# Representative survey of practices to reduce food waste in German households

Vera Lange, Jasmin Godemann

## Introduction

The generation of food waste is a problem that occurs along the entire food supply chain with far-reaching ecological, social, and economic consequences. Private households, in particular, account for a large proportion (52%) of the total amount of food waste in Germany [1]. Given the scale of this issue, reducing domestic food waste is essential. Against this background, practices to reduce food waste such as meal planning, systematic storage, and dealing with leftover food are discussed in the literature as possible solutions [2, 3]. These practices are taken up and communicated in public, media, and political spheres by various initiatives. German campaigns such as *Zu gut für die Tonne* (BLE) aim to raise awareness of the issue and support consumers in reducing food waste by providing practical tips and advice. The focus is specifically on providing information on how to encourage the adoption of practices that will alleviate food waste [1]. Despite these developments, the amount of discarded food in German households remains excessive [1], indicating a need for further improvements. Because of this, questions arise as to the extent to which these media-communicated practices for reducing food waste are already integrated into everyday life, how widespread they are in German households, and how these practices are shaped.

### Practices for reducing food waste and the focus on dealing with leftover food

Food waste and its prevention at the household level is a multifaceted issue, in which various practices related to food provision, such as planning meals, shopping for groceries, storing ingredients, preparing meals, eating, and dealing with leftover food, play a decisive role

## Abstract

Against the backdrop of the global food waste problem, practices such as storing and reusing leftover food are being forwarded as possible solutions. However, little is currently known about how widespread these practices are in German households. Therefore, this study investigates the extent to which these practices are integrated in Germany. Drawing on practice theory, a quantitative questionnaire was developed to assess the prevalence of food waste reduction practices in everyday German domestic life. The representative online survey was conducted with 2,172 participants in December 2022. Overall, respondents reported that they regularly use practices to reduce food waste and feel very competent in doing so. Notably, the influence of situational circumstances was cited as an obstacle. The data indicate that practices to reduce food waste are reproduced as socially accepted knowledge. However, they are not implemented in routine actions, as indicated by the figures for food waste remaining high. This suggests that in the future, the focus should not only be on the further dissemination of knowledge in this area; rather, the dynamics of practices and the underlying social norms that impact upon them must be taken into account.

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Fig. 1: **Food waste in private households (own illustration, based on [4])**

(♦ Figure 1) [2–5]. At each of these steps, food may be assessed in terms of its edibility and subsequently either discarded or reused [3]. These household routines therefore play an important role in reducing food waste.
The results presented below are part of a broader study focusing on planning before grocery shopping, systematic storage, and dealing with leftovers. The following section focuses on the handling of leftover food.

Storing and reusing food and leftovers is considered an important and effective strategy for reducing food waste [6–9]. This includes activities such as storing and preserving uneaten food in order to delay spoilage and enable later consumption. The processing and consumption of food and leftovers that are already available in a household also reduce the potential amount of food waste. Handling leftover food is an everyday routine in most households [10]. However, it is often performed without much consideration and can lead to high levels of food waste when leftover food is not used efficiently. Research shows that there are several reasons that prevent consumers from using food that has not been consumed. These include, for example, difficulties in assessing the shelf life of uneaten food, challenges in risk assessment when consuming them, feelings of guilt when serving leftover food to children, or an aversion to reheating it [2, 11]. Improper storage can also be problematic, for instance, such food can be forgotten, kept in the refrigerator for too long, and spoil prematurely. In addition, serving leftover food may be considered socially unacceptable when hosting guests [2, 11]. Routines and conventions that define what counts as "proper" food strongly shape the handling of food. For example, the social norm of using a variety of fresh ingredients may frequently lead to it being overpurchased [2]. These social conventions influence not only actions but also the emotional and moral considerations of household members. Feelings of guilt when discarding food, for instance, may cause consumers to adapt or question their practices [2, 11].
While there are numerous studies on consumer behavior regarding food waste and its determinants, there is a dearth of research on the embedding of practices to reduce food waste in German households. Although there is much discussion about such behaviors showing promise in efforts to reduce food waste, little is known about their prevalence and integration in German society. The literature provides little analysis or comparative data on the frequency or routinization of practices in handling leftover food. Research tends to focus more on other practices such as planning grocery shopping and meals [7, 12, 13]. Although various studies emphasize the importance of regular routines for reducing food waste, they focus more on their overall importance rather than on the detailed quantification of practices at an individual level [7, 12, 13]. Other studies are mostly based on qualitative data, which allow conclusions to be drawn about routines [11]. Quested et al. (2013) emphasize that while the strong routinization of these behaviors does impact on the generation of waste, they are not consciously carried out for the purpose of waste prevention [13]. Instead, they are part of habitual routines that have emerged and are performed for other reasons.

