BFJ
127,13

412

Received 11 December 2024
Revised 8 April 2025
Accepted 14 May 2025

Where and when matter: uncovering the hidden influences on household food waste generation rates

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Abstract

Purpose – Current scholarship on household food waste (HFW) is driven by the desire to uncover ways to reduce its amount. This endeavour is based on a set of assumptions that are rarely explicitly articulated. These include the expectation that HFW originates exclusively in the food purchased in the retail sector, that the type of place in which households are embedded plays a limited or no role in the amount and composition of food waste (FW) and that seasonal variations in the amount of produced HFW are unimportant.

Design/methodology/approach – This longitudinal, three-year research was based on repeated HFW composition analysis from 900 households located in three types of residential areas in a Czech city and on insights from six focus groups held in the same localities.

Findings – The paper shows that place and time are key factors in informing data collection and analysis needed for the formulation of policies aimed at meeting the ambitious international FW reduction targets.

Originality/value – The paper supports a currently minor strand of literature to argue that the HFW research needs to widen its focus beyond the usual "household food waste journey". To increase the accuracy and reliability of the data on the materiality of HFW, the design of future research also needs to replace the one-off data collection with repeated collections that reflect both seasonality and diversity of the types of residential areas.

Keywords Czechia, Food waste, Household, Knowledge production, Residence type, Seasonality

Paper type Research paper

1. Introduction

In the last decade, the literature on household food waste (HFW) has experienced an exponential rise [1] (Oláh *et al*., 2022). Both the United Nations and the European Union have set ambitious policy reduction targets that are certitude-invoking in terms of their deadline proximity (2030) and the scale of waste reduction (50%). Considered jointly, the literature boom and bold targets seem to suggest that the key issues concerning the epistemology of this research and the materiality of food waste (FW) have been settled. Drawing on HFW meta-studies (Oláh *et al*., 2022; Schanes *et al*., 2018) and the findings from large-scale empirical research on HFW in Czechia's second-largest city, Brno, we wish to contest this optimistic inference. In this paper, we argue that much of the existing scholarship on HFW neglects or at

Funding: Petr Jehlička's work on this article was supported by the Czech Academy of Sciences, Lumina quaeruntur award LQ300282103 "Inconspicuous innovations and resilience in the urban context: Researching global questions through Central and Eastern European cities", Lucie Veselá and Lea Kubíčková's work was supported by the Technological Agency of the Czech Republic, grant number TL02000092 "Pro-environmental behavior of households and incentives for behavioral change in food waste production".

British Food Journal
Vol. 127 No. 13, 2025
pp. 412-425
Emerald Publishing Limited
e-ISSN: 1758-4108
p-ISSN: 0007-070X
DOI 10.1108/BFJ-12-2024-1271

least tends to underestimate the importance of key considerations determining the understanding of HFW's generation rates. This, in turn, has significant implications for the planning for the achievability of the targets mentioned above.

The unreliability of data concerning HFW amounts based on self-reporting (the dominant source of information in scholarship on HFW), with estimates differing from reality by a factor of ten, is well established (Parizeau, 2020; van Dooren *et al.*, 2019). However, even in rare cases when samples of HFW are analysed for research purposes, two factors important for the accuracy of the findings are seldom included in the data-gathering process. They have to do with HFW's temporality and the place in which HFW originates, that is, the type of residence and geographical relations in which a household is embedded [2]. To us, the salience of these factors emerged from the confrontation of the findings of our research with some key – albeit often implicit – assumptions in what we consider the seminal literature on HFW.

Reliable HFW data are of critical importance for effective waste reduction policies. Studies have shown that flawed data collection methods can lead to misleading conclusions, resulting in ineffective or even counterproductive interventions (Wang *et al.*, 2024; Armington *et al.*, 2020; Corrado *et al.*, 2019). For instance, underestimating seasonal variations in HFW generation rates may cause policymakers to misallocate resources for prevention campaigns, while ignoring spatial differences can lead to one-size-fits-all policies that fail to address the specific needs of different residential areas. By incorporating both temporal and spatial dimensions into HFW measurement, our study aims to enhance the case for the accuracy of waste estimations, ultimately supporting more targeted and impactful strategies for HFW reduction.

