LONDON'S GLOBAL UNIVERSITY

UNDERSTADNING FOOD & CATERING EMISSIONS OF UCL'S BARTLETT FACULTY

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Contents

1. Introduction

Limiting global warming to 1.5°C requires immediate and deep emission reductions across all sectors. Major institutions play an important role in understanding, enabling and taking action on climate change and demonstrating support for environmental protection. The University College London (UCL), as London's Global University with a diverse community, has committed to lead by example and integrate sustainability into its planning, processes and culture. The university has adopted a strategy called "Change Possible: The Strategy for a Sustainable UCL 2019 – 2024" which details the principles and strategy to achieve the vision for a Sustainable UCL 2019-2024. The strategy also highlights how each part of UCL has a unique contribution to make to the university's sustainability mission. As a result, faculties are encouraged to take action at the department level, making their contribution to achieving Sustainable UCL 2019-2014.

The Bartlett, UCL's Faculty of the Built Environment, has committed to reach net-zero greenhouse gas (GHG) emissions as a faculty by 2030. This aligns with UCL's overall commitment of becoming a net-zero institution by the same year. As part of these efforts, the faculty seeks to have an improved understanding of the greenhouse gas emissions associated with its procurement of materials. This report specifically looks at emissions from food and catering and will provide recommendations on how emissions from this category can be reduced. In this report the overall emissions from food and catering of the Bartlett will be estimated using procurement data from 2018 to 2019 and life cycle assessment (LCA) data.

This report is organised as follows: the next section (section 2) will describe the aims and scope of the report and the methods employed to estimate the GHG emissions arising from the faculty's food and catering procurement. Section 3 will present the results. First, the faculty's food and catering spending will be reported then the greenhouse gas emissions associated with each aspect of food and catering spending will be presented. Section 4 will then discuss results and recommend ways in which the faculty's emissions from food and catering can be reduced. Finally, section 5 will summarise some of the key findings and conclude.

2. Aims, scope & method

2.1. Aims and scope

The aim of this report was to better understand the carbon emissions of food and catering of the Bartlett Faculty and to propose recommendations on how to reduce emissions from this category. Using the faculty's procurement data from 2018-2019, data on food and catering spending were extracted from the spreadsheet of the overall spending of the faculty. The extracted data were then broken down into the following eight categories for further analysis:

- **Catering for events**: catering provided for workshops, events, trainings, workshops etc.
- **Entertainment and hospitality**: staff and student entertaining means food or drink for two or more members of staff or registered UCL students in connection with UCL business activities. It includes working lunches/dinners, team-building events etc.

- **Meals – subsistence**: cost of meals (breakfast, lunch, dinner) while travelling both within the UK and abroad.
- **Individual food items**: the purchase of food items such as coffee products, tea, hot chocolate, milk, sugar, biscuits etc.
- **Venue hire and catering:** costs associated with catering and venue hire for events. Note: cost of venue hire and cost of catering were included as one figure.
- **Catering for internal meetings**: Food and drink for internal meetings.
- **Restaurants**: lunch and dinner in restaurants.
- **Other:** catering supplies and disposables (e.g., mugs, glasses, plates, cutlery, napkin etc.) and annual rental & total care service for coffee machines.

2.2. Method

The greenhouse gas emissions associated with the above-mentioned categories were estimated using Life Cycle Assessment (LCA) data from the literature. LCA is an environmental management tool and an internationally standardised methodology that can be used to quantify the potential environmental impacts of products and services over their full life cycles (ISO 2006a, ISO 2006b). LCA is widely used in the literature to estimate the environmental impacts of different food items and meals. To be able to apply the results of food LCA studies to this study, the procurement data had to be normalised to the same reference or so-called functional unit that were used in LCA studies to express the global warming potential of meals and food items (i.e., based on 'one meal' or 'one kilogram of food item').

2.2.1. Estimating the number of meals

Estimating the total number of meals was straightforward for the 'Meals – subsistence' category, where procurement data were already broken down into meals. In this category, the number of breakfasts, lunches and dinners were simply summed to get the total number of meals. For other categories, the number of meals had to be estimated using UCL's Expenses Policy. This was done by dividing the total costs by the spending allowed per head in each category according to the UCL Expenses Policy (see Table 1).

Table 1. Assumptions based on UCL Expenses Policy that were used to calculate the number of meals in each category.

Type of event / catering	Allowance
Staff and student entertaining	£20 per head
Business entertaining	£40 per head
Social functions	£20 per head
Meals – breakfast and lunch	£5 per meal (un-receipted)
Meals – dinner	£20 per meal (un-receipted)

For two categories (‘individual food items’ and ‘venue hire and catering’) estimating the number of meals was not possible based on the given procurement data. For the “individual food items’ category the amount of individual food items purchased (in kilograms) was estimated based on the price and description of the items given in the procurement data. The ‘venue hire and catering’ category, was excluded from the carbon footprint analysis because it was not possible to tell from the given procurement data how much of the spending was attributable to venue hire and how much to catering. No GHG emissions were estimated for the ‘other’ category either due to limited information given in the procurement data.

