Usage of (returnable) containers for takeaway food. Results of a representative survey

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1. Summary and Resumé

The mandatory offering of reusable packaging, in effect since 2023, aims to reduce the consumption of single-use packaging in Germany. Businesses offering takeaway meals are obligated to provide their customers with a reusable option. While the use of reusable cups for takeaway beverages has been quite well researched, there has been limited investigation into the usage of reusable containers for takeaway meals. In March 2023, a representative survey involving 2,101 individuals in Germany was conducted to understand user habits, preferences, and barriers regarding reusable containers for takeaway meals. The results indicate that consumers routinely use reusable containers for self-prepared meals; however, the usage of food containers for takeaway meals prepared by others is not yet widespread. Additionally, there are many uncertainties and everyday practical challenges regarding the usage of reusable containers that can be borrowed from pooling systems. These findings contribute to a better understanding of consumer behavior regarding food containers. Based on this, recommendations are formulated for restaurateurs, reusable food container suppliers and decision-makers in politics and administration, which should contribute to the promotion of reusable food and waste prevention in the takeaway sector.

2. Background of the study

Packaging is an integral part of our daily lives, serving many useful and necessary functions such as product protection, prolonging shelf life, and facilitating transportation. However, the increasing usage of packaging materials also raises ecological and economic concerns. In addition to the increased resource consumption, the growing amount of packaging waste poses a challenge for its proper disposal. Over the last three decades, the total consumption of packaging in Germany has risen by more than 20 percent, with the consumption of plastic packaging more than doubling with an increase of 138.6 percent (GVM 2022). With around 226 kilograms per capita, packaging waste in Germany is among the highest in Europe (Burger et al. 2022). This is primarily attributed to changing production, supply, and consumption patterns due to growing prosperity, including an increase in out-of-home consumption of food (Schüler et al. 2023). The COVID-19 pandemic has further intensified the trend of takeaway food consumption.

The mandatory offering of reusable packaging, in effect since 2023, aims to reduce the consumption of single-use packaging in Germany. It is part of the implementation of the European Single-Use Plastics Directive into German law (Directive (EU) 2019/904). The German Packaging Act (VerpackG), which regulates the placing on the market, take-back, and high-quality recycling of packaging, stipulates that "final distributors of single-use plastic food packaging and single-use beverage cups, which are only filled with goods at the final distributor's premises, [...] are obliged from January 1, 2023 to offer the goods offered in these single-use packaging also in reusable packaging for sale at the place of marketing. (...)" (§33 para. 1 VerpackG).

This obligation applies to all businesses offering prepared meals for takeaway (so-called "final distributors"), including restaurants, cafes, fast-food chains, food stands, as well as delivery services and supermarket fresh counters. However, the obligation only applies to larger businesses with at least five employees and a sales area exceeding 80 square meters. Smaller businesses whose sales area does not exceed 80 square meters must accept consumer-owned containers as an alternative to single-use packaging (§34 VerpackG).

Initial sample surveys and test visits to gastronomic businesses, however, indicate that the implementation of the mandatory offering of reusable packaging is proceeding slowly, with particular shortcomings observed in the crucial information provision regarding the availability of reusable options (Greenpeace 2023; DUH 2023a). While the use of reusable cups for takeaway beverages has been quite well researched, there has been limited investigation into the usage of reusable containers for takeaway meals. Therefore, the aim of the present study is to understand user habits, preferences, and barriers regarding the use of reusables for takeaway meals, as well as to assess consumers' knowledge about the availability and functionality of reusable systems. The insights from this study are intended to contribute to increasing the usage of reusable containers and packaging for takeaway meals, making them accessible and understandable to all segments of the population.

2.1 State of research and research questions

From existing research, various insights can be derived regarding the acceptance, evaluation, and utilization of reusable systems and containers for takeaway meals[1]. Initially, a distinction must be made between studies on reusable packaging for food products available in supermarkets (e.g. reusable glass jars for yogurt) and reusable containers for prepared meals.

Studies on reusable packaging for food products (e.g. reusable glass jars for yogurt or milk) examine consumers' willingness and intention to use them (e.g. Bovensiepen et al., 2018; Greenwood et al., 2021), perception of the design and appearance of reusable packaging (e.g. Madria & Tangsoc, 2019; Collins et al., 2023), as well as their ecological assessment (e.g. Coelho et al., 2020; Gallego-Schmid et al., 2019). Surveys also indicate that consumers are generally willing to use reusable alternatives to reduce packaging waste from food products (e.g., Bovensiepen et al., 2018; German Packaging Institute, 2023). However, there are indications of a gap between this intention and consumers' actual behavior (Marken, 2021).

Denter et al. (2023) also found in a study on the usage of reusable containers that 85 percent of respondents would use a reusable container for takeaway meals (intention). However, this conflicts with expert interviews conducted in the same study, which indicate a different behavior (actual behavior). This so-called intention-behavior gap is a well-known

1 When considering the current state of research, both scientific articles and gray literature (reports, survey results, etc.) were included.

psychological phenomenon (e.g., Sheeran & Webb, 2016), often observed in sustainable consumption behavior (Nguyen et al., 2019).

Various reasons are cited in the literature for why consumers do not or rarely use reusable containers for takeaway meals. Barriers to such behaviors include perceived high effort, hygiene concerns, a lack of (visible) offerings, and a lack of social incentives (Jiang et al., 2020; Kleinhückelkotten et al., 2022; Collins et al., 2023; German Environmental Aid, 2023). Information deficits also contribute to consumers not using reusable options (Schüler et al., 2023). The perceived environmental factors, such as the availability of disposable cups, also influence consumers' decisions (Ertz et al., 2017).

In contrast, flexible and smooth return options are essential prerequisites for the acceptance and willingness of consumers to use reusable options (Jiang et al., 2020; Denter et al., 2023; Schüler et al., 2023). Additionally, proactive communication and personal engagement with consumers by the staff in establishments are effective means to increase the usage of reusable containers (Kleinhückelkotten et al., 2022).

Studies on point-of-sale interventions, at the place of takeaway offerings, also highlight the importance of social factors in the willingness to use reusable containers (Dorn & Stöckli, 2018). Effective instruments for promoting the usage of reusable cups, for example, include not only providing reusable packaging (Poortinga & Whitaker, 2018) but also financial incentives (Nicolau et al., 2022) and dynamic norms[2] (Loschelder et al., 2019).

In summary, existing research underlines the complexity of consumer behavior regarding reusable containers. Besides the significant importance of flexible return systems, the role of information dissemination in promoting the usage of reusable containers is also evident. However, previous studies mainly focus on barriers at the point of sale and primarily on takeaway beverages like coffee (Loschelder et al., 2019; Nicolau et al., 2022; Poortinga & Whitaker, 2018). This may be attributed to the wider international prevalence of reusable solutions for takeaway beverages compared to takeaway meals.

Broader social surveys primarily examine the acceptance of reusable packaging for food or drugstore products, such as reusable glass jars for yogurt or refill packs for soap. However, these findings can only be transferred to the takeaway sector to a limited extent, as reusable packaging is integrated into entirely different supply structures and consumption practices. For instance, there is typically no interaction between the consumer and seller when purchasing reusable packaging in supermarkets.

Thus, there is a need for research into the dynamics and influencing factors affecting current usage habits and willingness to use reusable containers for takeaway meals. Specifically,

2 In environmental psychology, dynamic norms are defined as behaviors that do not fall under a static social norm (cf. Sparkman & Walton, 2017). While static norms prescribe certain actions, dynamic norms indicate that new behaviors are emerging and can encourage individuals to join this momentum. Therefore, dynamic norms can promote sustainable behavior when prevailing social norms do not (yet) align with the desired outcome, such as the use of reusable containers.

there is a research gap regarding the everyday challenges associated with reusable use, such as transportation, storage, and cleaning of containers. Another research gap lies in the challenges associated with the use of own containers that consumers bring to food businesses (also known as *BYO - Bring Your Own*).

Among others, the following questions will be addressed within the scope of the study:

- How frequently and in what situations are (owned or borrowed) containers used for takeaway meals by the public?
- How are the containers stored, transported and cleaned? What influences do sociodemographic aspects have on container usage?
- What container characteristics are important in the takeaway context from the perspective of consumers?
- How do consumers perceive the availability of reusable options for takeaway meals in their environment?
- What barriers exist for consumers in using borrowed or own containers for takeaway meals?
- What factors influence consumers' willingness to use reusable options in the takeaway sector? What role does the deposit amount play?
- What correlations exist between awareness of reusable options and sociodemographic aspects?
- How does precycling behavior correlate with the use of delivery services and reusable options for takeaway meals?

2.2 Definition of terms

Mehrwegverpackungen is defined in §34 of the German Packaging Act as "packaging designed and intended to be reused multiple times for the same purpose after usage, with their actual return and reuse facilitated by adequate logistics and promoted by suitable incentive systems, typically through a deposit" (German Packaging Act §3(3)). Reusable containers are defined there as "customer-owned, brought containers." This refers to containers such as lunch boxes, thermal mugs, or similar containers or products owned by the customer and filled by the gastronomic business with the sold food or drink. Bringing one's own containers is also referred to as *Bring Your Own* (BYO) or *Bring Your Own Container* (BYOC).

According to Zero Waste Europe, customer-owned containers are not returnable packaging, as the logistics for return and reuse are not present, and the container is owned by consumers, who refill it either in the store or at home (Schneider & Copello, 2022). In both cases, the container is not considered packaging but a product; therefore, this form should be referred to not as *packaging reuse* but rather as *packaging waste prevention* (p. 4).

To adhere to this distinction, this study will:

- Use the term **own containers** for customer-owned containers.
- Define **returnable containers** as borrowed food boxes from pooling system providers such as Vytal, Rebowl or Relevo.

Takeaway meals refer to externally prepared meals for takeout, such as those from a restaurant, food stand or supermarket. We distinguish between takeaway for pickup and takeaway through ordering from delivery services.

Therefore, this report considers the following two consumption practices:

- The use of own reusable containers for self-prepared meals as well as for externally prepared takeaway meals for pickup.
- The use of borrowed reusable containers for externally prepared takeaway meals for pickup and for ordering from delivery services.