The objectives of our paper are twofold. First, to demonstrate the importance of including these two factors in the research design of projects on HFW for data accuracy and reliability. Second, to discuss several possible reasons for neglecting these factors in the literature on HFW. In the next section, we start by outlining the dominant approaches in HFW research and identify some key problematic points related to the two factors at the centre of this paper – HFW's temporality and the type of residential area in which HFW originates.

2. Literature review

Most of the literature on HFW that is typically driven by the desire to change human behaviour towards reducing FW falls in the strand represented by the theory of planned behaviour (TPB) (Moreno *et al.*, 2021; Schanes *et al.*, 2018). According to this psychology-based theory elaborated on the theory of reasoned action (Ajzen, 1985), "an individual's behaviour is thought to reflect their beliefs" (Keegan and Breadsell, 2021, p. 2). In other words, a causal relationship is assumed between beliefs and intention to reduce FW and action.

The other, comparatively minor, strand of the literature on HFW is inspired by the sociology-based social practice theory (SPT) that "does not support the assumption of a causal one-way relationship between attitudes or values and practices" (Schanes *et al.*, 2018, p. 981). Instead, it provides what can be considered a more realistic understanding of the challenge to "shift society to more sustainable lifestyles and resource use" (Keegan and Breadsell, 2021, p. 6), including HFW reduction. Addressing the TPB's limitations such as the tendency to reduce HFW as a problem of individuals and neglect the value-action gap, "SPT offers [. . .] a conceptual approach to grasp the *socio-temporal* nature of practices unfolding in the household" (Schanes *et al.*, 2018, p. 981; emphasis added). SPT is attentive to individuals' embeddedness in wider social networks and the extent to which individuals' everyday routines are conditioned by social structures beyond their control (Evans, 2011; Moreno *et al.*, 2021). SPT holds that social practices are a key unit of analysis (Seyfang *et al.*, 2010) and lie at the intersection of lifestyle and the system of provision (Spaargaren, 2003). Further, social practices integrate human and non-human elements with social and technical components and become embodied within practitioners through repetition (Seyfang *et al.*, 2010).

In different ways, therefore, both approaches allow researchers to better understand food-wasting behaviours (for TPB, its conscious and information-driven changes; for SPT, the importance of daily food-related routines and habits and their conditioning by material resources available to individuals). However, they also have limitations. TPB has been criticised for overreliance on the rationality of human behaviour and insufficient attention to the role of emotions in completing intended actions (Conner and Norman, 2005). SPT may underestimate the extent to which individuals adjust their behaviour under the influence of technological innovations and new information. At the same time, there seems to be a growing recognition of the potential complementarity of the TPB and SPT approaches and the benefits of their combination for a more comprehensive understanding of food-wasting behaviour (Fraj-Andrés *et al*., 2023; Schanes *et al*., 2018). However, the SPT approach appears to offer an opportunity to study food waste as "an unintended result of multiple moments of consumption dispersed in space and time across other integrated practices [. . .] which are themselves embedded in broader contextual factors" (Ganglbauer *et al*., 2013, p. 1), such as, for example, seasonality and the type of dwelling.

Most of the literature on HFW that is informed by SPT (e.g. Keegan and Breadsell, 2021; Moreno *et al*., 2021) does not systematically engage with these factors. However, its subset (Ganglbauer *et al*., 2013; Jörissen *et al*., 2015; Keegan and Breadsell, 2021; Nakamura *et al*., 2022) relates lower volumes of HFW with the household's access to a productive garden. Keegan and Breadsell (2021) make a case for adopting the SPT lens in this research as it "links growing your own food to further practices conducive to reducing waste" (Keegan and Breadsell, 2021, p. 20). They identify the materiality of the garden as a reason for a "shift in practices from the norm" (Keegan and Breadsell, 2021, p. 20). In addition to the effect of the garden on reducing the amount of HFW in municipal mixed waste (MMW) by its diversion to compost and animal feed (Ganglbauer *et al*., 2013), there might be less obvious and little-explored reasons for HFW reduction. These might include the intimate experience of growing and handling food as practices contributing to HFW stigmatisation (Sovová *et al*., 2021).