### Practice-theoretical perspective on food waste

The topic of food waste has received increasing scientific attention over the past two decades [3, 14]. While the majority of studies, particularly from environmental and social psychological perspectives, regard food waste as the result of individual decisions and attitudes, a practice-theoretical perspective focusing on everyday actions has recently gained ground [2, 3].

From a practice-theoretical perspective, everyday life consists of a multitude of interconnected and overlapping practices. These are understood as being routinized everyday activities such as cooking or shopping [15]. In this view, the emphasis is not on the individual and their actions, consciousness, and attitudes, but rather on the doing itself [15]. Practice theory highlights that an action is not based solely on individual intentions and motives but is also structured by norms embedded in specific social orders and shaped by infrastructures and material resources [16]. Practices are understood as a pattern of meanings, competencies, and physical abilities, as well as material prerequisites [16]. These three elements are not isolated components but interlinked and are constantly influencing each other. Together, they contribute to the formation, maintenance, and change of practices [16]. They are not always performed uniformly and can vary from one performance to another and from person to person [17]. However, the regular and frequent performance of a practice contributes to its stability. Through their repetition, practices become automated and increasingly implicit. As a result, purely knowledge-based approaches to implementing change often fail, since established patterns of action are shaped not only by knowledge but also by established routines. However, through repeated performance, new actions may emerge, resulting in changes in the practice itself. Thus, practices exist in a tension between routine and change and are not subject to rigid patterns [18].

This practice-theoretical approach offers a more comprehensive framework for understanding the phenomenon of food waste in all its complexity. It shifts the focus from individual behaviors to everyday practices and social routines that shape household actions. In doing so, it addresses the limitations of earlier approaches that often neglected the social and cultural contexts in which consumers operate. From this perspective, food waste is understood as a multilayered phenomenon embedded in a network of practices, norms, and structures, and cannot solely be attributed to individual factors. This perspective enables a deeper understanding of the dynamics and mechanisms that contribute to food waste at the household level.

It can be seen that, until now, there has been insufficient studies that focus on food waste reduction at the national level in Germany or consider the complexity of relevant practices. This article therefore takes a practice-theoretical perspective on household food waste and seeks to generate insights into the current state and structuring of practices in German households. To this purpose, the following research questions are addressed: How are food waste reduction practices shaped in German households? How and to what extent are practices of food waste prevention and reduction integrated into everyday life? What patterns of meaning, material arrangements, and competences underpin these sustainable practices? These questions are investigated through a nationwide representative survey, with the aim of deepening the understanding of practices that reduce food waste.

## Method

In the context of practice-theoretical research, qualitative methods such as interviews and observations are commonplace [19], as they are well suited for capturing the nuances of social interactions, meanings, and contexts of practices. However, there are divergent views on the appropriateness of their methodological implementation [19, 20]. Halkier (2017) and Shove (2017) argue that practice-theoretical research should not be limited to qualitative methods alone, and some researchers advocate for increased methodological openness and flexibility [19, 21]. In some cases, it may be useful to apply quantitative methods or hybrid qualitative and quantitative approaches in order to quantify certain aspects of practices or to identify statistical patterns and relationships [19], depending on the research question and objective in hand. For this study, quantitative methods can be used to describe practices without establishing causalities [21]. Utilizing questionnaires and mixed methods in data collection makes it possible to capture both the routinized performance and the constitutive elements of practices [21, 22]. For this reason, such an approach is applied in the present study as food waste reduction practices are analyzed using a quantitative survey.