2.2.2. Calculating greenhouse gas emissions

Once the number of meals and amount of food items purchased was estimated, the carbon footprint of individual food items and meals was calculated using Life Cycle Assessment literature data. Table 2 provides a summary of the literature data used for the assessment of carbon footprint of individual food items.

Table 2. Summary of literature data used for assessing the carbon footprint of individual food items.

	kg CO2-eq per FU	Functional unit (FU)	Reference
Coffee	28.5	1 kg of ground, roasted beans	(Poore and Nemecek, 2018)
Tea	28.5	same as above	(Poore and Nemecek, 2018)
Biscuits	1.6	1 kg of bread (variable protein wheat)	(Poore and Nemecek, 2018)
Sugar	3.2	1 kg of raw/refined sugar	(Poore and Nemecek, 2018)
Milk	3.2	1 litre of pasteurized milk	(Poore and Nemecek, 2018)
Soy milk	1.0	1 litre of soymilk	(TAPP Water, 2019)
Water	0.17	1 litre of bottled water	(Poore and Nemecek, 2018)
Soft drink	3.2	1 kg of raw/refined sugar	(Poore and Nemecek, 2018)

To estimate the GHG emissions associated with meals, further assumptions had to be made as the GHG emission of meals vary greatly depending on the type of meal (e.g., meat-based, vegetarian, or vegan). There was no indication in the procurement data whether meals would be vegetarian or meat-based therefore GHG emissions were calculated for two scenarios:

- Scenario 1: Assuming all meals were meat-based (before ‘UCL Powered by Plants’ campaign)
- Scenario 2: Assuming all meals were vegetarian (after ‘UCL Powered by Plants’ campaign)

Calculating the GHG emission of meals under these two scenarios is useful as it can show the impact of the ‘UCL Powered by Plants’ campaign, which asks departments to provide 100% vegetarian catering across all events and meetings. The campaign was initiated by UCL's department for Psychology and Language Science in 2019 and adopted later by some departments in the Bartlett and other faculties.

For breakfast, lunch and dinner, the following meals were used as proxies to estimate the GHG emission of meals under the two different scenarios (meat-based and vegetarian). For dinner, 3 meat-based options were considered: one with beef, one with chicken, and one with an average value to take into account that some types of meat (e.g. beef and red meat) have significantly higher carbon footprint than other types of meat.

Breakfast:

- Scenario 1 (meat): egg, toast, bacon + coffee
- Scenario 2 (vegetarian): breakfast pastry (120 g) + coffee

Lunch:

- Scenario 1 (meat): bacon, sausage & egg sandwich + packet of crisps + bottle of water (500 ml)
- Scenario 2 (vegetarian): egg & cress sandwich + packet of crisps + bottle of water (500 ml)

Dinner:

- Scenario 1 (meat):

  Option 1: beef lasagne or similar + cake slice + beer (660 ml);

  Option 2: roast chicken or similar + cake slice + beer (660 ml);

  Option 3: “average” meal + cake slice + beer (660 ml)

- Scenario 2 (vegetarian): vegetarian meal + cake slice (120 g) + beer (660 ml)

As for the catering menus, the following options were assumed:

Catering menu (lunch / refreshments)

- Scenario 1 (meat): average meal with meat, crisps (34.5 g), bottle of water (500 ml), a cup of coffee (latte) or tea, one slice of cheesecake (120 g)
- Scenario 2 (vegetarian): vegetarian meal, (34.5 g), bottle of water (500 ml), a cup of coffee (latte) or tea, slice of cheesecake (120 g)

Catering menu (dinner / entertainment)

- Scenario 1 (meat): average meal with meat, bottle of water (500 ml), beer (660 ml), slice of cheesecake (120 g)
- Scenario 2 (vegetarian): vegetarian meal, bottle of water (500 ml), beer (660 ml), slice of cheesecake (120 g)

The carbon footprint values of the different meals and beverages used as proxies in this study were sourced from literature and are summarised in Table 3 below.