Linking the amount of HFW to growing food in the garden and, by extension, to "garden time" (Taylor, 2018) suggests the possibility of the role of cycles of growth and seasonality for seasonal fluctuations in HFW generation. However, perhaps surprisingly, most of the limited literature informed by SPT does not connect the inherent temporality – the seasonality and cyclicity – of food growing, processing and eating with the temporality of HFW generation. No less surprising is the fact that one of the very few studies that place seasonality at the centre of researching the amount of HFW – Adelodun *et al*.'s (2021) study of FW from 84 South Korean households based on weighing and composition analysis of the waste – is not grounded in the SPT approach. Importantly for the argument of this paper, however, in addition to highlighting the importance of HFW seasonality, Adelodun *et al*. (2021) underline the role of "housing types on the food waste generation rate" (Adelodun *et al*., 2021, p. 72).

By considering the type of dwelling and seasonality *simultaneously*, Adelodun *et al*.'s (2021) article remains fairly unique in the context of HFW scholarship [3]. While the literature that considers the type of dwelling in HFW analyses is slowly growing, scholarly accounts paying attention to HFW's seasonality remain extremely rare. To verify this impression, we searched the Web of Science database for recent articles that included the phrases "food waste" and "household" combined with the word "season*" published between January 2014 and 22 November 2023. While 1,408 articles included the keywords "food waste" and "household", only 29 included the keyword "season*". On closer inspection, only 11 out of these 29 articles considered seasonal variations in HFW generation rates. However, unlike Adelodun *et al*.'s (2021) article (30 citations on 25 April 2024) in which the information on the seasonality of HFW was based on waste collections spread throughout the four seasons of the year, the three most cited articles on HFW that made references to seasonality (Bernstad, 2014 [169 citations on 22 November 2023], Parizeau *et al*., 2015 [362 citations], Abdelradi, 2018 [125 citations]) were not empirically based on HFW collections organised in all four seasons of the year. These findings underline the importance of our research, in which both the types of dwellings and seasonal fluctuations were factored into the analysis.

3. Methods of sample collection and data analysis

The argument of this paper on the importance of the type of dwelling and seasonality for HFW analysis is based on the data and findings from two separate but coordinated projects. To obtain as accurate information as possible concerning the "what" and "how much" of HFW (Moreno *et al*., 2021), a longitudinal, three-year research based on compositional analysis of FW collected four times a year from 900 households was conducted in three types of residential areas in Brno, defined as follows:

(1) The rural residential area (but within the administrative city limits) consisting of family houses with gardens and with the possibility of HFW composting or feeding animals.

(2) The urban residential area of family houses and rental villas with gardens typically used for ornamental purposes.

(3) The urban housing estate of apartment buildings without the possibility of on-site HFW management.

This study was conducted between the summer of 2019 and the spring of 2022. This was complemented with findings from qualitative research based on insights from six focus groups.

The accuracy of HFW quantification is highly influenced by the method of measurement (Baquero *et al*., 2023). Therefore, to obtain accurate results on the amount and structure of waste, it is optimal to deploy the MMW analysis. This costly and time-consuming method, considered the most accurate (Quested *et al*., 2020; Withanage *et al*., 2021; Giordano *et al*., 2018), was used in the Brno study. The preliminary findings of the surprisingly low volumes of FW produced by Brno households raised the "why" (so little FW) question. Consequently, six focus groups with participants recruited from the same three residential areas were held in October and November 2021. As the "why" question lies outside the scope of this paper, the focus group material is used as an illustration of some of the findings yielded by the quantitative research.