### Study design

To examine practices of food waste prevention, a quantitative online questionnaire was developed. The structure of the content is based on practice theory and refers both to routinized performance and to the three constitutive elements in a practice identified by Shove et al. (2012): meaning, material, and competencies [16]. The questionnaire contains 37 questions, 13 of which relate to the analysis section "Dealing with food leftovers" described below. This section is divided into the following categories: storing and preserving food and leftovers and processing and using available food and leftovers. In addition, the

questionnaire also asked about which members in each household participated in food provision and collected sociodemographic data in order to draw conclusions about the distribution of food practices in German society. Routine was measured by jointly querying "frequency" and "automaticity" [23]. A further item addressed reasons that led respondents to deviate from their routine, thereby capturing aspects of changes in practices. Meanings were captured through questions addressing the reasons for performing (or not performing) these behaviors. Respondents who reported more frequent engagement in the practices were asked to state their reasons for doing so, whereas respondents with less frequent engagement were asked about their reasons for not doing so. The material resources were covered by questions on the objects or tools used in the respective practices. To assess competences, questions were developed that addressed the skills, knowledge, and experience required to carry out a practice [16].

The response options for the questions were predominantly in the form of rating scales, which were grouped into matrix questions (sets of items). Each rating scale consisted of seven response categories. To ensure and improve the quality of the questionnaire, pretests were conducted prior to the survey. These pretests examined the suitability, technical functionality, and comprehensibility of the questionnaire [24].

| Sociodemographic characteristic | n | % |
|---|---|---|
| **Gender** | | |
| Male | 1,001 | 46.1 |
| Female | 1,171 | 53.9 |
| **Age category** | | |
| 18-29 | 352 | 16.2 |
| 30-39 | 394 | 18.1 |
| 40-49 | 352 | 16.2 |
| 50-59 | 482 | 22.2 |
| 60-74 | 592 | 27.3 |
| **Household size** | | |
| Single households | 522 | 24.0 |
| 2-person households | 827 | 38.1 |
| 3-person households | 364 | 16.8 |
| 4+-person households | 422 | 19.4 |

Tab. 1: **Sociodemographic characteristics** (Source: own data, n = 2,172)

The questionnaire was newly designed and developed according to the specific objectives of this study. To ensure content validity, it was discussed within the research team and subjected to pretesting. The cognitive pretests in particular served to validate the content of the questions. In addition, for the aspect of automaticity, a reliability test (Cronbach's alpha) was carried out to ensure the internal consistency of the items.

### Data collection

Data were collected between December 5 and December 15, 2022, using the software Limesurvey. The survey was conducted in German. In cooperation with Cint, a nationwide market research institute, all participants were recruited from its panel. The sampling procedure applied by Cint ensured representativeness of the sample regarding age, gender, household size, and federal state (♦ table 1). The central inclusion criterion was active participation in food provision within the household. After data cleaning, a total of 2,172 respondents were included in the analysis.

### Data analysis

The data were analyzed using IBM SPSS Statistics (Version 29.0.2). Descriptive statistics were calculated to describe the sample and the variables collected. Categorical variables were presented using absolute and relative frequencies. For ordinal data in Likert-scale format, means were calculated. Interval-scaled data, particularly constructed scales, were also described using means. No further statistical analysis of the data was conducted in the context of this article.

## Results

The survey aimed to examine the handling of leftover food in private households in Germany. The results suggest that practices of storing, preserving, reusing, and processing leftovers and food are embedded in German society, but vary in intensity. These differences result from variations in the respective elements of routines, competences, meanings, and material aspects.