Table 3. Carbon footprint of meals and beverages used as proxies in this study

	Carbon footprint (g CO2 eq / FU)	Functional unit	Source
Meals			
Toast with eggs and bacon	1441	per sandwich	(Espinoza-Orias and Azapagic, 2018)
Breakfast pastry	1780	per kg of cake slice	(Konstantas et al., 2019)
	214	per slice (120 g)	
Bacon, sausage & egg sandwich	1441	per ready-made sandwich	(Espinoza-Orias and Azapagic, 2018)
Egg & cress sandwich	739	per ready-made sandwich	(Espinoza-Orias and Azapagic, 2018)
Packet of crisps	80	per packet (34.5 g)	According to PepsiCo's eco label on packet
Beef lasagne or similar	5000	per meal	(Ernstoff et al., 2019; Schmidt Rivera and Azapagic, 2019)
Roast chicken	2500	per meal	(Schmidt Rivera and Azapagic, 2019)
"Average" meal	3700	per meal	(Saxe et al., 2018)
Vegetarian meal	1000	per meal	(Ernstoff et al., 2019)
Cheesecake	4830	per kg of cheesecake	(Konstantas et al., 2019)
	580	per slice (120g)	
Beverages			
Coffee (latte)	234	per serve	(Hassard et al., 2014)
Bottle of water	83	per 500 ml	(TAPP Water, 2019)
Beer	876	per litre	(Amienyo and Azapagic, 2016)

3. Results

3.1. Bartlett's food and catering procurement

Based on procurement data from 2018-2019, the faculty's spending on food and catering was £413,610. Figure 1 shows the breakdown of spending within the food and catering category. As shown in Figure 1, catering for events made up most of the spending (45%), followed by hospitality entertaining for staff, student or business with 23% (i.e. food or drink for UCL staff and/or students in connection with UCL business activities). Subsistence meals, purchased both in the UK and abroad, made up 8% of the total spending, while another 8% was spent venue hire and catering. Catering for internal meetings contributed 6%, eating out in restaurants contributed to 4%, and purchasing individual food items (e.g., coffee, milk, tea, biscuits etc.) contributed another 4% of the total food and catering spending of the faculty. The remainder of 2% was spent on catering supplies and disposables (e.g., mugs, glasses, plates, cutlery, napkins etc.) and annual rental & total care service for machines (e.g., coffee machines).

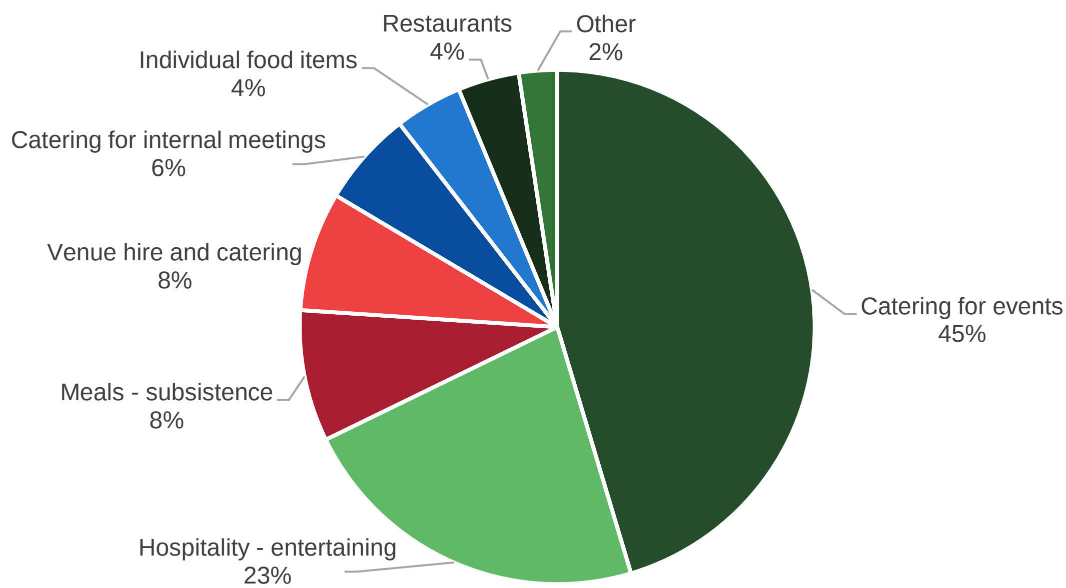

Figure 1. Breakdown of the Bartlett's food and catering spending in 2018-2019

3.2. Bartlett's greenhouse gas emissions from food and catering

In this section the faculty's greenhouse gas emission from food and catering is reported under the two scenarios: meat-based and vegetarian. In Table 4, the results are summarised showing the total amount of £ spent in each category, the estimated number of meals within each category, and the carbon footprint of each category under the meat-based and the vegetarian scenarios.

Table 4 Summary of results and total carbon footprint of the faculty under the meat-based and vegetarian scenarios.