Table 1: Overview of the considered consumption practices (Source: own illustration)

Ownership	**Type of Meals**		
	Self-prepared	Takeaway pickup	Takeaway order
Own Container	x	x	
Borrowed Container (Pooling System)		x	x

2.3 Methodical approach

The data collection was conducted as a representative online survey (*Computer Assisted Web Interview*, CAWI) for all devices by the market research service provider Bilendi. The survey took place from February 27th to March 24th 2023. A total of 2,101 individuals between the ages of 16 and 68, who live in Germany and speak German, participated. The sample was quota-based according to age, gender, education level and federal state, in accordance with best4planning2021. The online questionnaire comprised 31 questions on the topic of reusable usage as well as questions on sociodemographics.

The content related questions were divided into seven thematic blocks, whereby this report includes an evaluation of blocks one to six. Questions regarding subjective time usage and perception (section 7) were analyzed as part of a master's thesis.

1. Usage of own reusable containers for home-cooked meals
2. Usage of own reusable containers for takeaway meals
3. Utilization and experience with reusable packaging systems in gastronomy for takeaway meals

4. Usage of delivery services
5. Personal attitude towards reusable packaging systems
6. Individual precycling behavior
7. Subjective time usage and perception

The questionnaire covered various types of questions and responses: single-choice and multiple-choice, Likert scales, rating scales, matrix questions with rotating items and open-ended questions.[3]

Some questions and items were adopted from published studies (ALLES IM FLUSS 2021; Greenwood 2021; Marken and Hörisch 2019; Statista 2018 and 2022a; Kleinhückelkotten et al. 2022; Klug und Niemand 2021; Schöneck 2009; Statistisches Bundesamt 2016; Kantar Public 2020) or further developed. To check the comprehensibility of the questions, a pretest was conducted beforehand with twelve individuals.

2.4 Description of the sample

The sample composition is as follows:

Age. On average, respondents at the time of the survey are 44 years old, with 21 percent being under 30 years old, 39 percent between 30 and 49 years old, and 40 percent between 50 and 68 years old (see Figure 1).

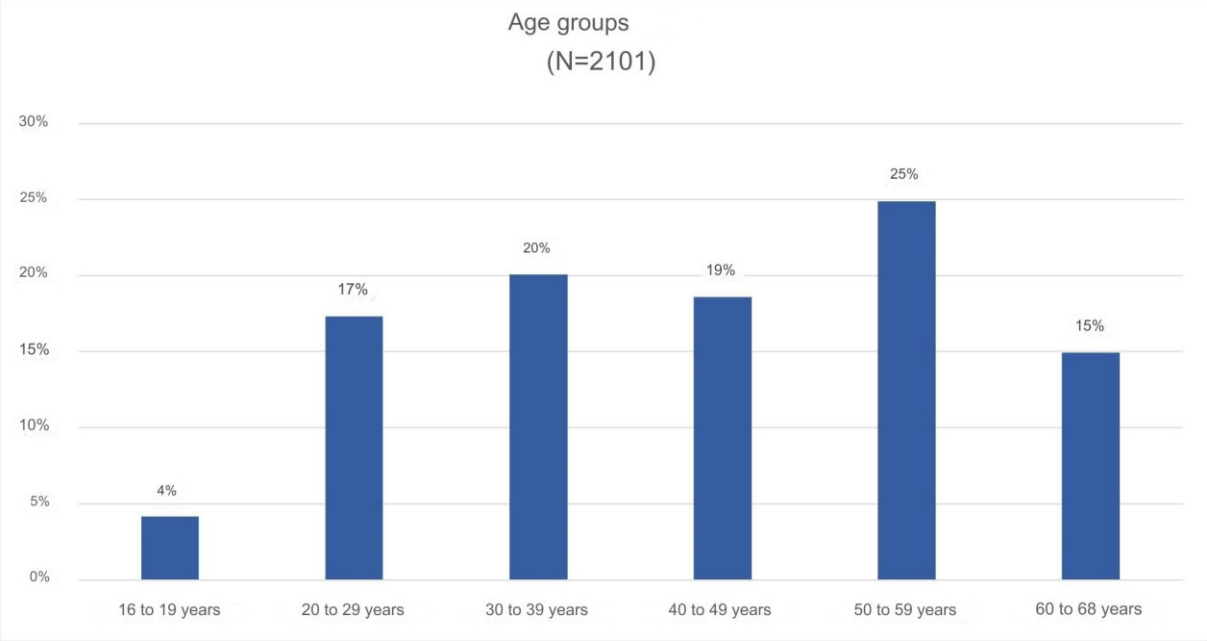

Figure 1: Age groups (Source: own illustration)

3 The graphics were translated on the basis of the German originals using an AI tool (Google Translate).

Gender. Women (50.6 %) and men (48.7 %) are represented in the sample in roughly equal proportions, with 0.5 percent identifying as non-binary, and 0.2 percent choosing not to disclose (see Figure 2).

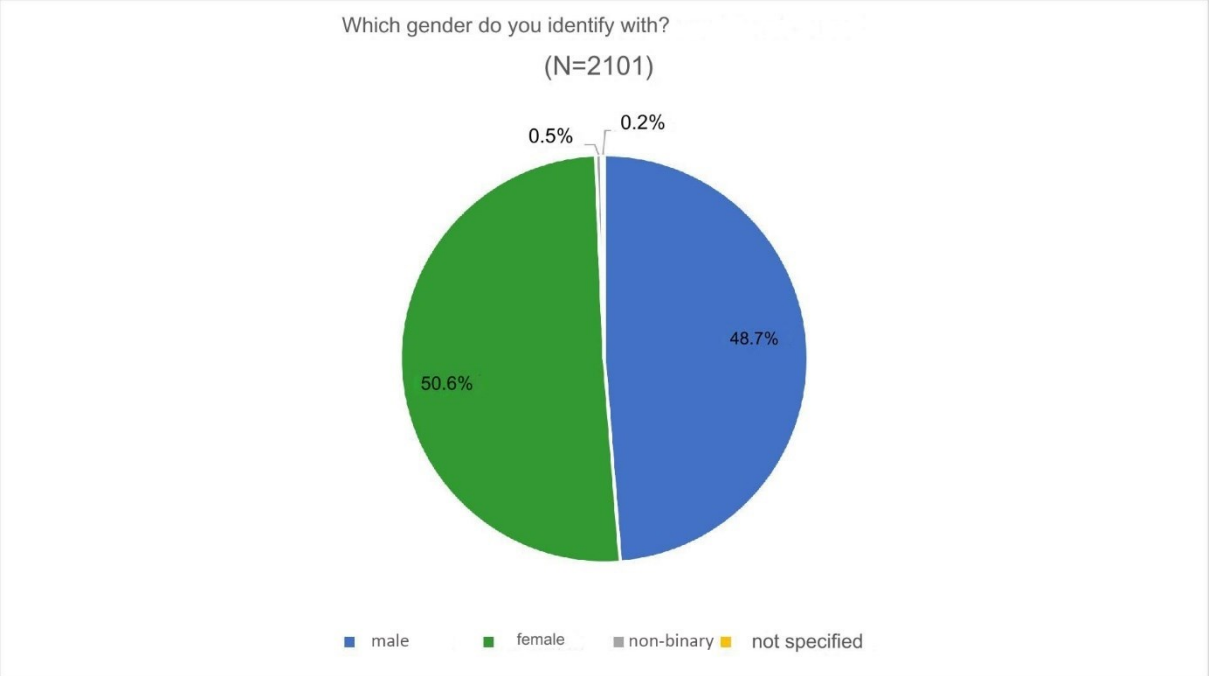

Figure 2: Gender (Source: own illustration)

Educational qualification. At the time of the survey, 3 percent of respondents are in school, 4 percent have completed school without a diploma, approximately 15 percent have completed secondary school, 35 percent have completed intermediate secondary school, 22 percent have completed high school, and 21 percent have a university degree (see Figure 3).

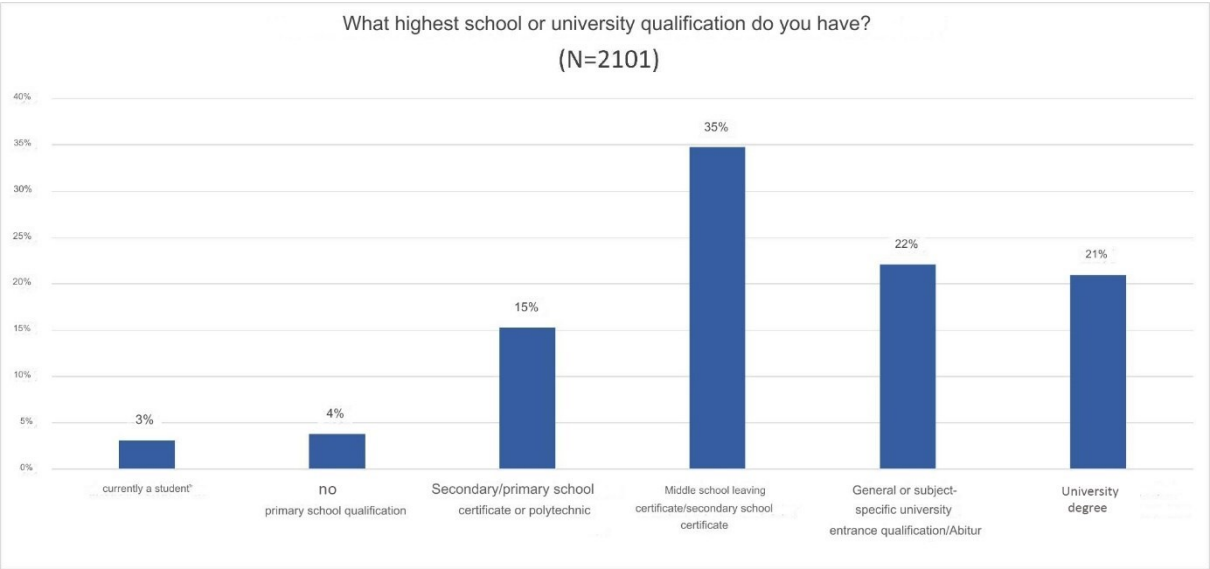

Figure 3: Educational qualification (Source: own illustration)

Federal states. 6 percent of respondents are from the new federal states, and 84 percent are from the old federal states (including Berlin).