The waste analysis was conducted over the three consecutive years starting in the summer of 2019. To capture the seasonality of HFW production, samples were collected and analysed four times a year, providing insight into the variability of HFW amount and composition across all four seasons. HFW was collected in three types of residential areas, where the MMW analysis was conducted separately for each area. Each residential type was represented by three separate locations, with 100 households per location, ensuring a total of 300 households per area. The selection of these sites was based on their representativeness of the defining characteristics of each residential category. Housing estates were chosen in locations where apartment buildings lack direct HFW management options. Urban residential areas included streets with villas featuring ornamental gardens but no domestic animals. Rural areas consisted of streets with houses that typically have large gardens, composting systems and often also small livestock such as rabbits and chickens. To ensure that household food waste practices were not influenced by the study, residents were unaware that their HFW was being analysed for research purposes. Furthermore, to ensure accurate per capita HFW calculations, data on the number of permanent residents in the analysed collection routes were obtained from the Brno City Council. This step helped mitigate potential bias by allowing for a more precise calculation of HFW per capita generation.

The MMW composition was determined by analysing a 200 kg sub-sample extracted from the collected waste using the quartering method. The waste composition was determined by sieve analysis and manual sorting into specified substance groups, as shown in Figure 1. Therefore, the waste from each of the three residential areas was collected as a whole and uncompacted. This required dispatching a special vehicle to collect waste from 100 households along a specific route. A 40 $\times$ 40 mm mesh sieve was used to conduct sieve analysis. The choice of this sieve size was based on its demonstrated accuracy in previous research and methodological recommendations from the project *Methodologies for Monitoring and*

Figure 1. Analysis of mixed municipal waste

Evaluation of the Waste Prevention Programme Implementation (TB940MZP002), commissioned by the Czech Ministry of the Environment. As part of this project, sieve size selection was tested to determine the most suitable mesh size for the MMW analysis. The results confirmed that a 40 × 40 mm mesh sieve was optimal for separating fine organic matter while minimising errors associated with the manual classification of decomposed FW. This approach reduces contamination of the sample by non-food organic materials. Compared to visual waste sorting, which may introduce subjectivity in categorisation, or self-reported HFW diaries, which are prone to recall bias, sieve-based separation provides a standardized and replicable method for HFW quantification. The retained fraction was further categorized into predefined food waste groups, ensuring consistent classification across different residential areas and seasonal periods. The sub-sieve fraction (i.e. pieces not retained by the sieve) was further divided into wasted food and other materials. Unavoidable food scraps, such as bones, apple cores or eggshells, that is inedible HFW, were not included in the analysis. Subsequently, the actual quantity of edible wasted food in each residential area was recalculated from the subsample. The HFW data obtained from the MMW analysis were processed using basic statistical methods and Power BI software.

4. Results: insights from mixed municipal waste analysis and focus groups

One of the key results of the adoption of the above-described methods of analysis was that seasonality was a significant factor that affected HFW rates (Figure 2).

The analysis indicates that the highest amount of HFW was generated in summer, followed by autumn (except for the autumn of 2020, which was affected by the COVID-19 pandemic lockdown). The lowest amount of HFW was produced in spring, just before the start of the

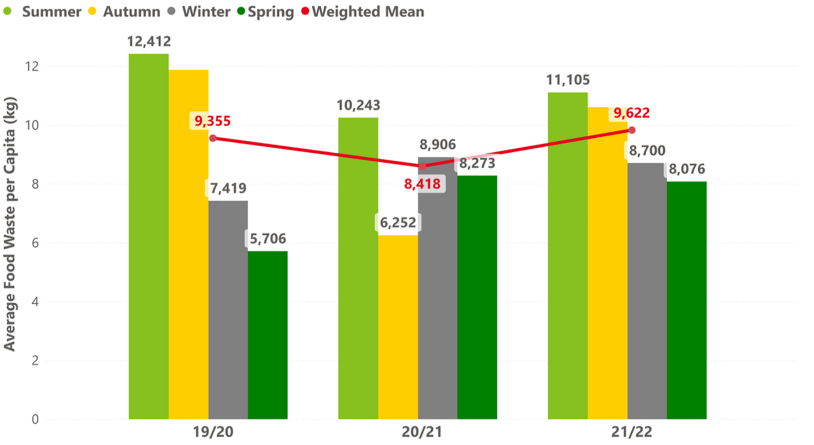

Figure 2. Average amounts of HFW (kg per capita per season) (Brno, summer 2019 – spring 2022)

garden harvest season. This pattern remained stable across all three years of investigation, confirming the structural nature of these seasonal variations rather than random fluctuations. Participants of the focus groups, even those living in apartments (i.e. without access to adjacent gardens and hence composting facilities), were aware of the summer and autumn peaks in HFW production, as evidenced by the following quotations:

> It can also be related to the quantity. For example, I receive a lot of tomatoes in the summer [and] I think yes, I'll eat that, but then it stays in the fridge. I go somewhere abroad, I arrive [back home], and, unfortunately, the quantity was too big and it stayed there. (male apartment dweller, 28, focus group 27 October 2021)

> Also with the spoilage, you bring apples in, and it's a fact that now I've thrown apples out too because they looked good in the cellar, but they just turned black [when brought] upstairs. So I think it's more the summer and then the autumn, that's when you kind of throw away more of these fruits or vegetables. (female apartment dweller, 53, focus group 27 October 2021)

The repeated occurrence of seasonal peaks suggests that HFW behaviours are influenced by predictable annual cycles, particularly related to food availability and storage conditions. This pattern with summer and autumn peaks was consistent across all three years, except for the autumn of 2020, which saw a reduction in HFW rates due to constraints on daily life caused by the pandemic measures. For the same reason, the spring of 2020 showed abnormally low HFW rates. Despite these short-term deviations, the overall seasonal pattern of Brno households remained unchanged, further reinforcing the importance of seasonality in HFW generation.

The research also confirmed the influence of the type of residential area on HFW rates (Figure 3). The analysis indicates that throughout the entire study period, HFW rates were highest in housing estates, while rural areas exhibited the lowest amounts. On average, households in housing estates generated 42.9% more FW than those in urban family houses and 52.5% more than rural households, underscoring the role of the residential environment in waste generation patterns. Notably, HFW rates in housing estates showed greater variability, particularly during the pandemic, when they experienced the most significant reduction in HFW compared to the other two residential areas. Thus, for residents of housing estates, the restrictions associated with the pandemic led to a more pronounced change in HFW management. The most significant reduction was observed during the autumn of 2020, with a recorded value of 4.984 kg of HFW per capita (Figure 4).

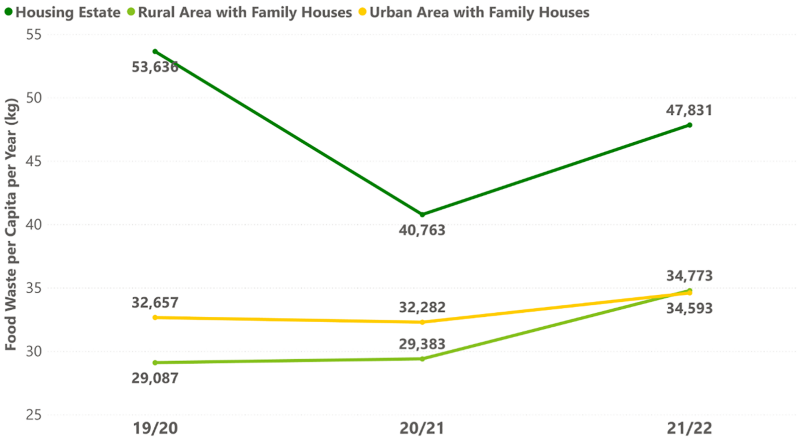

Figure 3. The annual amount of HFW (kg per capita per year) in three types of urban residential areas (Brno, summer 2019 – spring 2022)

