions, as was reported to have occurred post-COVID-19 at the Indian canteen. In addition, the changed, refined, and more standardised menu that was introduced in the Indian canteen post-COVID-19 was reported to have led to less FW being generated at the canteen. Cohen et al. [24] and Schwartz et al. [25] found that standardising menus at school canteens in the US led to reductions in waste of up to 28% for certain food items, showing that menu changes can bring about significant FW reductions. COVID-19 was also reported to have brought about increased FW awareness and resultant reductions in FW generation at the canteen. Studies by Principato et al. [26] and Burlea-Schiopoiu et al. [27] reported similar findings, thus supporting this theory. These studies only looked at attitude changes and did not assess specific FW reductions; thus, it was difficult to quantify what impact COVID-19-related behavioural changes may have had on FW generation at the Indian canteen.

The 50% per capita FW reduction post-COVID-19 and postinterventions were likely caused in part by the behavioural-change interventions, but much of the reduction was likely to have resulted from the COVID-19 impacts. It is probable, when examining the survey and focus-group responses, that the FW-reduction interventions were more impactful at the Indian canteen than at the UK canteen. Assuming, however, that the interventions had a similar impact in both countries, COVID-19 impacts could have been responsible for a per capita FW reduction of over 35%. While the combined impact of such specific changes on FW generation have not been assessed in the literature, there have been studies that assessed the impact of awareness campaigns and infrastructural changes on FW generation and showed similar impacts in comparable settings. Visschers et al. [43] found in a Swiss university canteen setting that awareness-raising behavioural-change intervention (similar to that used in this study) increased the FW awareness of students, but did not impact self-reported FW generation (plate waste). However, when the behavioural-change intervention was combined with an infrastructural intervention, in the form of offering smaller meal portions, plate scrapings were reduced by 20%. Moreover, Pinto et al. [57] found that an awareness-raising behavioural-change intervention combined with the same infrastructural intervention—the provision of smaller meals—at a Portuguese university canteen led to a reduction in plate scrapings by 15%. Additionally, the researchers provided the catering team with data on food production, food consumption, and surplus leftover food at the canteen. The catering team then adjusted the amount of food they produced accordingly, leading to a 73% reduction in surplus food due to this additional infrastructural intervention. These studies showed that a combination of behavioural-change interventions (such as the one used in this study) and infrastructural interventions such as improved portion control and improved food demand estimation (as was introduced in the Indian

canteen post-COVID-19 through a switch to table service and improved student number monitoring) can lead to significant FW reductions, with the infrastructural changes having a greater contribution to the reduction than the behavioural-change interventions.

In addition, Malefors et al. [58] compared the impact of an awareness-raising behavioural-change intervention with infrastructural interventions on FW generation at Swedish schools. They found that the behavioural-change intervention led to a 35% reduction in plate scrapings. When examining the impacts of infrastructural interventions, they found that offering tasting spoons, to see if students liked the meal before serving it on their plates, led to a 22% reduction in plate scrapings. In a similar vein, in the Indian canteen post-COVID-19, servers offered students tastings of dishes if they were not sure they would like them. Malefors et al. [58] also gave feedback on FW generated daily at the canteen and how many meals this equated to, and allowed the students to report why they wasted the food, including issues with the taste of certain meals. This intervention resulted in a 37% reduction in plate scrapings through improved FW behavior and a 62% reduction in surplus unserved food through the menu being refined. At the Indian university canteen, the FW feedback poster that was introduced had similarities to the feedback materials introduced by Malefors et al. [58], while the menu was also refined in a similar way post-COVID-19 at the Indian university canteen, reportedly leading to reductions in FW. Malefors et al. [58] also found that improved student number monitoring (as was introduced post-COVID-19 at the Indian canteen) led to a reduction in surplus leftover food by 49%. Overall, the feedback led to the greatest reduction in FW of all of the interventions, followed by the student number monitoring. The findings of this study were in line with Visschers et al. [43] and Pinto et al. [57] by indicating that infrastructural changes (such as those made post-COVID-19 at the Indian canteen) lead to a greater FW reduction in canteens than behavioural-change interventions (such as the one introduced at the Indian and UK university canteens).

The impacts of COVID-19 changes, similar to those at the Indian university canteen, were studied by Ismail et al. [59] in a Tunisian university canteen setting. Post-COVID-19, the canteen changed its catering style and infrastructure, with improvements reported in the menu, food presentation, food safety and hygiene, and general food quality, as well as an increased FW awareness after the emergence of COVID-19. Similar improvements in meal quality and safety, as well as increased FW concern post-COVID-19, were also reported at the Indian canteen. Overall, Ismail et al. [59] found that post-COVID-19, 28% more students reported to have wasted no food, while 55% reported to have wasted less food when compared to pre-COVID-19. This therefore showed that COVID-19 impacts, similar to those experienced at the Indian canteen, significantly impacted FW behavior and generation.

Bearing in mind the fact that the majority of studies found comparable outcomes when canteens underwent similar infrastructural changes, and the fact that previous studies found that infrastructural changes contributed more than awareness campaigns to FW reduction, it is likely that the changes were responsible for the majority of the per-capita FW reduction observed at the Indian university canteen. Moreover, there could be a real opportunity for combining behavioural-change interventions with infrastructural changes at canteens to lead to major reductions in FW generation. It is also possible that the behavioural-change interventions had an enhanced impact due to complimentary COVID-19-related attitude changes concerning FW [27,28,59]. Furthermore, similar impacts may be possible when enacting the same infrastructural changes post-COVID-19 at other university canteens in India. From this, we gleaned that such infrastructural changes were a highly effective method for reducing FW and its related impacts.