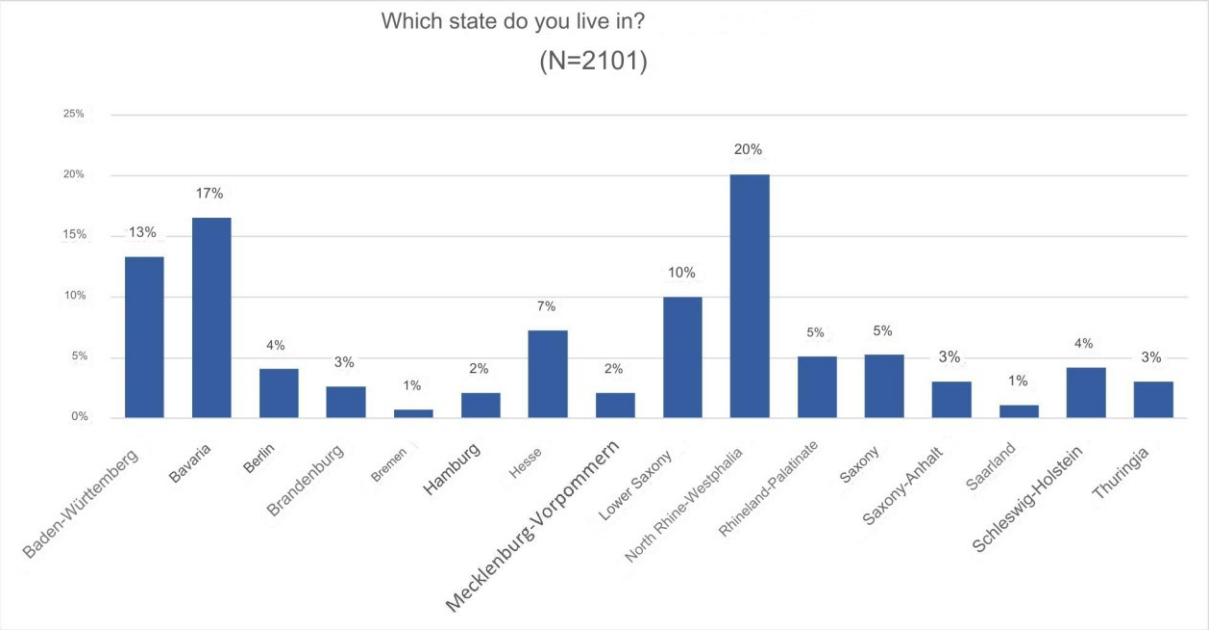

Figure 4: Federal states (Source: own illustration)

Residential area size. 22 percent of respondents live in a major city, 15 percent live on the edge or suburbs of a major city, 35 percent live in a medium-sized or small town, and 27 percent live in a rural village (see Figure 5).

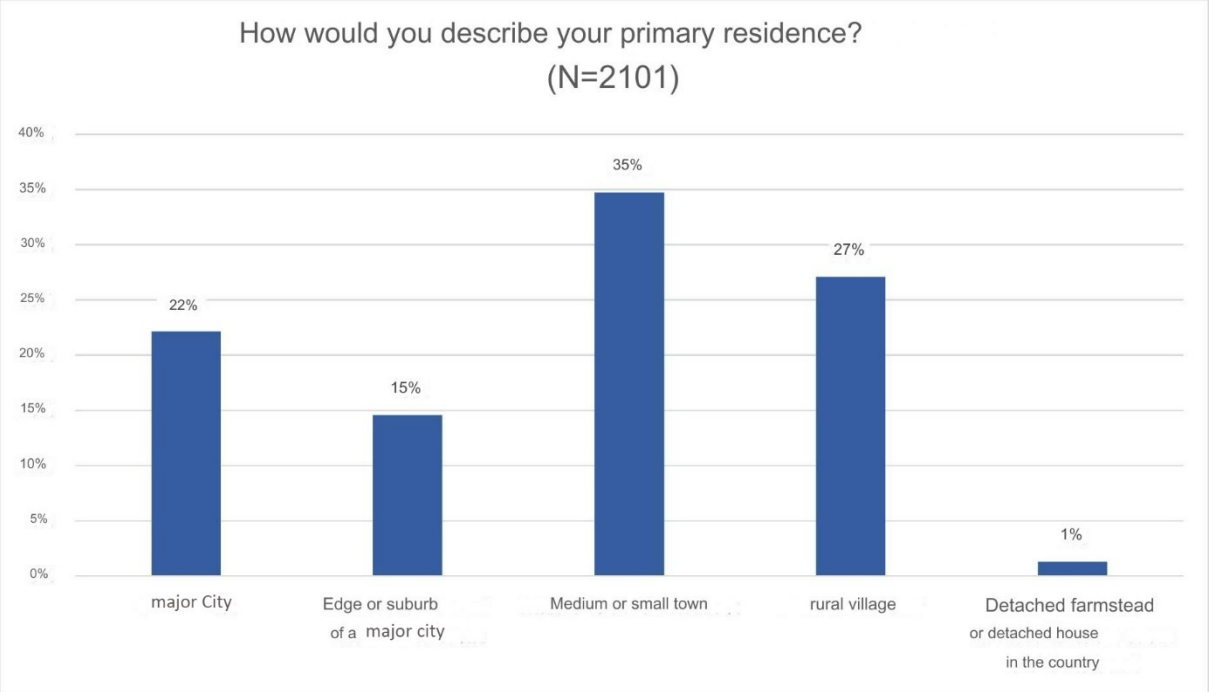

Figure 5: Settlement structure (Source: own illustration)

Working time. More than half (56 %) of the respondents work at least 30 hours per week, 21 percent work part-time, and 23 percent are currently not employed, including teenagers, individuals on parental leave, and retirees (see Figure 6).

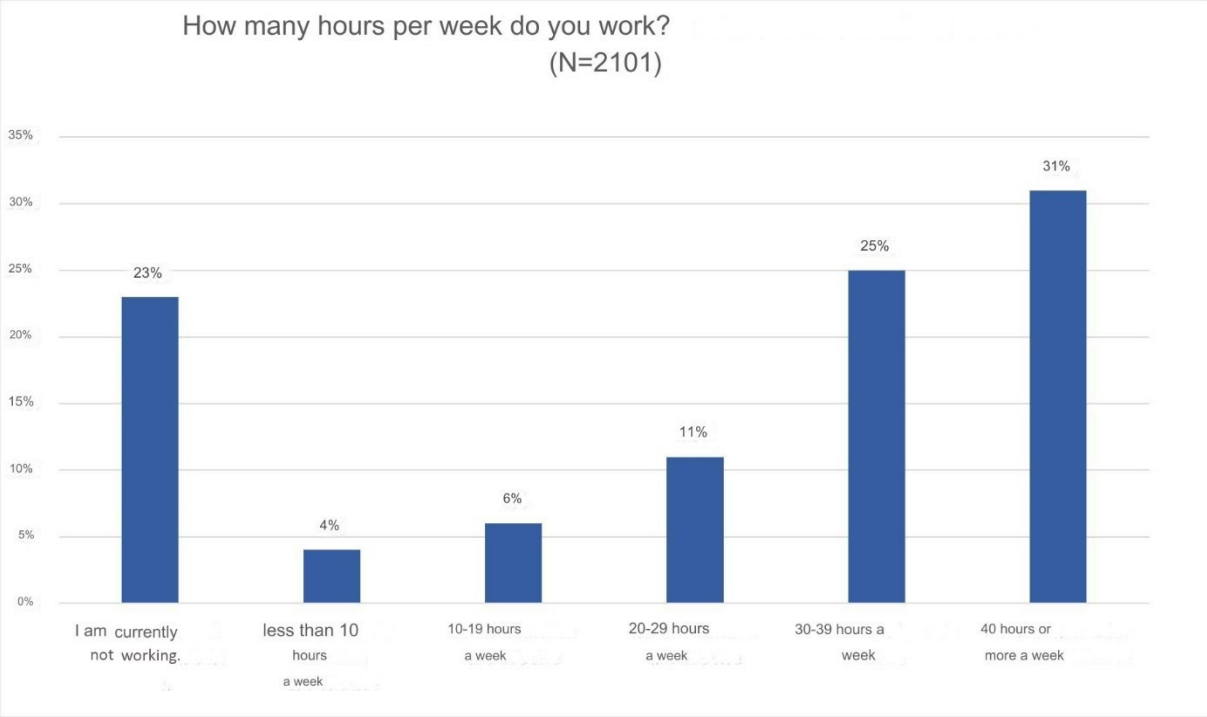

Figure 6: Working hours (Source: own illustration)

Income. The average monthly household net income ranges between 2,500 and 3,000 euros. Respondents have the following household net incomes: four percent have incomes below 500 euros, 18 percent have incomes between 500 and 1,499 euros, 35 percent have incomes between 1,500 and 2,999 euros, 20 percent have incomes between 3,000 and 3,999 euros, and 23 percent have household incomes of 4,000 euros or more (see Figure 7).

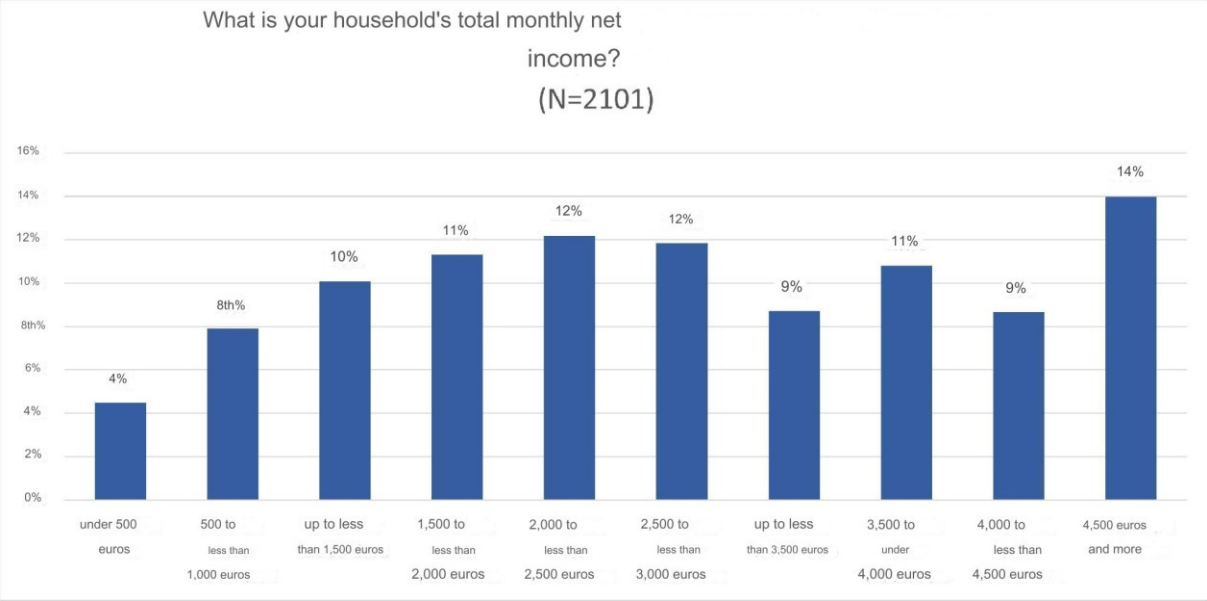

Figure 7: Income (Source: own illustration)

In 2021, the average net income of German households was 3,813 euros (Statista 2022b). Therefore, the average household income of the surveyed individuals is between 813 and 1,313 euros below the average of the general population.