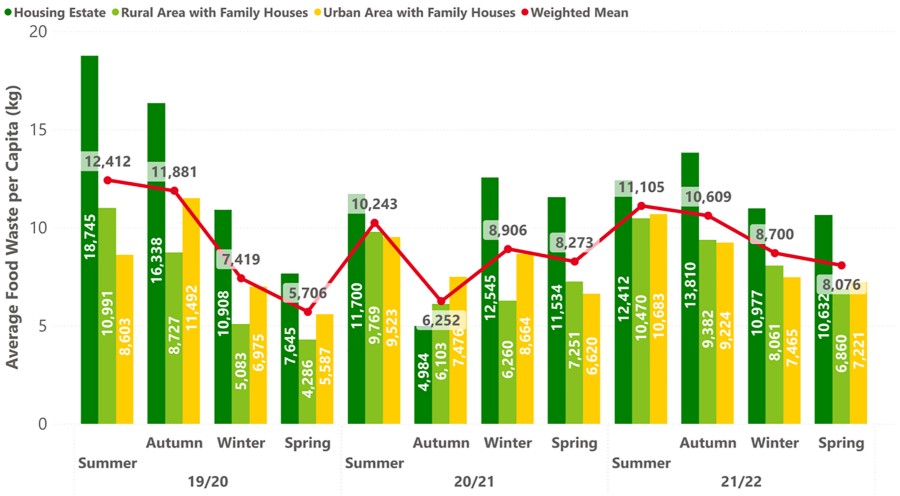

Figure 4. Average amounts of HFW (kg per capita per season) in three types of urban residential areas (Brno, summer 2019 – spring 2022)

Figure 4 demonstrates the strong influence of both seasonality and the type of residential area on HFW rates. While the differences in HFW rates between urban and rural areas with family houses were relatively small, households in housing estates consistently generated noticeably higher amounts of FW compared to the other two residential types. Households in housing estates produced a significantly higher level of FW across the whole three-year period. The exception was the severe lockdown period during the pandemic when housing estates produced a significantly lower level of HFW compared to the "normal" period (Figures 3 and 4). This suggests that contextual factors specific to certain types of residential areas, such as access to gardens and composting, influence HFW rates. Figure 5 shows that, when averaged over the three years of the study period, the annual HFW generation rate per capita in rural residential areas (with a greater likelihood of access to gardens) is 34.4% lower than in housing estates. This aligns with the overall pattern mentioned above, where households in housing estates generated approximately 1.5 times more FW than rural households and approximately 1.4 times more than those in urban family houses, underscoring the role of the residential environment in waste generation patterns.

5. Discussion of the Brno study findings

The findings from a tiny segment of the extant literature on HFW generation that explores this topic in relation to seasonality are inconclusive. The generation of HFW in 1970s Britain (Wenlock *et al*. 1980) and 2010s South Korea (Adelodun *et al*., 2021) was seasonally

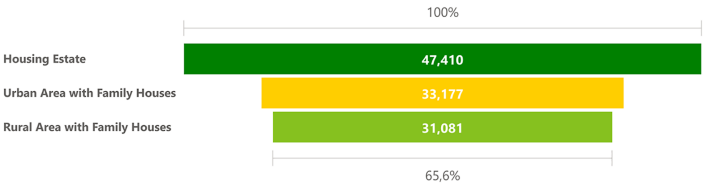

Figure 5. Household food waste (kg per capita per year) in three types of urban residential areas (Brno, summer 2019 – spring 2022)

structured; in the latter case, with a peak in summer and autumn. On the other hand, Edjabou *et al*. (2018) found the seasonal differences in FW generation in 2010s Denmark to be insignificant. Wenlock *et al*. (1980) related seasonal fluctuations in HFW rates to fluctuations in food purchases. Other studies (Gómez *et al*., 2009; Kormaňáková *et al*., 2021) assumed that the seasonal patterns of HFW rates resulted from local climate and seasonal fluctuations in food availability. In Czechia, the availability of fresh fruits and vegetables during the summer harvest translated into higher consumption and higher HFW rates, whereas in winter, limited availability led to reduced waste rates (Kormaňáková *et al*., 2021). Our findings provide further empirical support for this, demonstrating a stable pattern of summer and autumn peaks in HFW generation rates.

The results of the Brno study point to the role of garden food in the seasonal fluctuations of HFW generation rates. In general, foods such as garden-grown fruits and vegetables are the most commonly wasted food items in households (Djekic *et al*., 2019; Herzberg *et al*., 2020), and to a large extent, they also account for the summer and autumn peaks in HFW generation. In Brno, 4.1 kg, that is 44% of the total average of 9.4 kg of fruit and vegetable waste per person per annum, was wasted in the single season – the summer – in contrast to 1.8 kg (19%) in the spring (Kubíčková *et al*., 2021).