	Total amount spent (£)	Number of meals	Total carbon footprint (t CO2-eq) scenario 1: meat	Total carbon footprint (t CO2-eq) scenario 2: vegetarian
Catering for events	187,672	9,384	46.4	21.0
Hospitality – entertaining	92,687	4,634	22.9	10.4
Meals – subsistence	34,188	3,296	9.8	4.3
Venue hire and catering	31,005	n/a	excluded	excluded
Catering for internal meetings	24,673	1,234	5.8	2.4
Individual food items	17,568	n/a	21.0	21.0
Restaurants	15,923	796	4.9	1.7
Other	9,895	n/a	excluded	excluded
Total	**413,610**	**19,344**	**110.7**	**60.9**

Under the meat-based scenario, the faculty's total GHG emission from food and catering was estimated to be 110.7 t CO2 eq. Catering for events was the largest contributor to the total emissions with 46.4 t CO2 eq (42%), followed by emissions from 'hospitality – entertaining' and 'individual food items' with 22.9 (21%) and 21.0 t CO2 eq (19%) respectively. These three categories together made up 82% of total emissions from food and catering. The remainder 18% was attributed to 'meals – subsistence' (9.8 t CO2 eq, 9%), 'catering for internal meetings' (5.8 to CO2 eq, 5%) and eating out in restaurants (4.9 t CO2 eq, 4%).

In contrast, under the vegetarian scenario the faculty's total GHG emission from food and catering was estimated to be 60.9 t CO2 eq. Figure 2 shows the comparison of GHG emissions under the meat-based and the vegetarian scenario. As it can be seen from Figure 2, in the vegetarian scenario emissions went down by at least 50% in all categories except for the 'individual food items' category. In this category, no change was observed as all food items ordered and purchased by the faculty were vegetarian by default (e.g. coffee, tea, milk, biscuits etc.). In the vegetarian scenario, 'catering for events' (21.0 t CO2 eq, 35%) and 'individual food items' (21 t CO2 eq, 35%) were two of the greatest contributors to total emissions. This was followed by 'hospitality – entertaining' with 10.4 t CO2 eq (17%). Similar to the meat-based scenario, the remainder of categories: 'meals – subsistence', 'catering for internal meetings' and 'meals consumed at restaurants' contributed to 7, 4 and 3% respectively to the faculty's total GHG emissions from food and catering. The lower contribution of these categories to emissions in both scenarios can be explained by the lower number of meals in these categories. In the following sections, the GHG emissions from each category are described in more detail.

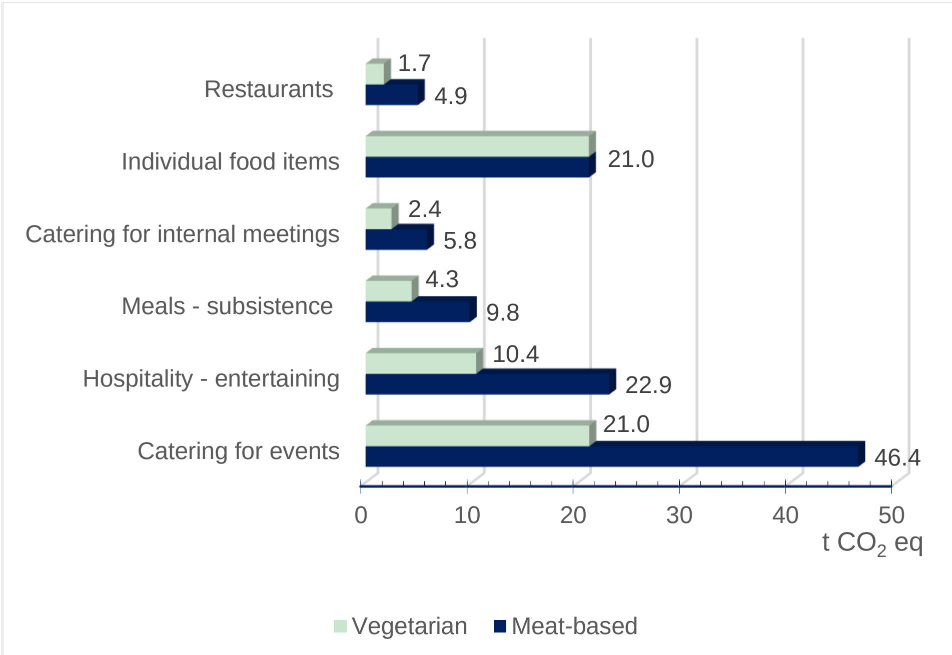

Figure 2. Carbon footprint of each category under the meat-based and the vegetarian scenario.