All respondents were involved in food provision to a certain extent, as this was an inclusion criterion for participation in the study. Of these, 54.5% (n = 1,183) reported being solely responsible for food provision, while 45.5% (n = 985) shared this responsibility with other household members. Among those solely responsible, more than half were women (62.5%, n = 739), while 37.5% (n = 444) were men. Among respondents sharing responsibility, 43.7% (n = 432) were women and 56.3% (n = 557) were men. In terms of household size, in one-person households, the

[1] Frequencies were assessed using a scale from 1 to 7, where 1 = never, 2 = very rarely, 3 = rarely, 4 = occasionally, 5 = often, 6 = very often, and 7 = always. All other questions were assessed using a scale from 1 to 7, where 1 = does not apply at all, 2 = mostly does not apply, 3 = rather does not apply, 4 = partly applies, 5 = just about applies, 6 = mostly applies, and 7 = fully applies.

respective person is of course always solely responsible for food provision, regardless of gender. In households with two or more people, women predominantly take sole responsibility (between approx. 51% and 52%), while men are less often solely responsible (between 22% and 38%).

Respondents mainly stored food and leftovers in the refrigerator and freezer (93.8%). For this purpose, 74.4% use containers, other storage methods mentioned included "covering leftovers with foil on a plate" and "plastic bags." Approximately one-third of respondents had high automaticity for storing leftover food ($\bar{x}$ = 5.45) and did it frequently ($\bar{x}$ = 4.86), indicating a fairly well-established routine (♦ Figure 2). Preserving food that cannot be consumed in time is only slightly less automatic ($\bar{x}$ = 4.96) and frequent ($\bar{x}$ = 4.69), which suggests a less established routine. Leftovers are frequently ($\bar{x}$ = 4.99) and, in particular, automatically ($\bar{x}$ = 5.44) processed, which indicates an established routine, while only 32.3% always or very often prefer to use leftover food, which is comparatively low (frequency $\bar{x}$ = 4.68). In contrast, food close to or at the end at its best-before or expiration date is used more frequently ($\bar{x}$ = 5.11) and equally automatically ($\bar{x}$ = 5.46), which is thus firmly anchored in everyday life for the majority of the sample. The results show a strong tendency among respondents to prepare meals exclusively with food already available in the household. The very high frequency ($\bar{x}$ = 5.29) and strong automaticity ($\bar{x}$ = 5.39) suggest a well-established routine. Respondents rarely disposed of food that was still edible (frequency $\bar{x}$ = 2.52). Deviations from the routines of storing and reusing leftover food were mainly due to external factors such as time pressure (40.1%), eating out (40%), and hosting guests (33.7%). Overall, it becomes evident that storing and preserving food and leftovers is less strongly routinized in the German population than actively processing and using existing food and leftovers. Moreover, differences between practices also emerge in terms of frequency and automaticity.

In the area of competences (♦ figure 3), "storing and preserving" is somewhat less pronounced than "using and consuming food and leftovers." Specifically, 61.4% of respondents considered themselves highly competent in properly storing leftover food to keep them fresh for as long as possible ($\bar{x}$ = 5.55). By contrast, more than 64% ($\bar{x}$ = 5.65) felt highly competent in assessing the edibility of leftovers. This high self-reporting of competence also extended to the evaluation of edibility across specific food groups (68.3%, $\bar{x}$ = 5.77). Broken down by food group, the self-assessed competence was reported as follows: bread, rolls, and baked goods: 71.8%; fruit and vegetables: 71%; dairy products/dairy alternatives: 67.3%; and meat and sausages/meat and sausage alternatives: 62.8%.