The observed seasonal fluctuations can be attributed to multiple factors. First, the increased availability of fresh produce during summer and early autumn leads to higher HFW levels, particularly among households growing or receiving garden surplus produce or purchasing perishable food in larger quantities. Second, elevated temperatures accelerate the spoilage of fruits and vegetables, reducing their shelf life and increasing waste. Third, behavioural patterns such as summer travel result in food being discarded before or after holidays. Finally, limited storage capacity in housing estates may reduce households' ability to store perishable food for extended periods.

This pattern is also evident in quotations from the focus groups mentioned earlier in the text. Our research thus provides robust evidence of the seasonal patterns in HFW rates. It underlines the importance of including this factor in research design and analyses of HFW generation rates. Excluding the pandemic period, the highest levels of HFW occurred during the summer and autumn months. As evident in Figure 3, the average HFW amount per capita in summer (11.25 kg) was 1.53 times higher than in spring (7.35 kg). This indicates the need to widen the scope of investigation of HFW beyond the retail sector as a source of food-turned-waste and to include food produced in gardens and food received as a gift. At the same time, however, there is a strong indication in the literature (Jörissen *et al*., 2015; Keegan and Breadsell, 2021) that access to a garden may result in all-year-round reduced rates of HFW via garden composting. While garden-grown produce contributes to seasonal peaks in HFW, access to gardens may help mitigate long-term waste generation by enabling composting and redistribution of surplus food.

Our findings also confirm the importance of another factor that has, until recently, largely escaped researchers' attention – the implications of the type of residential area for HFW generation rates. While some studies do not distinguish between HFW in urban and rural areas (Neff *et al*., 2015; Thyberg *et al*., 2015), other sources point to higher FW production in urban households (Secondi *et al*., 2015; Hanssen *et al*., 2016). According to Sunday *et al*. (2022) and Lebersorger and Schneider (2011), urban households and higher-density dwellings produce higher HFW rates. Other studies (Hanssen *et al*., 2016; Kubíčková *et al*., 2021; Sosna *et al*., 2019) support this finding, indicating lower levels of HFW originating in rural areas.

Our analysis aligns with these findings but takes the argument further. It is not necessarily only the rural versus urban environment that is the discriminator between lower and higher per capita rates of HFW. Instead, drawing on research conducted in the Brno urban environment, we claim that it is the type of dwelling – houses with gardens versus apartments – that matters. For households living in blocks of flats, the options alternative to FW disposal may be more limited compared to those of households occupying family houses in either rural or urban areas of a city. The latter households can, for example, compost the food that they do not consume, or

redistribute it as animal feed. These findings suggest that FW policies should take into account not only broad urban-rural distinctions but also the more nuanced differences related to housing types and access to alternative waste management options.

One of the key aspects of linking our methodological contributions to practical implications for municipalities is incorporating housing types and seasonality into HFW monitoring. For accurate HFW assessments, city authorities should collect FW data periodically throughout the year to include seasonal variations in their policy planning. Current policies often rely on one-off or short-term surveys, which may distort actual trends in HFW generation rates (Armington *et al*., 2020).

Our study also suggests that lower amounts of avoidable FW are related to households with access to gardens and home food self-provisioning. To fully understand how exactly food self-provisioning mitigates HFW requires further research. Nevertheless, urban planning strategies should support community gardens, local food networks and non-market food exchange systems initiatives that can enhance food resilience and reduce waste (Eades *et al*., 2020; Ribeiro *et al*., 2024).

Finally, developing localized interventions tailored to different residential areas is crucial. Since HFW generation rates vary depending on the type of housing, policymakers should adapt prevention campaigns to the types of residential areas. For example, suburban households may benefit from strategies focused on processing food during seasonal harvest surpluses (Beavers *et al*., 2024). Households dwelling in apartments may need interventions addressing limited food storage options (Young *et al*., 2018).