3.2.1. Catering for events and internal meetings

Catering for events and internal meetings was the biggest source of spending as well as GHG emissions of the faculty from food and catering. In these categories a wide range of events were included ranging from catering for meetings to catering for conferences, field trips, parties, dinners and various socials and events. Depending on the type of event, and whether a meat-based or vegetarian scenario was assumed, the GHG emissions of the catering menu varied. For example, the carbon footprint of the lunch / refreshment catering menu was estimated to be 4677 g CO2 eq (per meal) for the meat-based option, while 1977 g CO2 eq for the vegetarian option. The carbon footprint of the dinner / entertainment catering menu was slightly higher than the lunch menu due to the inclusion of alcoholic beverage. The carbon footprint of the dinner menu was 4941 g CO2 eq for the meat-based option and 2241 g CO2 eq for the vegetarian option. A detailed breakdown of the GHG emissions of different catering menus can be found in Appendix A. The positive impact of UCL's Powered by Plants' campaign asking departments to provide 100% vegetarian catering across all events and meetings is demonstrated clearly here. Replacing meat-based catering with 100% vegetarian catering for events and internal meetings across the entire faculty resulted in a 45% reduction in carbon footprint.

3.2.2. Individual food items

The purchase of individual food items only made up 4% of the faculty's total food and catering spending, however, it contributed to 21 tonnes of CO_2 equivalent, which is equivalent to 19% of food and catering emissions under the meat-based scenario and 34% of emissions under the vegetarian scenario. The high emissions associated with this category was due to the purchase of food items that normally have high carbon footprint (e.g., coffee, tea, milk etc., see Table 2).

In 2018-2019 the faculty purchased 385 kg of coffee (e.g., ground coffee and coffee beans) which was responsible for 11 tonnes of CO_2 eq emissions (see Table 5). The second largest spending and emissions in this category came from milk purchase. The faculty ordered 2745 L of milk which corresponded to 8.6 tonnes of CO_2 eq emissions. As mentioned before, there was no difference in the carbon footprint of this category under the meat-based and vegetarian scenario. Therefore, different mitigation alternatives need to be considered to reduce emissions from this category. One option could be to replace all or part of the milk purchases with plant-based milk alternatives such as soy milk. Since the carbon footprint of soy milk is about one third of that of milk (1 kg CO_2 eq per litre for soy milk instead of 3.2 kg CO_2 eq for milk), significant reductions could be achieved this way. If all milk purchases were replaced by soy milk, the emissions from this category could be reduced by approximately 6 t CO_2 eq resulting in 15.1 t CO_2 eq of total emissions from this category instead of 21 t CO_2 eq. Another possibility to reduce the faculty's emissions from this category is reduce the amount of coffee purchased. For example, a 20% reduction in the amount of coffee purchased would result in a reduction of 2.2 t CO_2 eq.

Table 5. Faculty's spending and carbon footprint from the purchase of individual food items.

	Spending (£)	Amount purchased	unit	Total carbon footprint (kg CO2 eq)
Coffee	8,100	385	kg	10,995
Tea	526	30	kg	849
Biscuits	85	58	kg	91
Sugar	135	37	kg	118
Milk	2,508	2745	L	8,646
Soy milk	46	22	L	22
Water	838	722	L	120
Soft drink	54	48	L	152
				20,993

3.2.3. Restaurant and subsistence meals

Meals, such as subsistence meals and meals consumed in restaurants, made up 12% of the faculty's food and catering spending, and 13% (meat-based scenario) or 10% (vegetarian scenario) of its food and catering carbon footprint. The total number of subsistence meals in 2018-2019 was 3296. Most of the meals (79%) were consumed overseas. Forty-one percent of them were dinner, 34 percent were lunch and 24 percent were breakfast. In this category, the impact of choosing a vegetarian meal instead of a meat-based meal was demonstrated clearly. In Table 6 below, the differences between the carbon footprints of meat-based and vegetarian breakfasts, lunches and dinners are summarised. Meat-based meals had 1.7 to 3.7 times greater climate impact than vegetarian meals. A summary and a more detailed breakdown of the number of subsistence meals and corresponding GHG emissions can be found in Appendix B.

Table 6. Comparison of carbon footprint of meat-based and vegetarian breakfast, lunch, and dinner.

Breakfast (meat)	1675	g CO2 eq / meal
Breakfast (vegetarian)	448	g CO2 eq / meal
Lunch (meat)	1604	g CO2 eq / meal
Lunch (vegetarian)	902	g CO2 eq / meal
Dinner (beef)	6158	g CO2 eq / meal
Dinner (chicken)	3658	g CO2 eq / meal
Dinner (average)	4858	g CO2 eq / meal
Dinner (vegetarian)	2158	g CO2 eq / meal

4. Discussion and recommendations

Catering for events and internal meetings was not only the largest source of spending (51%) but also the greatest contributor to the faculty's GHG emissions from food and catering (47% under the meat-based scenario and 39% under the vegetarian scenario). Subsequently, reducing emissions from this category is a priority. The positive impact of dietary change, and its importance in reducing food related emissions, has been highlighted consistently in the literature e.g. (Hallström et al., 2015; Stylianou et al., 2021). This report also demonstrated the environmental benefits of providing 100% vegetarian catering across events and meetings instead of meat-based catering. By replacing meat-based catering with 100% vegetarian catering for events and internal meetings, a 45% reduction in carbon footprint could be observed.