Additionally, other studies have shown that other FW-reduction methods, such as trayless canteens [23] and reduced portion and utensil sizes [21,22,54,57], were highly effective in reducing FW. Further still, redistributing surplus food can help reduce FW further, as it tackles the surplus food stream, while the other interventions mentioned targeted the reduction of plate scrapings, and should be carried out where possible [60]. As was

discussed in the focus groups and interviews, surplus food from catering establishments can be reduced through using mobile phone apps such as Too Good To Go, which reduces FW by offering discounts on uneaten food before the closure of canteens [61]. The final daily surplus can then be redistributed by FW charities [60]. Reducing FW in the catering sectors is incredibly important, as it is one of the largest sources of global FW [1], and is associated with particularly high GHGEs per quantity of FW, as there are upstream emissions that result from agriculture, processing, storage, and transport equivalent to over 2 tonnes of CO_2eq per tonne of FW [62], and FW also contributes significantly to food insecurity [1].

5. Conclusions

In conclusion, this research achieved either all of its objectives fully or in part, and in doing so, has added to the literature to increase our understanding of the topic area.

The first objective, 'to greater understand FW generation behaviour and FW management among university students in the UK and India', was achieved at a more surface level by comparing the surveys, and at a deeper level by comparing focus groups and interviews at the different institutions. Specific FW-related cultural differences between university students in the two countries had not previously been studied. In achieving this objective, we helped to fill knowledge gaps. The survey found that students in India had greater concerns about social FW issues, while students in the UK were more concerned about financial and economic impacts. This work also identified that cultural diversity was a greater cause of FW in India. The analysis also found that students in India appeared more concerned about FW than students in the UK were. Similar research methods should therefore be expanded to other institutions across the two countries, in order to ascertain which of the differences observed can be attributed to countries as a whole, and which may be institution-specific. In addition, the results should be statistically modelled in order to give more weight, robustness, and scientific significance to the findings.

The second objective, 'to assess the impact of introducing informative and prompt printed information on FW generation at university canteens in the UK and India', was partially achieved by assessing statistical differences in pre- and postintervention FW generation, as well as focus groups and interviews to understand how and why the interventions made an impact. The paper has helped add to the literature, and agreed with the findings of previous studies that educational and awareness-raising interventions can help improve FW-generation attitudes and change behaviours, resulting in reduced FW, which in turn results in wide-ranging benefits. This objective was only partially completed, however, due to COVID-19-related changes being combined with the behavioural interventions at the Indian university, meaning that the exact extent of FW reduction through printed and prompt interventions could not be ascertained. Additionally, a lack of statistically significant postintervention surveys meant that there was a limited understanding of the degree to which the behavioural-change FW interventions affected FW-generation behaviours and attitudes.

The third objective, 'to assess the impact of COVID-19-induced changes on FW generation at an Indian university canteen' also was achieved by assessing FW-generation levels before and after the pandemic-induced infrastructural changes, as well as gaining anecdotal information from canteen staff on how and why they impacted FW levels. We observed that infrastructural changes brought about by COVID-19 likely led to significant reductions in FW, while the COVID-19 pandemic itself may have increased FW awareness among students in India. Knowledge of this can in turn help in our understanding of how and why infrastructural changes to canteens may offer opportunities for significant FW reductions. This could, in turn, help form a template for canteens in India and perhaps other similar institutions globally to adapt the way they are run to reduce FW generation, adding to previous research. The research has also helped increase our understanding of the impacts of COVID-19 in the catering setting, and on FW behaviours, also building on the existing literature. The novelty of our research was also greatly increased by the fact that it was one

of very few projects that incorporated the impacts of COVID-19 on FW generation, and that discussed opportunities that have emerged in the catering and FW management sector as a result of the pandemic. However, as the behavioural changes and COVID-19 infrastructural changes were introduced together, it was impossible to know precisely what proportion of the FW reduction observed was due to COVID-19 infrastructural changes. Further research should be conducted on similar-style institutions, replicating the preintervention conditions and adopting similar behavioural-change interventions, as well as similar infrastructural changes at different times, in order to specifically differentiate the individual impacts the different changes have on FW generation at the university canteens.

Furthermore, there was clearly a lack of literature concerning how FW-related attitudes differed between institutions in different countries and how this affected the impact of FW-related interventions. Further research should be conducted to bridge this knowledge gap by expanding the size of the study to examine numerous other universities across the UK and India to ascertain how representative the two case studies in this research were. Moreover, additional research needs to be carried out to assess and quantify the true environmental, economic, and social benefits that could result from site-specific FW reduction from interventions and infrastructural changes, as well as related feasibility and economic outlays for carrying out said interventions and infrastructural changes.

Using the findings of this research, a number of recommendations can be made to inform FW managers at universities to improve their FW management. In order to reduce FW at university canteens, a similar FW-reduction campaign with informative printed interventions being displayed in the canteens should be adopted, as they were effective, at least in the short term; they were highly cost effective; and they would be very easy to replicate. Furthermore, COVID-19 should be seen as a major opportunity to implement similar infrastructural changes, such as improved food estimation, refined menus, and a switch to table service in order to reduce FW generation, as COVID-19 has made society more adaptable and accepting of changes to which they may previously have been averse. Other initiatives mentioned, such as introducing smaller plate sizes and having trayless canteens, should also be explored wherever feasible. Furthermore, refining menu plans to fit the needs of students and having effective estimation systems to reduce the likelihood of overcatering would also be advisable to further reduce FW. Additionally, efforts should be made to set up systems in which surplus catered food can be redistributed to local food charities.

Supplementary Materials: Supporting information including the survey, focus group and the interview questions can be downloaded at: https://www.mdpi.com/article/10.3390/su14095486/s1. Document S1: Canteen food waste survey; Document S2: Focus group questions and plan; Document S3: Semistructured interview questions.

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