Household size. One-quarter of the respondents live alone, 35 percent live in a two-person household, approximately one-third of the respondents live with three to four people in a household, and 5 percent of the respondents live with five or more people. Over half (57 %) of the respondents live without children under 18 years old, 23 percent of the respondents have one child in the household, 16 percent have two children, and four percent of the respondents have three or more children in the household (see Figure 8).

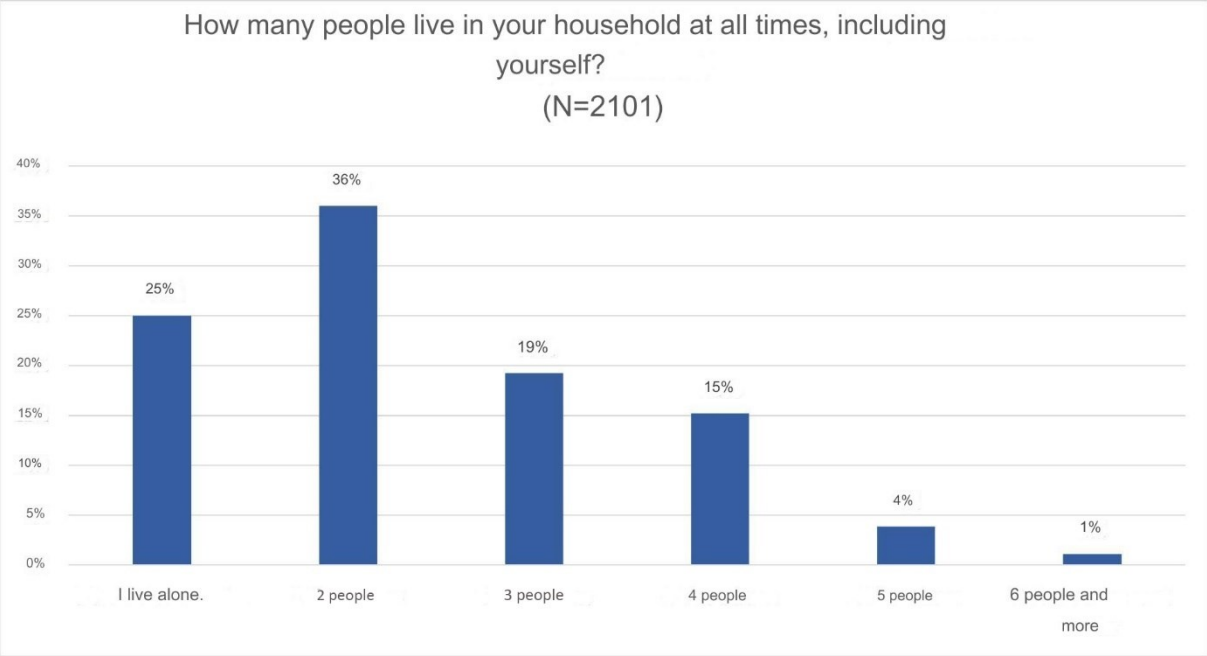

Figure 8: Household size (Source: own illustration)

Type of Building. Approximately half of the respondents (53 %) live in an apartment, while 44 percent live in a house. 37 percent of the respondents live in a residential building with 3-8 apartments, and 14 percent live in a residential building with more than eight apartments. Three percent indicated living in an agricultural residential building, and two percent live in a high-rise building (see Figure 9).

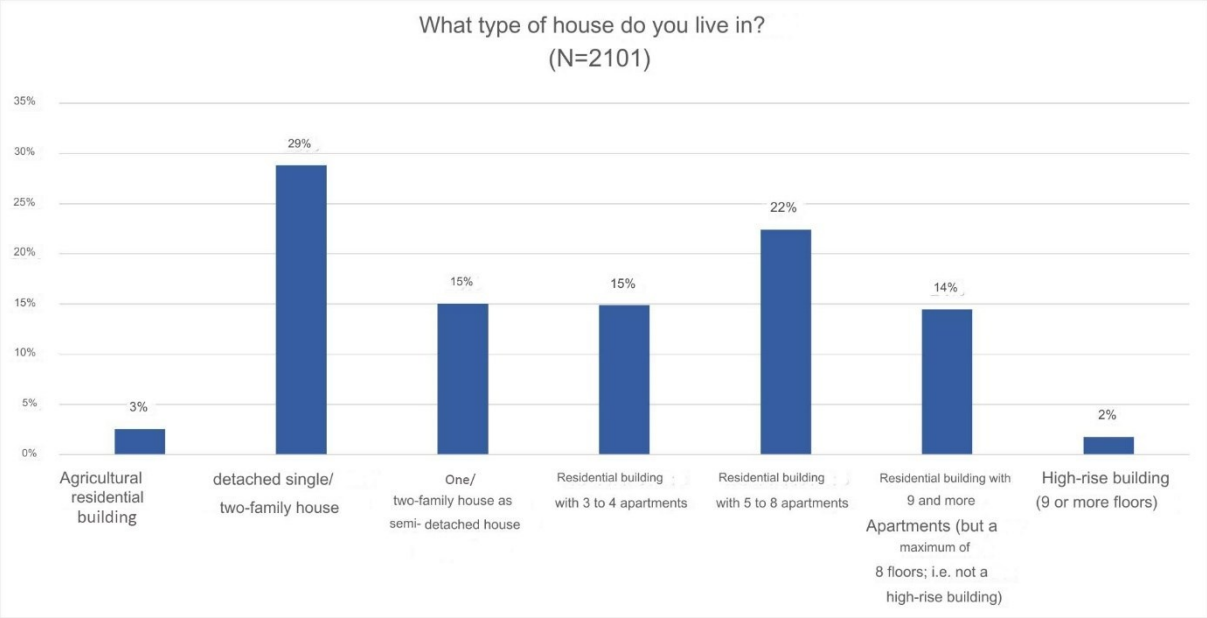

Figure 9: Type of building (Source: own illustration)

3. Results of the descriptive analysis

Based on the questionnaire items, this chapter presents the results of the representative survey, which examines various aspects of sustainable consumption behavior related to takeaway and self-prepared meals. The survey focuses on the usage of own reusable containers, the utilization of borrowed reusable containers, the usage of delivery services, as well as the attitudes and precycling behavior of the participants. The presented findings offer insights into the current situation and behaviors of the population regarding reusable containers.

3.1 Use of personal containers for self-prepared meals

This section describes how respondents use their own reusable containers for self-prepared meals. It examines the frequency and context of usage as well as the type of containers used.

3.1.1 The frequency of using personal containers

Out of the respondents (N=2,101), 77 percent indicated that they regularly, meaning at least once a week, use reusable containers for storing or transporting self-prepared meals. Among them, 26 percent use their own containers once to twice a week, 27 percent three to four

times a week, and 24 percent at least five times weekly. Another 10 percent of respondents use their own reusable containers at least once a month, while five percent stated doing so at least once a year. Only eight percent of respondents reported never using their own reusable containers (see Figure 10).

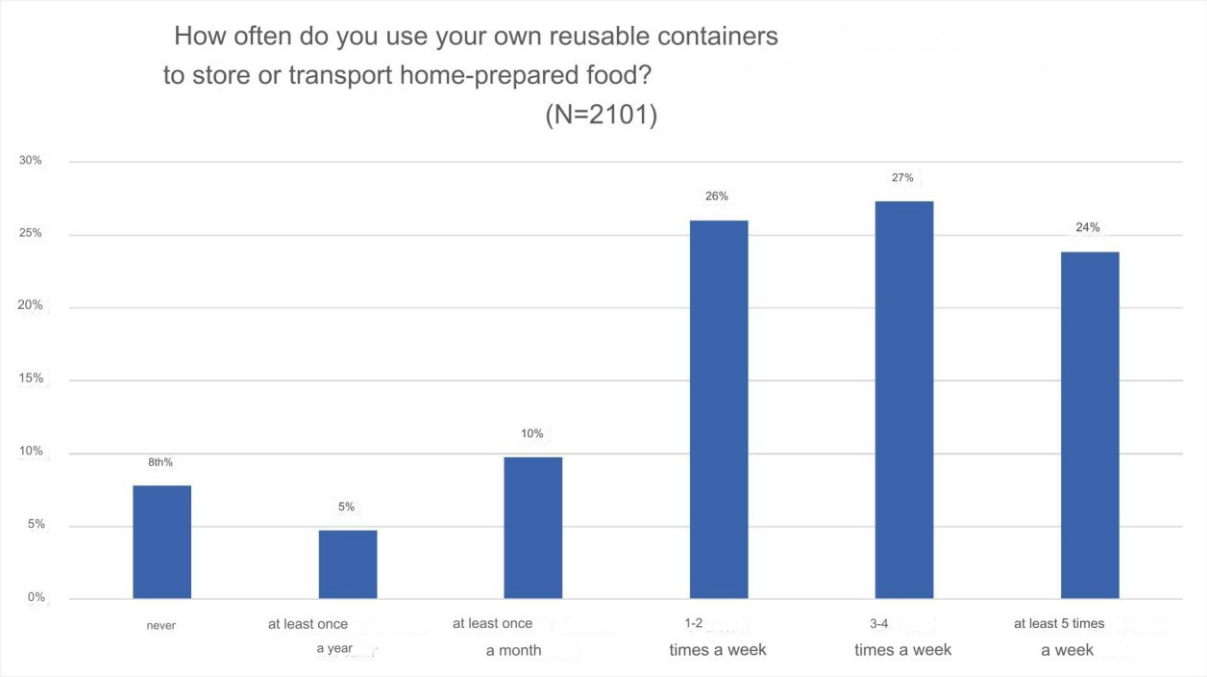

Figure 10: Frequency of using own containers for self-prepared meals (Source: own illustration)

These results indicate that the use of own containers for self-prepared meals is widespread and apparently integrated into everyday routines.