6. Conclusion: the reasons for the limited attention to place and time in household food waste studies

The findings of the Brno study on significant seasonal and spatial differences in HFW generation rates confirm the conclusions of a small number of previous studies. However, those studies were based on considerably smaller household samples and one-off or short-period data collections. The study also raises a fundamental question about the reasons for the general tendency in the literature to disregard the importance of place-based and seasonal variations in HFW generation rates. Without claims about comprehensiveness, we address this question by drawing attention to the following set of interrelated factors that may contribute to the dominant way the issue of HFW is framed.

The first factor contributing to the way HFW is framed as a problem is the implicit assumption that HFW originates almost exclusively in the food *purchased in the market economy*, that is, in "the retail environment removed from where or how it is grown" (Keegan and Breadsell, 2021, p. 5). A typical approach here is to consider individual phases of the "household food waste journey" (Principato *et al*., 2021, p. 643) – planning, shopping, storing, cooking, consuming and disposing of food – as situations in which the consumer in interaction with the wider "food environment" (Downs *et al*., 2020) behaves in a more or less wasteful way. The dynamics concerning the generation of HFW are understood to be closely associated with people acting as *consumers* in the market-based food chain. The tendency to equate people with consumers is reflected in referring to this type of waste as "consumer food waste" (Schanes *et al*., 2018; Stancu *et al*., 2016) rather than HFW.

Limiting humans to consumers obtaining food exclusively within the retail sector, a tendency informed by the TPB approach, provides little space to consider the complexity and diversity of the practices of obtaining, using and discarding food. These include dispersed and horizontal "webs" of interconnected food practices, including purchases, food production, gifts, exchanges and foraging. These practices are subject to seasonal and place-dependent variations, in contrast to the narrower linear "household food waste journey". There is also little attention to the role of infrastructures such as gardens as both sources and sinks of HFW.

Finally, it seems beyond dispute that the literature on HFW is predominantly driven by the objective of finding ways to *reduce* or prevent FW (Oláh *et al*., 2022; Raippalinna, 2020; Alexander, 2024). This is particularly the case with studies underpinned by the TPB approach. Implicitly and sometimes explicitly (e.g. Principato *et al*., 2021), this research is premised on the assumption that humans are naturally wasteful (for the critique of this bias, see Liboiron and Lepawsky, 2022); that instances of non-wasteful behaviour are exceptions rather than the rule. The assumption of inherent wastefulness blamed on individual consumers sourcing their food solely by purchase leaves little room for appreciating differences in waste-related practices, such as variations in HFW rates conditioned by the combination of season and place.

To end this paper on a more upbeat note, we attempt to convert the critical points on HFW scholarship articulated above into two recommendations for future research. First, in HFW studies, it is beneficial to draw inspiration from SPT-based approaches and avoid isolating the individual consumer from broader social relations and infrastructures. Future research should adopt a more holistic perspective on HFW behaviours, considering not only market-based food consumption but also alternative sources such as home-grown and donated food. This broader approach would enhance understanding of how seasonal and spatial factors influence HFW and provide a stronger foundation for targeted policy interventions. Second, rather than assuming that reducing HFW relies solely on consumer education, future research should also investigate structural and contextual factors that contribute to low HFW generation rates. By identifying and promoting effective household practices, research can help shape policies that go beyond awareness-raising and instead focus on enabling the structural conditions necessary for waste prevention. After all, the findings from the Brno study that these households produce, in the European context, low amounts of HFW underscore the role of households' access to gardens. However, there are likely to be other factors behind these low HFW rates which remain underexplored and deserve scholarly attention.

Notes

1. For example, a ten-fold increase recorded in the Scopus database between 2010 and 2020 (Giordano and Franco, 2021).
2. For example, the Routledge Handbook of Food Waste, with 31 chapters by 87 authors, does not directly address the spatiality and temporality of HFW. On the other hand, Merian *et al*. (2024) list the lack of 'spatial and temporal representativeness' of HFW as a key barrier to its accurate measurement.
3. Edjabou *et al*. (2016) considered the types of housing *and* seasonality (three collections in May, October and March) but found no significant difference in the amount of HFW caused by either of these factors.

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