Reasons for engaging in routines concerned both storing/preserving and reusing leftover food. The majority of respondents stated that it was important to store leftover food to avoid wasting resources (80.1%). About two-thirds reported doing so to save money (69.6%) and

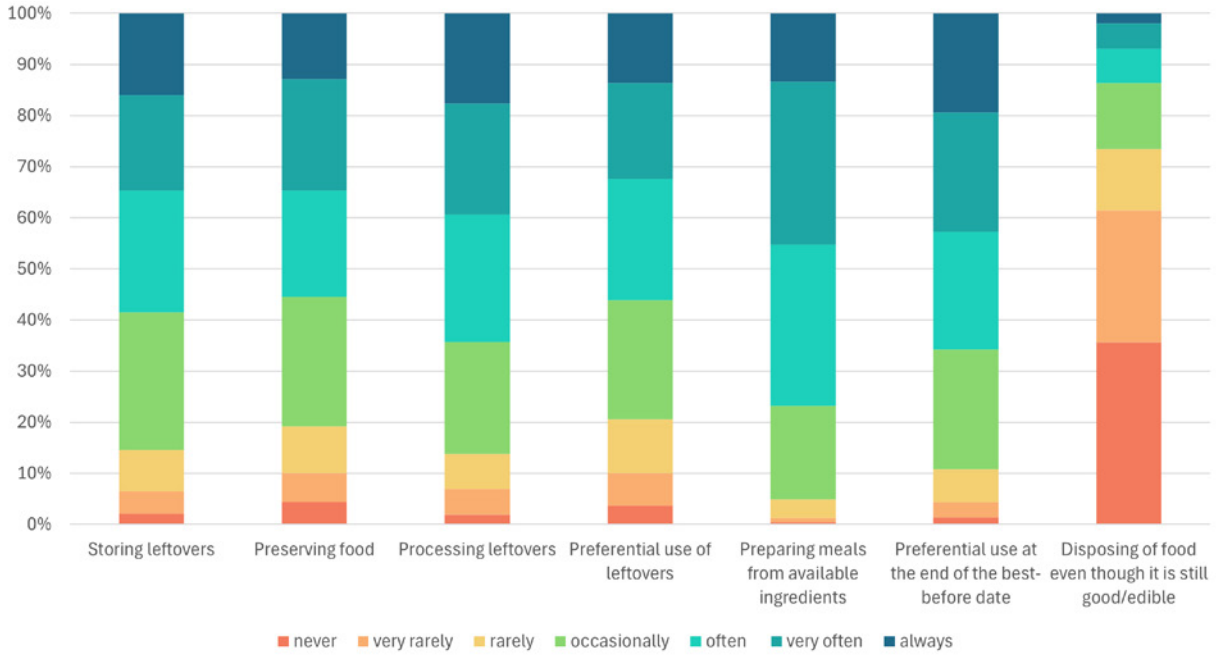


Fig.: **Frequencies** (Source: own data, n = 2,172)

to save time when preparing further meals (61.1%). The reason of serving as a role model received less agreement (33.4%). Thus, there appears to be motives other than role modeling that drive the storage and reuse of leftover food. At the same time, respondents also indicated reasons against engaging in these practices. For example, they agreed that they did not store leftover food because it was too time-consuming (5%), they had no further use for them (8.8%), they were unsure whether the food was still edible (10.6%), or they anticipated not using the leftover food later on (12.8%). In addition, 7.9% of respondents considered it unnecessary to store leftover food, while 5.9% had never thought about doing so.

## Discussion

The data from this survey provides insights into the practice of dealing with leftover food in the German population. The results show that these practices are mostly moderately to strongly integrated into everyday life, but that individual sub-practices differ in how widespread they are. While preserving food is considerably less routinized, other practices, such as preferring to use food already available in the household, are carried out more frequently. The practices of storing leftover food and preserving food aim to delay the point of consumption and reduce food waste. While storing leftover food is probably practiced more frequently due to its lower complexity and time requirement, preserving food requires more time and more specialized equipment (e.g., freezer containers or jars), which may explain its lower frequency. These results highlight the relevance of analyzing and comparing practices that are assigned the same meaning but are differently embedded, in order to better understand them.