In general, vegetarian meals have lower carbon footprint than meat-based meals, especially if they are replacing meals made with beef and red meat (Saarinen et al., 2012; Saxe et al., 2018; Takacs and Borrion, 2020). But vegetarian meals containing high amounts of animal products (e.g. cheese and other dairy products, eggs etc.) can have an impact as high as some meat-based meals (De Laurentiis et al., 2019). On the contrary, 100% plant-based meals (i.e., vegan meals), especially those made with whole plant foods (i.e., fruit, vegetables, grains, legumes, nuts, and seeds) have the lowest carbon footprints (Takacs et al., 2022; Üçtuğ et al., 2021). Meat-based meals have 14 times higher environmental impact, while vegetarian meals have approximately 3 times higher environmental impact than vegan meals (Takacs et al., 2022). Making a swich to 100% plant-based catering for events and meetings therefore could provide an even stronger positive impact than vegetarian catering.

In addition, switching the narrative to plant-based meals and catering can not only make substantial carbon savings but can also have a positive influence on the health of staff and students. There is compelling scientific evidence that reducing meat consumption and increasing the proportion of plant-based meals improves health and reduces the risk of chronic disease (Melina et al., 2016; Papier et al., 2021). A substantial increase in consumption of fruits and vegetables would therefore benefit both human and planetary health (Willett et al., 2019).

4.1. UCL Healthy and Sustainable Food Policy

As part of UCL's Healthy and Sustainable Food Policy (July 2022), UCL aims to provide healthy food offers that are good for staff and students as well as the planet. Since plant-based meals made with fruit, vegetables and grains have lower carbon footprints in general than meals made with meat and dairy, part of UCL's 2022/2023 commitments is to ensure that at least 50% of all menus or food offers provided across UCL's catering and accommodation are vegan or vegetarian.

The success of UCL's Healthy and Sustainable Food Policy, as well as UCL's Strategy for a Sustainable UCL 2019 – 2024 is dependent on faculties and their actions. Achieving these goals will require members of staff and students to make informed and conscious decisions that are in alignment with UCL's vision. UCL's current contract caterer, CH&Co, is working in partnership with UCL to deliver a sustainable catering service across campus. Their catering menu now features a wide range of 100% plant-based (vegan) menus, making it easier than ever to choose 100% plant-based catering for events at UCL. Some examples from their menu include but are not limited to:

- **Vegan sandwich box**: selection of sandwiches with a piece of seasonal fruit + allotment garden crudités - with assorted peppers, breakfast radishes, cherry tomatoes, carrots + houmous and guacamole
- **Vegan salad box**: choice of one of 3 vegan salads e.g., vegan Caesar salad + oatmeal cookie energy bites + fresh fruit pot
- **Vegan grazing**: spiced butternut squash and corn fritters with harissa dip + sweet potato falafel with mixed salad leaves + olives + red pepper houmous + vegan Applewood cheese + lentil salad with tomatoes, parsley and a balsamic dressing + breads + orange sponge slices.

The full menu and meal options can be found in UCL's Autumn - Winter 2022 – 2023 brochure. The price of these vegan menu options is similar or the same as the price of the vegetarian options therefore choosing them over any other menu option is also financially viable. It is up to departments and members of staff responsible for organising catering for faculty events and meetings to be proactive and request these kinds of meals and menu options. Therefore, it is also important to communicate the positive impacts of vegan meals to members of staff and students across the university, so they are aware of the impact of different food consumption choices and can make informed and conscious decisions. When people understand the impact of their choices and realise that plant-based eating does not mean missing out on flavour and tasty food, they are more likely to choose and welcome food that is not only delicious but is also the best for the planet.

4.2. Beyond plant-based catering

Providing 100% plant-based catering can potentially have a much further reaching impact than simply reducing the carbon footprint of departments, faculties, and the university. The provision of appetising plant-based meals in meetings and events can also play an important role in changing food culture and facilitating sustainable food transitions. Exposing people to new dishes and new ways of thinking about food can ingrain a new understanding of plant-based eating. It is important to show people that plant-based meals can be delicious, healthy, and have a low environmental impact at the same time. Such exposure to plant-based meals could also potentially have a knock-on effect and encourage the uptake of healthy eating habits outside of the university. This is important if the faculty also wants to address emissions from food and meals consumed outside of UCL (e.g., subsistence meals or meals consumed in restaurants) which make up 10-13 percent of the faculty's GHG emissions from food and catering.