3.1.2 Use context of personal containers

The survey results indicate that own reusable containers are primarily used in the context of work. Among the respondents (N=1,937), 49 percent reported using reusable containers "always" or "mostly" during work hours or while commuting to/from work; another 17 percent use them "frequently" in this context, while 19 percent use them "rarely" or "never". While traveling, reusable containers are used "frequently" or more by over half (59 %) of the respondents, while about a third (34 %) indicate doing this "rarely" or "never". Approximately two-thirds (65 %) of the respondents use reusable containers frequently or more during trips (e.g. on weekends). In contrast, 29 percent of respondents stated that they "rarely" or "never" do so (see Figure 11).

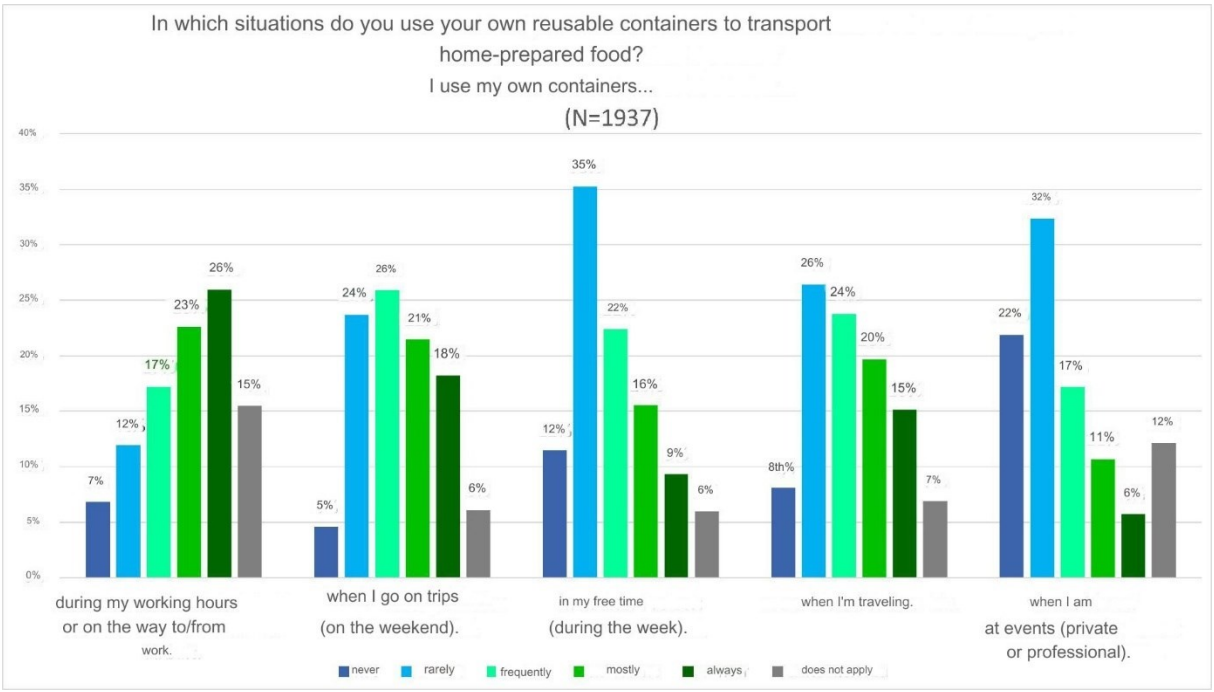

Figure 11: Context of using own containers for self-prepared meals (Source: own illustration)

These findings resemble the observations of another real-world laboratory study (Süßbauer et al., 2022): participants in the HomeLabs often used reusable food utensils when they were on the go, such as containers for drinks and food. This suggests that many people naturally incorporate reusable containers into their daily lives, particularly for self-prepared meals.

However, the results of the current survey also indicate that the usage of reusable containers in leisure activities and events differs from their usage in the workplace, while traveling, or during trips: about half of the respondents reported using reusable containers "rarely" or "never" during their leisure time (47 %) and at events (54 %). One reason for this could be that meals during leisure activities and events are often consumed spontaneously, for example, when purchasing snacks, and own reusable containers may not always be available (see Figure 11).

Note: In this question about usage context were three response options towards positive tendencies (frequent, mostly, always), but only two towards negative tendencies (rarely, never). This could have led to a bias in response behavior towards positive tendencies.

3.1.3 Inventory of personal containers

Within our survey, participants were asked about the number of reusable containers they own. Below, we describe the inventory of the respondents (N=1,937).

The total number of recorded containers amounts to 57,646 pieces, resulting in an average of 29.76 containers per participant. This average was calculated by dividing the total number of containers by the number of participants (N=1,937). Since the average value is very susceptible to outliers and thus distortions of the result, the median was additionally calculated. This median is 23, implying that half of the respondents own fewer and the other half own more containers. Thus, influences of extreme outliers can be minimized, focusing on the central value.

Below, the results for each container type are presented.

Containers made of hard plastic (e.g. Tupperware)

The majority of respondents (62 %) own more than five but fewer than 100 hard plastic containers (e.g., Tupperware). A significant portion of this group (58 %) has between six and 30 hard plastic containers, while four percent reported owning more than 30 but fewer than 100 such containers. About one-third (35 %) own between one and five hard plastic containers. Only three percent of respondents indicated that they do not own any containers of this type. On average, each respondent owns twelve (11.59) hard plastic containers (see Figure 12).

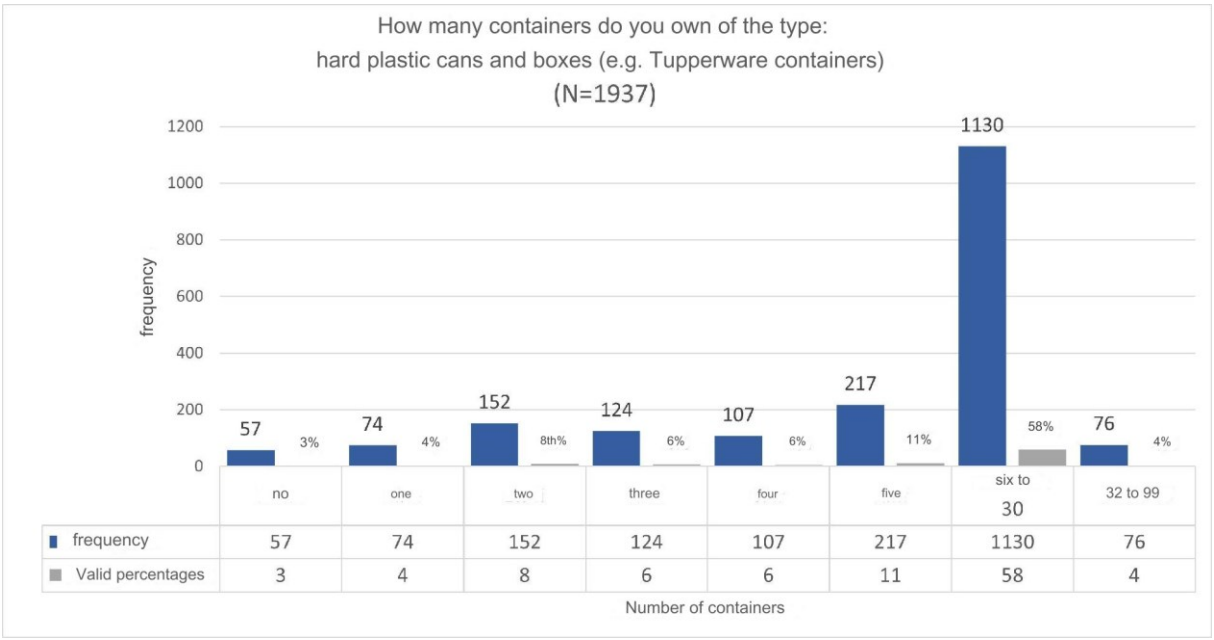

Figure 12: Inventory of own containers made of hard plastic (Source: own illustration)

Stainless steel containers

While nearly two-thirds (63 %) of respondents do not own stainless steel containers, approximately a quarter (26 %) stated that they own one to two stainless steel containers. Only eleven percent of respondents have three or more containers of this type. On average, each respondent owns less than one (0.91) stainless steel container (see Figure 13).