The findings indicate that while a majority of respondents feel competent (approx. 60%), only a minority (approx. 20%) regularly carry out the practice. This points to a gap between competence and implementation. This discrepancy is also supported by the amount of food waste identified in other studies, which, at 6.6 million tons per year, remains too high [1]. The data suggest that it is not insufficient competence that hinders the carrying out of practices, but rather aspects such as time constraints, the need to adapt to changing circumstances, uncertainty about edibility, or the influence of situational circumstances. Factors for engaging in food waste reduction practices include waste avoidance and saving costs. These different influences may conflict in certain situations, which can then lead to discrepancies and deviations from routines. For example, eating out, hosting guests, or being under time constraints may make the reuse of leftover food appear less appropriate in that situation, leading to temporarily abandoning routines and ultimately to food being spoiled and discarded. Thus, situational factors may cause determining influences to come into

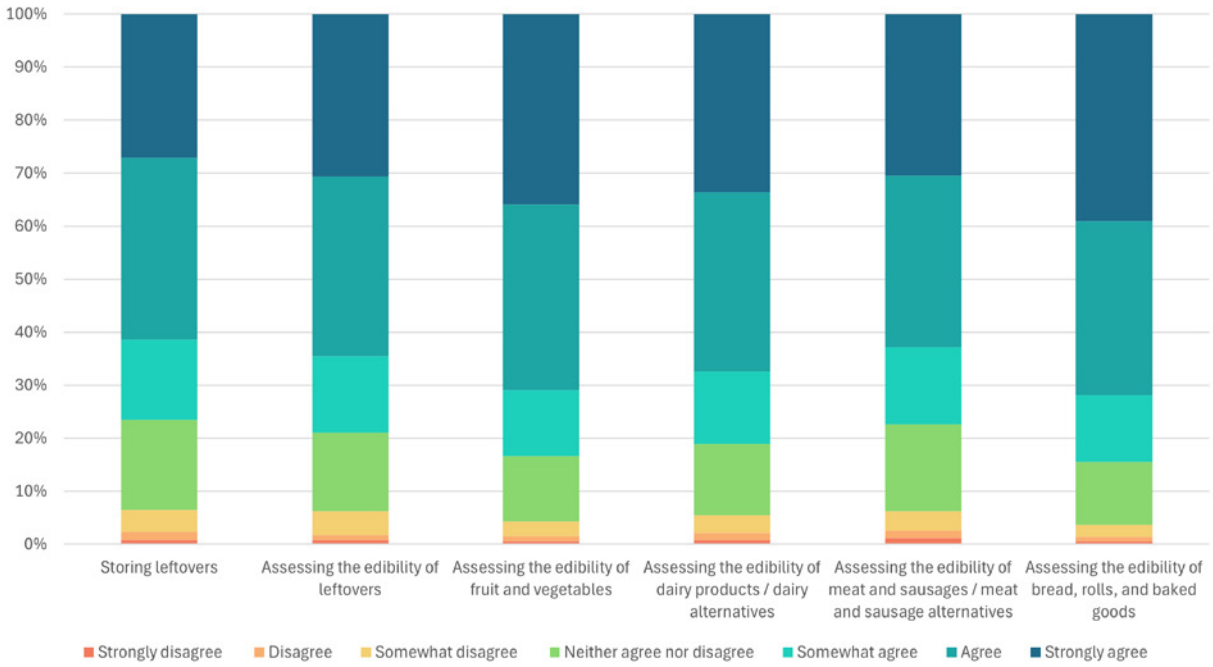


Fig. 3: **Competencies** (Source: own data, n = 2,172)

conflict, shaping the decision for or against practicing food waste reduction [25].

Such conflicts between different influencing factors are also evident in other studies, which emphasize the complexity of decision-making processes, especially with regard to handling food [26, 27]. In addition to these situational influences, normative orientations also play an essential role in the implementation of practices for dealing with leftover food. Studies show that moral values, social expectations, and culturally influenced embedded ideas of household management and responsibility influence routines [11, 27, 28]. These norms can have both a positive and a negative effect in relation to not wasting food, for example by reinforcing economical and sustainable behavior or by increasing the pressure to always have a plentiful supply available. The importance of these influences should be explored further in future analyses [11, 28].