4.3. Limitations

There are some limitations of this research that needs to be kept in mind when interpreting the results. Frist, the faculty's GHG emissions from food and catering were estimated using procurement data. Since no information was given in the procurement data on the number of meals ordered / consumed, the number of meals were estimated using UCL's Expenses Policy. However, it is possible that this method underestimated the total number of meals consumed, which in turn would underestimate the magnitude of greenhouse gas emissions from food and catering.

Second, in the original procurement data there were no information on what kind of meals people would order and consume therefore several assumptions, which were detailed in section 2.2.2., were made to estimate the faculty's greenhouse gas emissions arising from food and catering. While the underlying assumptions and proxy meals have been chosen to be representative of typical meals and catering menus in the UK, it is possible that the actual food consumption of the faculty was different. However, this would probably not change significantly the results, as the magnitude of GHG emissions of different types of meals would remain the same i.e. meals with red meat would still have the highest impact, followed by other meat-based meals, vegetarian meals and vegan meals.

Third, secondary data from literature was used to estimate the GHG emissions of meals and food items, which can leave uncertainties in data quality. However, the main objective of this study was not to assess the environmental impacts of meals but to give a flavour of the GHG emission reduction potential of different consumption choices (e.g. vegetarian or vegan meals and/ or menu options) and to estimate the faculty's GHG emissions from food and catering and give recommendations on how it can be reduced.

4.4. Recommendations

Despite the above-mentioned limitations, this study provides important insights into the greenhouse gas emissions arising from the Bartlett's food and catering procurement. Based on the results of this study the following recommendations can be given to further reduce emissions:

- Choose 100% plant-based (vegan) options from the catering menu for meetings and events.
- Educate members of staff and students about the benefits and positive environmental and health impacts of plant-based eating.
- Communicate it clearly why the faculty is choosing plant-based meals over vegetarian and meat-based options when providing catering for events and meetings.
- Record more information on the types of meals and menus ordered e.g., indicate whether it was meat-based (also indicate if it was beef, pork, chicken or fish), vegetarian, or vegan menu and the number of meals ordered so that a more accurate estimate of the faculty's GHG emissions can be calculated.
- Encourage the consumption of plant-based alternatives outside of UCL (e.g. subsistence meals, and when eating out in restaurants)
- Reduce the purchase of food items with high environmental impact:

- Replace milk purchases with plant-based milk alternatives e.g. soy milk.
- Reduce coffee consumption or overall coffee purchase (i.e., ground coffee and coffee beans).

5. Conclusions

The aim of this research was to help the Bartlett Faculty better understand its emissions associated with food and catering and to reduce emissions from this category. This report identified eight major categories of food and catering spending of the faculty and analysed the greenhouse gas emissions associated with these categories. GHG emissions were calculated for two scenarios: one in which all meals were assumed to be meat-based, and one in which all meals were assumed to be vegetarian.

The faculty's total food and catering spending for year 2018-2019 was £413,610, and the total GHG emissions of food and catering was estimated to be 110.7 t CO2 eq under the meat-based scenario and 60.9 t CO2 eq under the vegetarian scenario. Catering for events and internal meetings was the largest source of spending (51%) and also the greatest contributor to the faculty's GHG emissions from food and catering (47% under the meat-based scenario and 39% under the vegetarian scenario).

This report showed clear reductions of carbon footprint in the vegetarian scenario compared to the meat-based scenario. Replacing meat-based catering with 100% vegetarian catering for events and internal meetings resulted in a 45% reduction in carbon footprint. While the provision of vegetarian catering shows clear environmental benefits, it is worth noting that even better outcomes could be achieved if catering was 100% plant-based (i.e. vegan). In alignment with UCL's Healthy and Sustainable Food Policy, UCL's current contract caterer, provides a wide range of 100% plant-based (vegan) menus, making it easier than ever for faculties to organise events with sustainable meals and catering service. To ensure the acceptability and feasibility of changes in menus and catering, it is important to educate members of staff and students about the benefits and positive environmental and health impacts of plant-based eating. In addition, communicating why the faculty is favouring plant-based catering for events and meetings over vegetarian and meat-based options is also recommended.