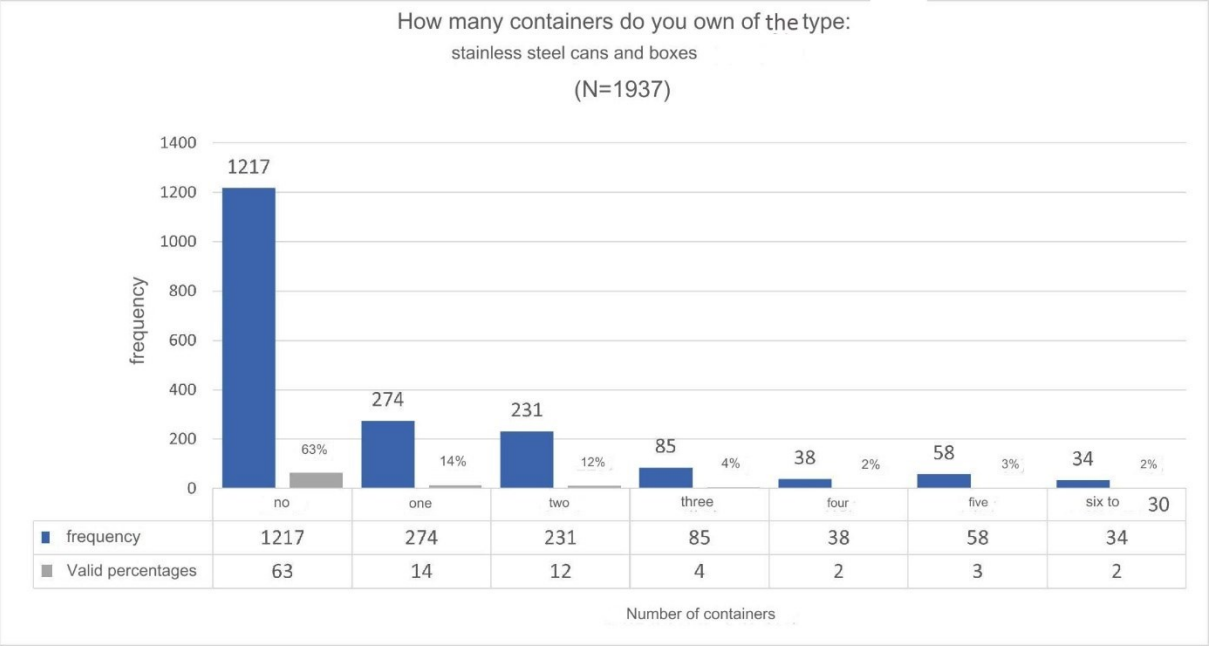

Figure 13: Inventory of own stainless steel containers (Source: own illustration)

Glass container with lid (partly plastic)

While about a third (32 %) of respondents do not own any glass containers, 46 percent have one to five containers of this type. 15 percent of respondents own six to 20 glass containers. Only one percent of respondents own many more, specifically between 24 and 53 glass containers. On average, each respondent owns three (3.06) glass containers with lids (some made of plastic) (see Figure 14).

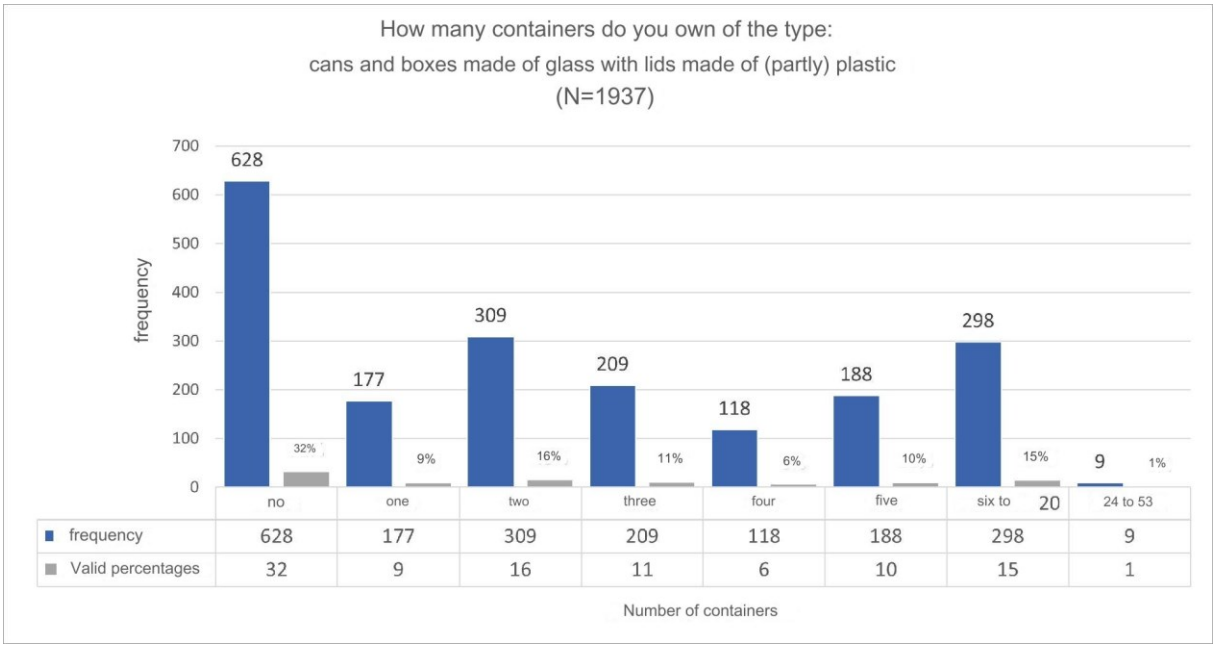

Figure 14: Inventory of own glass containers with lids (Source: own illustration)

Containers with several compartments (e.g. lunch boxes)

More than half (55 %) of the respondents reported not owning any container or box with multiple compartments. However, 35 percent have one to three boxes of this type. Only eight percent of respondents have between four and five boxes; only two percent own six to 25 containers with multiple compartments. On average, each respondent owns one (1.23) container or box with multiple compartments (e.g., lunch boxes) (see Figure 15).

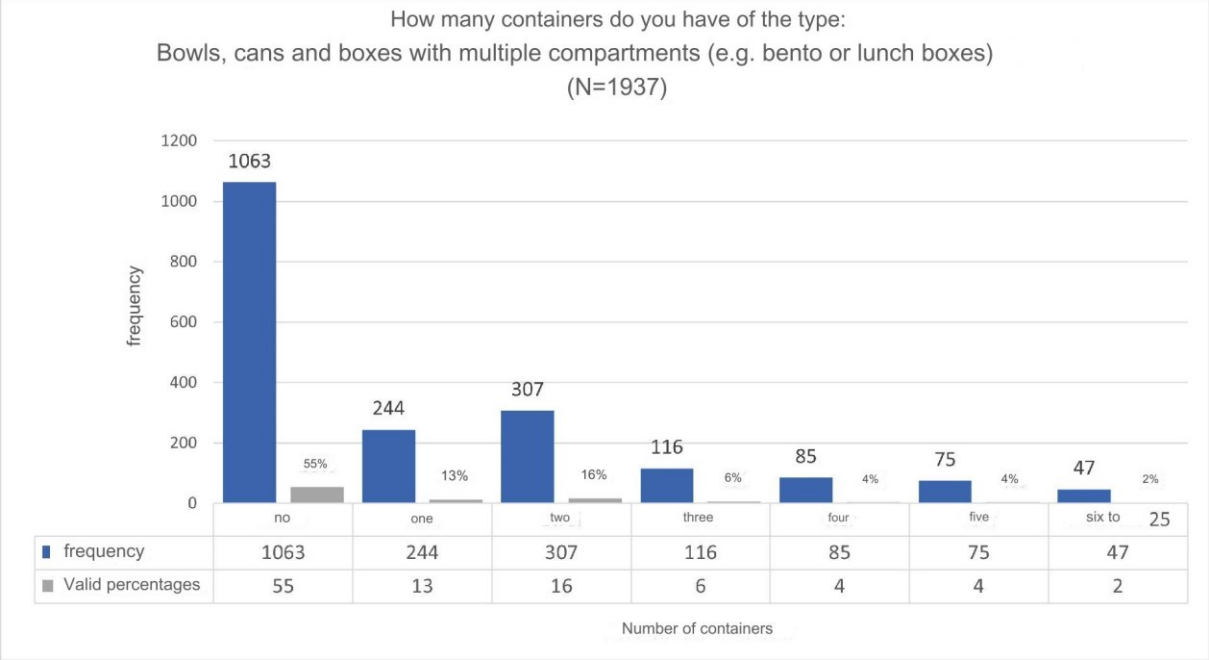

Figure 15: Inventory of own containers with several compartments (Source: own illustration)

Disposable packaging made of hard plastic (e.g. yogurt buckets)

While the majority (62 %) of respondents stated that they do not have any single-use plastic containers, about a third (33 %) have between one and five containers of this type. Five percent reported having between six and 50 of these containers. On average, each respondent owns one (1.39) single-use plastic container (see Figure 16).

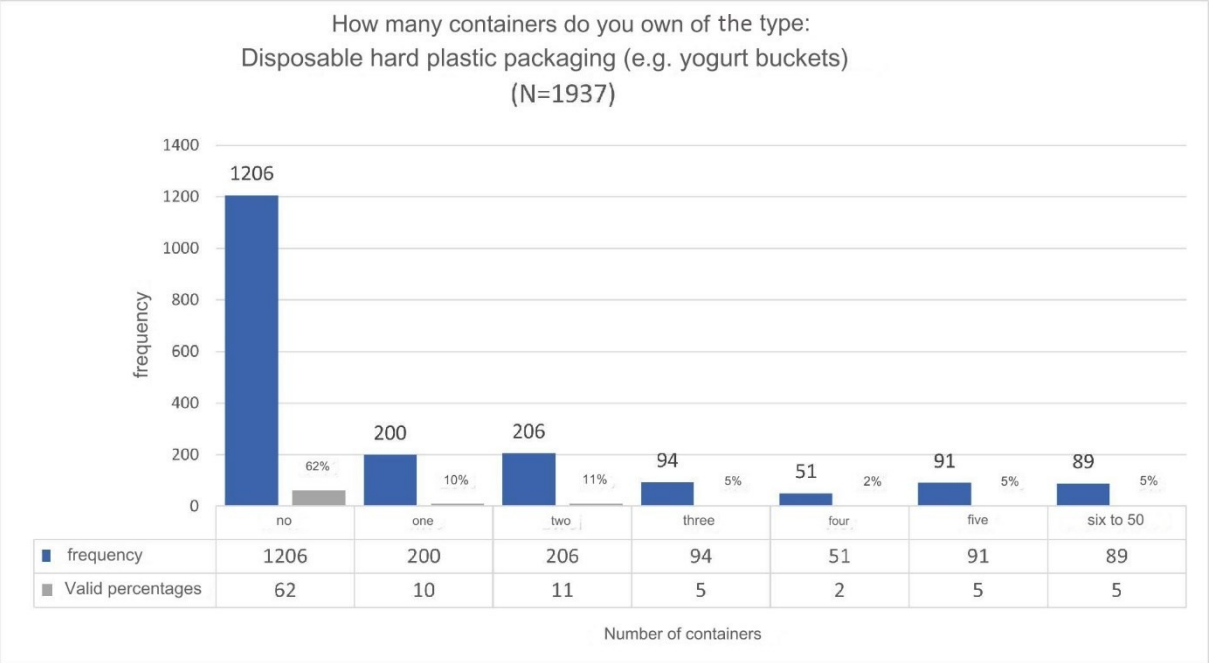

Figure 16: Inventory of own disposable packaging made of hard plastic (Source: own illustration)

Disposable glass packaging (e.g. jam jars)

Approximately one-third (34 %) of respondents stated that they own between six and 99 single-use glass containers. 36 percent of respondents have one to five single-use glass containers. In contrast, 30 percent reported not owning any single-use glass containers. On average, each respondent owns eight (8.11) single-use glass containers, such as jam jars (see Figure 17).