Decisions about the disposal of food and leftovers are shaped by various factors, with no clear boundary between "storing" and "discarding" [2]. Food often passes through a "disposal gap" – an intermediate stage in which it is set aside before being finally disposed of. This phase offers an opportunity to reevaluate the value of the food [2]. Conflicting factors include cultural norms, emotional and moral considerations, as well as practical considerations and concerns about hygiene [26, 27]. These elaborate influences interact with the distribution of household tasks and roles in everyday life, potentially creating further conflicts that often hinder the consistent implementation of sustainable practices in the handling of food. Cappellini and Parsons (2012) highlight the need for flexibility and adaptability in family life [11]. Social aspects such as the distribution of tasks and responsibilities also play a central role here. Household dynamics, including negotiations over roles and responsibilities, can strongly influence how food practices are implemented [11]. Responsibilities within the family can determine who has access to and control over food supplies, which in turn has an impact on the routinization and situational adaptation of practices. Social norms, such as caring for the family or hospitality, can also lead to deviations from routines and cause conflicts or resistance to the implementation of food management systems. The influence of different, often conflicting factors and deviations from routines is therefore an essential part of everyday practices; they are not rigid and must be constantly renegotiated and adapted. It can therefore be concluded that situational circumstances can be understood both as a challenge to achieving sustainable practices and as an inevitable part of household management. This underlines the complexity of everyday decision-making processes and the need to develop flexible strategies to promote long-lasting practices while taking into account diverse and dynamic situational influences.

This study has several strengths and limitations. A central strength lies in its broad data base with a representative sample (n = 2,172), which allows for detailed analyses of practices and their situational deviations. This provides robust insights into German households. In addition, combining a practice-theoretical approach with a quantitative survey contributes to methodological diversity and broadens the perspective on food waste as a socially embedded, routinized practice. This opens the possibility of examining not only individual decisions but also the complicated social and routine structures involved in reducing food waste.

At the same time, some limitations must be considered. Since the study is based on self-reported information, biases due to socially desirable responses cannot be ruled out. Furthermore, subjective assessments of one's competencies and routines may differ from the actual performance of practices. As no direct measurement or observation of actual practices was carried out, this potential discrepancy cannot be empirically validated.

Aside from internal content validation and a reliability test of the automaticity scale, no further validation of the questionnaire was conducted. Future research could address this issue by providing more comprehensive validation to increase measurement accuracy. Despite these limitations, the study provides valuable insights into the handling of food waste in German households and highlights the factors that influence routines and situational deviations from such practices.

## Conclusion

The results of this study show that practices of handling leftover food are already widespread in German society. While respondents reported that relevant competences for avoiding food waste are available, the level of action is less pronounced. The practices are characterized by a combination of routinized and situational forms of action. It becomes evident that individual sub-practices vary in prevalence and that situational action emerges as an important influencing factor, underlining the relevance and complexity of situational factors in the context of food utilization [2, 11, 28–30].

Any future attempts to establish a deeper and broader embedding of practices, particularly with a focus on routines, should consider the dynamic nature of these practices. Routines are not rigid, immutable sequences but consist of dynamic elements shaped by social interactions and contextual conditions, which are subject to constant change [16]. This means that a stronger embedding of routines does not necessarily mean just setting up rigid mechanisms but should also allow for deviations and adaptations. In doing so, norms that

guide action in respective situations must be considered, although it remains unclear which norms are particularly pertinent, and this requires further investigation. Since this is a multi-stage study, concrete recommendations for implementation can only be developed based on the results of the subsequent research. The embedding of routines should therefore be understood as part of a continuous process of negotiation that considers both the specific situations and the perspectives of the actors involved.

Future research should therefore focus on developing a deeper understanding of everyday practices, situational factors, and individual contexts of meaning. This includes exploring the individual contexts of meaning and cultural values that shape everyday actions. In addition, situational influences and normative conflicts that affect decisions in handling food should be analyzed, taking into account the dynamic nature of routines and their adaptability to changes in the social context. Such analysis is still lacking and, given the current gaps in knowledge, should be conducted using qualitative approaches in order to gain deeper insights.

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