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Appendix A: The breakdown of GHG emissions of different meal / menu options

Breakfast	GHG emissions	per funtional unit
Meat		
Coffee (latte)	234	g CO2 eq /serve
Toast, egg, bacon	1441	g CO2 eq /serve
Total meat	**1675**	**g CO2 eq / breakfast**
Vegetarian		
Coffee (latte)	234	g CO2 eq / serve
Cake slice	214	g CO2 eq / slice
Total vegetarian	**448**	**g CO2 eq / breakfast**
Lunch		
Meat		
Meat sandwich (bacon, sausage & egg)	1441	g CO2 eq / ready-made sandwich
Packet of crisps	80	g CO2 eq / packet (34.5 g)
Bottle of water 500 ml	83	g CO2 eq / bottle (500 ml)
Total meat lunch	**1604**	**g CO2 eq / lunch**
Vegetarian		
Vegetarian sandwich (egg and cress)	739	g CO2 eq /ready-made sandwich
Packet of crisps	80	g CO2 eq / packet (34.5 g)
Bottle of water 500 ml	83	g CO2 eq / bottle (500 ml)
Total vegetarian lunch	**902**	**g CO2 eq / lunch**
Dinner		
Meat option 1		
Beef lasagne or similar	5000	g CO2 eq / meal
Beer	578	g CO2 eq / 660 ml (2 bottles)
Cheesecake	580	g CO2 eq / slice
Total	**6158**	**g CO2 eq / meal**
Meat option 2		
Roast chicken or similar	2500	g CO2 eq / meal
Beer	578	g CO2 eq / 660 ml (2 bottles)
Cheesecake	580	g CO2 eq / slice

Total	**3658**	**g CO2 eq / meal**
Meat option 3		
Average meal	3700	g CO2 eq / meal
Beer	578	g CO2 eq / 660 ml (2 bottles)
Cheesecake	580	g CO2 eq / slice
Total	**4858**	**g CO2 eq / meal**
Vegetarian		
Vegetarian meal	1000	g CO2 eq / meal
Beer	578	g CO2 eq / 660 ml (2 bottles)
Cheesecake	580	g CO2 eq / slice
Total	**2158**	**g CO2 eq / meal**

Catering menu (lunch / refreshments)

Meat			
Average meal		3700	g CO2 eq / meal
Crisps		80	g CO2 eq / serving of 34.5 g
Bottle of water 500 ml		83	g CO2 eq / bottle (500 ml)
Coffee (latte) or tea		234	g CO2 eq / serve
Cheesecake		**580**	**g** CO2 eq / slice
Total	4677		
Vegetarian			
vegetarian meal		1000	g CO2 eq / meal
Crisps		80	g CO2 eq / serving of 34.5 g
Bottle of water 500 ml		83	g CO2 eq / bottle (500 ml)
Coffee (latte) or tea		234	g CO2 eq /serve
Cheesecake		**580**	**g** CO2 eq / slice
Total	1977		

Catering **menu (dinner / refreshments)**

Meat		
Average meal	3700	g CO2 eq / meal
Bottle of water 500 ml	83	g CO2 eq / bottle (500 ml)
Beer	578	g CO2 eq / 660 ml (2 bottles)
Cheesecake	**580**	**g** CO2 eq / slice

Total	4941	

Vegetarian meal	1000	g CO2 eq / meal
Bottle of water 500 ml	83	g CO2 eq / bottle (500 ml)
Beer	578	g CO2 eq / 660 ml (2 bottles)
Cheesecake	**580**	**g** CO2 eq / slice
Total	**2241**	

Appendix B: Summary of number of subsistence meals and corresponding GHG emissions

Breakfast (meat)	1675	g CO2 eq / meal	1.68	kg CO2 eq / meal
Breakfast (vegetarian)	448	g CO2 eq / meal	0.45	kg CO2 eq / meal
Lunch (meat)	1604	g CO2 eq / meal	1.60	kg CO2 eq / meal
Lunch (vegetarian)	902	g CO2 eq / meal	0.90	kg CO2 eq / meal
Dinner (beef)	6158	g CO2 eq / meal	6.16	kg CO2 eq / meal
Dinner (chicken)	3658	g CO2 eq / meal	3.66	kg CO2 eq / meal
Dinner (average)	4858	g CO2 eq / meal	4.86	kg CO2 eq / meal
Dinner (vegetarian)	2158	g CO2 eq / meal	2.16	kg CO2 eq / meal

Table B1. Summary of subsistence meals broken down into different categories.

	Total amount spent	%	Total number of meals
Breakfast overseas	3791	11	572
Breakfast UK	1452	4	229
Lunch overseas	6605	19	822
Lunch UK	2144	6	306
Dinner overseas	16725	49	1092
Dinner UK	3471	10	275
TOTAL	**34188**	**100**	**3296**
Meals overseas	27121	79	2486
Meals UK	7067	21	810

Table B2. Summary of breakfast, lunch & dinner (subsistence) and the total GHG emissions corresponding to them.

	Total amount spent	%	Total number of meals	GHG emissions (meat) kg CO2 eq	GHG emissions (vegetarian) kg CO2 eq
Breakfast	5243	15	801	1342	359
Lunch	8749	26	1128	1810	1018
Dinner	20196	59	1367	6641	2950
TOTAL	**34188**	**100**	**3296**	**9792**	**4326**