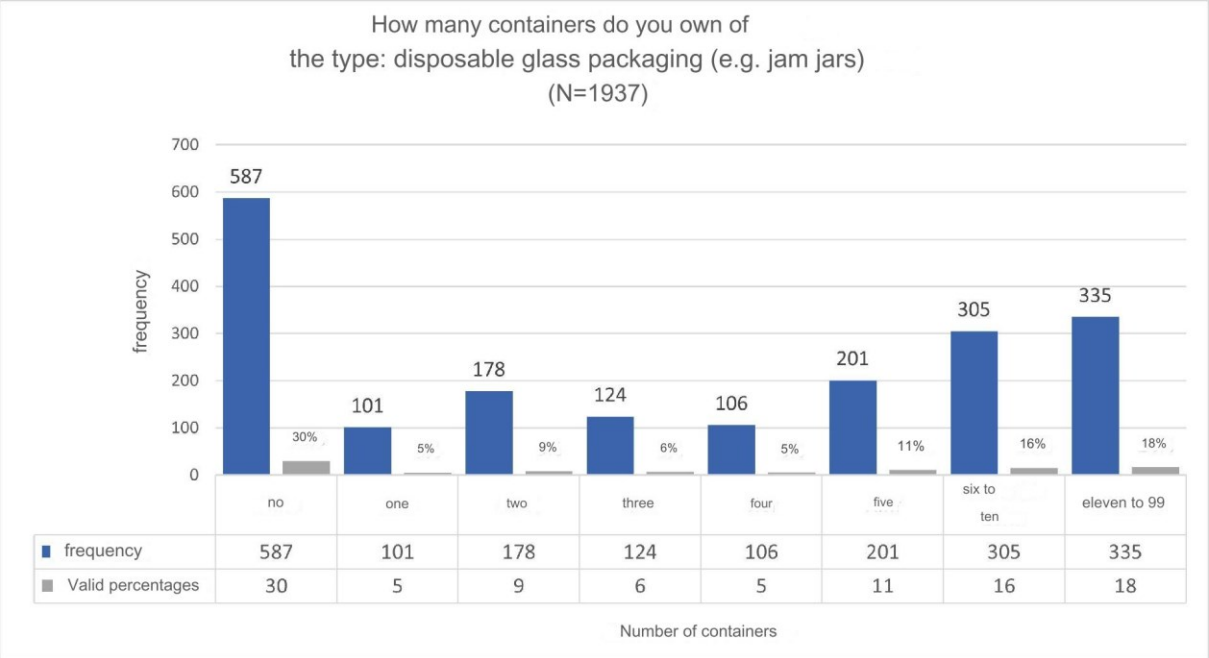

Figure 17: Inventory of own disposable packaging made of hard plastic (Source: own illustration)

3.1.4 Storage locations of personal containers

The majority (82 %) of respondents (N=1,986) store their own containers in the kitchen cupboard or shelf, while one-third (35 %) store them in a utility room. Additionally, 14 percent of respondents mentioned alternative storage locations for their containers, including shopping bags, the car, the basement, a bicycle trailer, or the garage (see Figure 18).

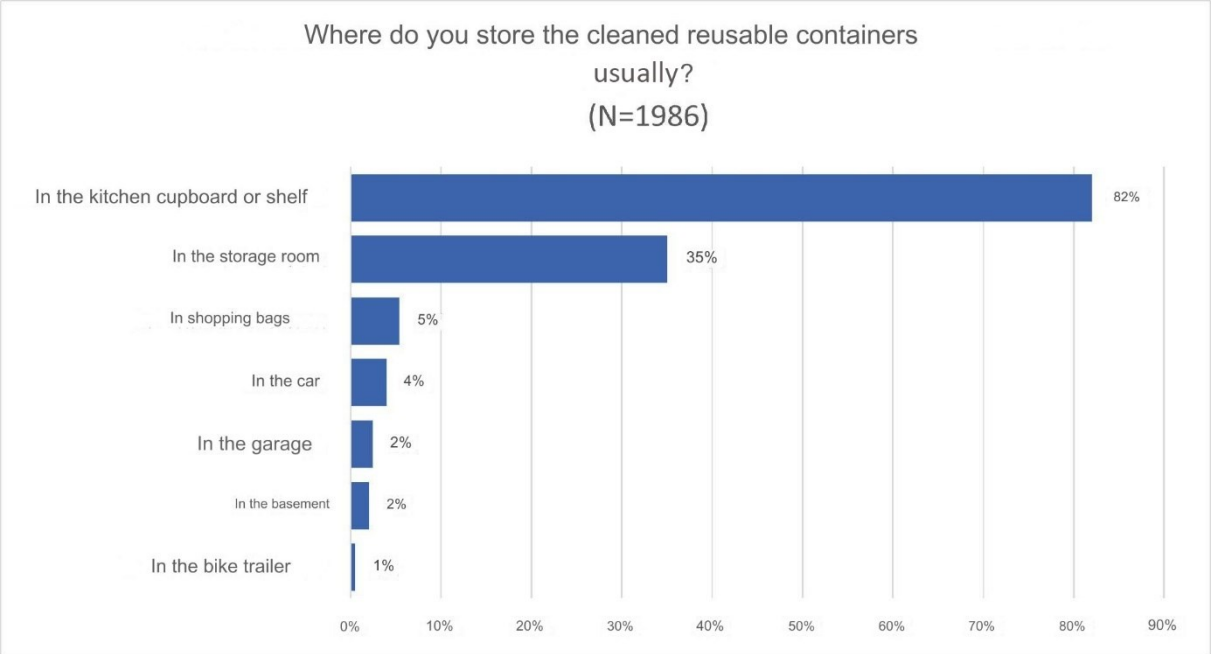

Figure 18: Storage location of the own reusable containers (Source: own illustration)

3.1.5 Characteristics of own containers

The results of the survey also indicate that certain characteristics of reusable containers are more important to the respondents (N=2,101) than others. Topping the list is leakage-safety, which is considered somewhat important (19 %) or very important (75 %) by 94 percent of the participants. Also of great importance are durability (93 %) and easy cleaning (93 %) of the containers (32 % somewhat important, 61 % very important). Additionally, 92 percent of the respondents value an appropriate filling volume (41 % somewhat important, 51 % very important). On the other hand, other features are less essential: For example, a child-friendly design is not important to 53 percent of the respondents. Similarly, respondents find multiple compartments in a container (29 % "not important", 41 % "somewhat unimportant") and the exterior appearance (14 % "not important", 35 % "somewhat unimportant") rather insignificant (see Figure 19).

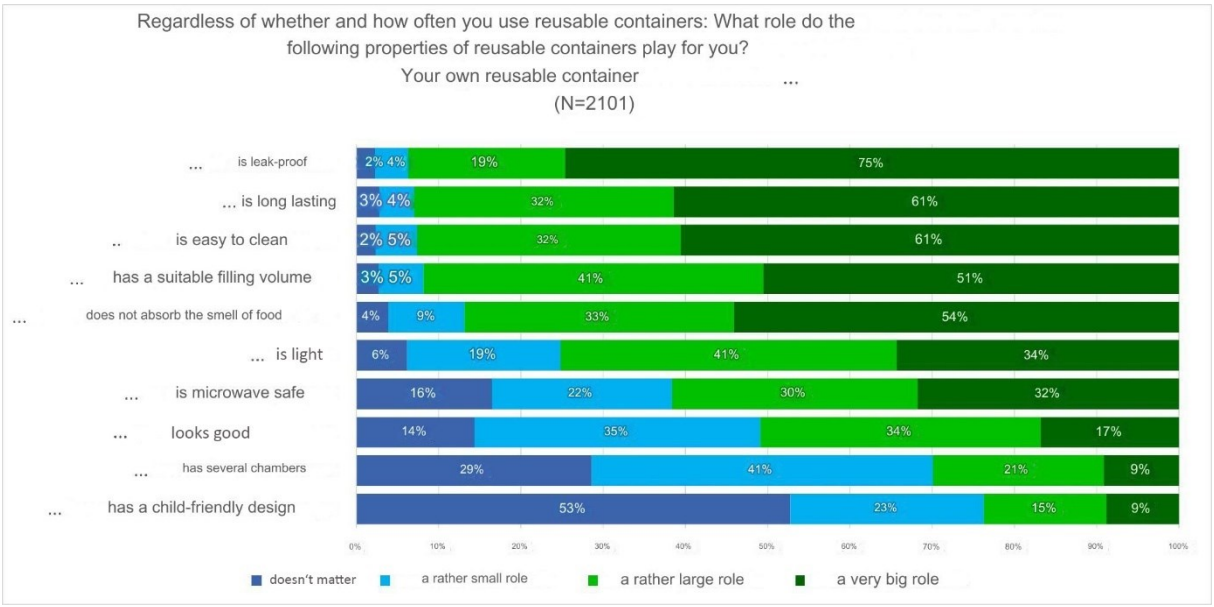

Figure 19: Properties of own reusable containers (Source: own illustration)

In summary, respondents place great importance on the functionality and practical usability of reusable containers; they should cause as little effort as possible. However, aesthetic aspects such as design or external appearance are less important (see Figure 19).

3.2 Use of personal containers for takeaway food

This section addresses the usage of customer-owned containers for taking away food prepared by others, in the following referred to as "takeaway food". We were initially interested in how often takeaway food is consumed and, if it is consumed, where this happens. Subsequently, we inquired about the use of own containers for picking up takeaway food and the barriers related to this practice.

3.2.1 The frequency of takeaway consumption

Regarding the frequency of takeaway consumption among respondents, there are significant differences. Approximately one-third of the respondents (35 %) reported consuming takeaway food several times a week. Another third (33 %) buys a meal to take away at least once a month. A smaller portion (12 %) stated that they "never" purchase takeaway food. For an even smaller portion (6 %), consuming takeaway is a daily habit (see Figure 20).

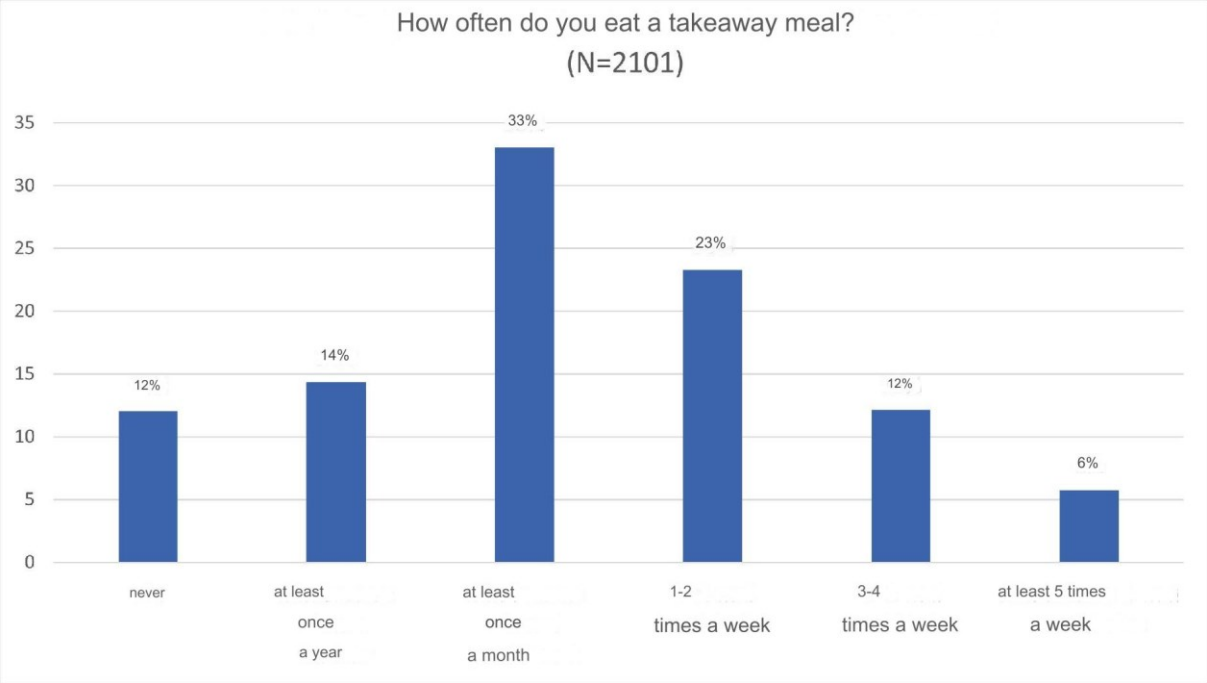

Figure 20: Frequency of consumption of takeaway meals (Source: own illustration)

The consumption of takeaway food in Germany is indeed widespread and occasionally practiced, but it does not constitute a daily consumption habit.

3.2.2 Places of takeaway food pickup

Regarding the places of takeaway food pickup, data from the surveyed individuals (N=1,680) show that for regular pickup of takeaway food (one to five times per week), supermarkets (23 %) and restaurants/food stands (18 %) are similarly popular. For occasional and rare takeaway pickups (monthly/yearly), restaurants, fast-food restaurants, and food stands (58 %) are used more frequently than supermarkets (41 %). Interestingly, 36 percent of respondents do not use supermarkets for purchasing takeaway food at all, while 24 percent never use restaurants and food stands (see Figure 21).

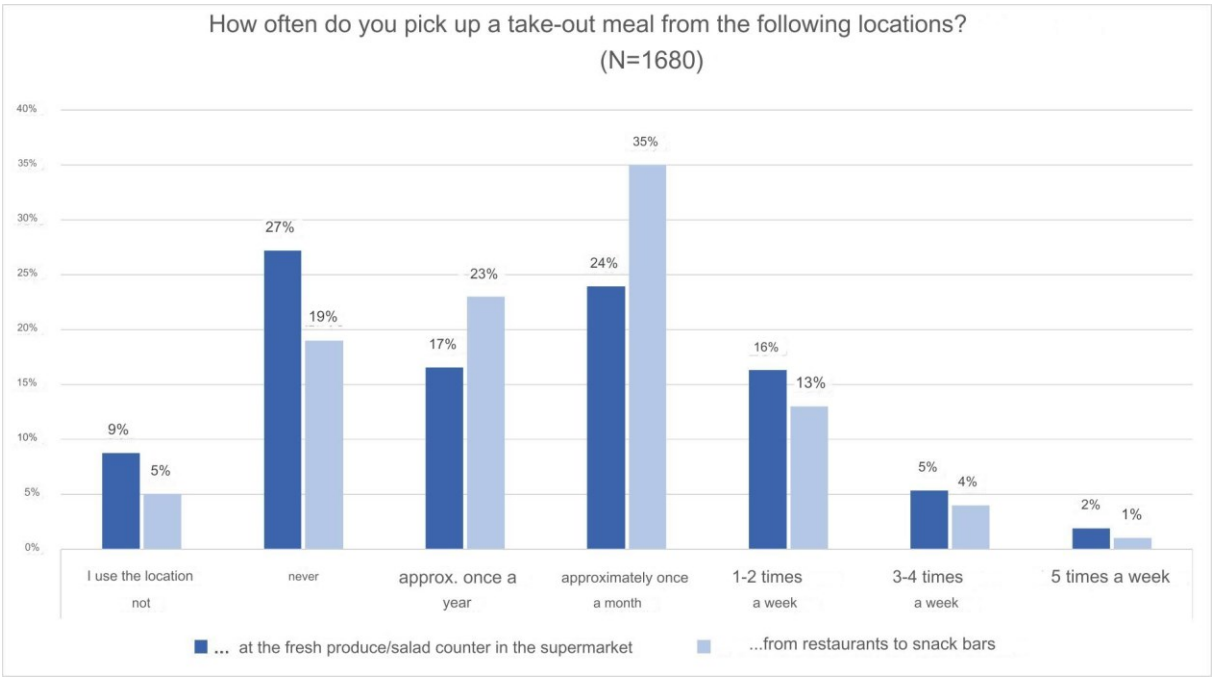

Figure 21: Location-based consumption of takeaway meals (Source: own illustration)

This result could indicate the different contexts of usage for a restaurant visit compared to shopping in a supermarket. Differences could also be attributed to price, the associated social event, or the status significance of various pickup locations.

3.2.3 The frequency of using personal containers for takeaway food

Almost two-thirds (63 %) of the surveyed individuals (N=1,860) "never" (41 %) or "rarely" (22 %) bring their own container to pick up takeaway food from dining businesses. About one-third (32 %) of participants (15 % "mostly," 9 % "frequently," 8 % "every time") regularly bring their own containers. A small portion (5 %) do not pick up the food themselves but have the meals delivered (see Figure 22).

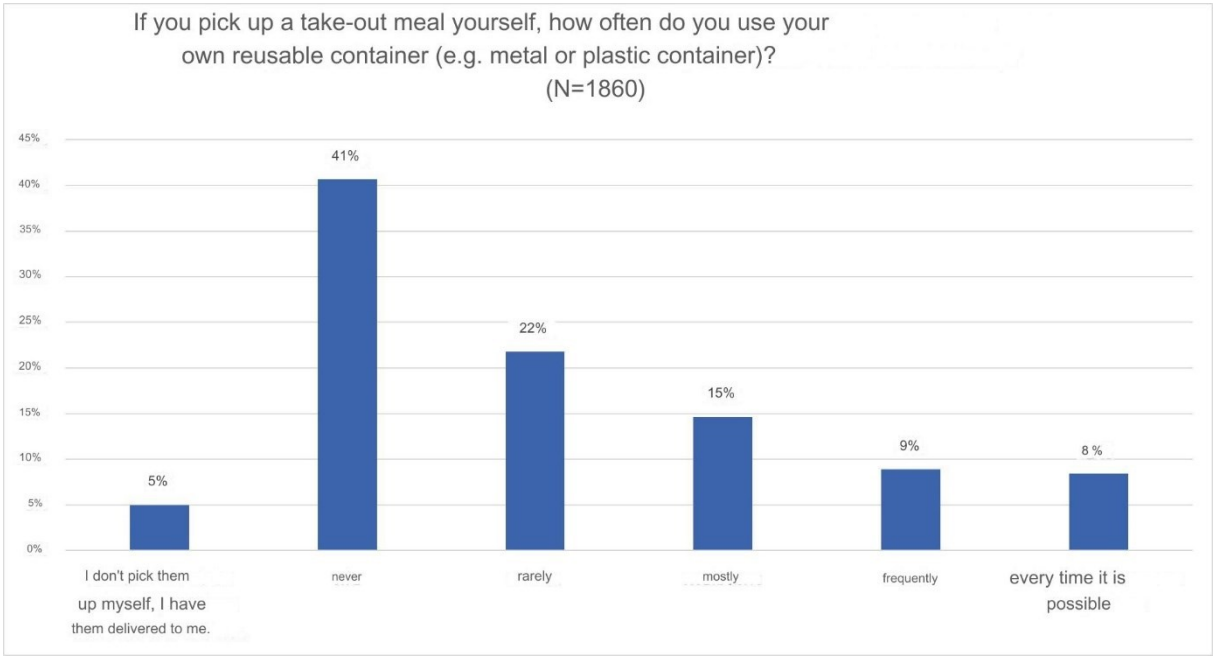

Figure 22: Frequency of using own containers for collecting takeaway meals (Source: own illustration)

The data show that the majority of respondents generally do not bring their own containers to pick up takeaway food. The reasons for this will be described in the next section.

3.2.4 Barriers of using personal containers for takeaway food

Barriers to the usage of own containers when purchasing takeaway food primarily revolve around lack of knowledge and uncertainty. Approximately 38 percent of respondents (N=1,703) are unsure about which stores they can use their containers in. 27 percent do not know if the containers are the right size. Additionally, the additional effort for preparation and planning (26 %), perceived additional time required (12 %), as well as existing habits and routines (16 %) lead respondents to not bring their own containers when purchasing takeaway food. If favored gastronomy businesses do not allow the usage of own containers (24 %) or if explicit permission is required (19 %), these are also barriers to utilization (see Figure 23).

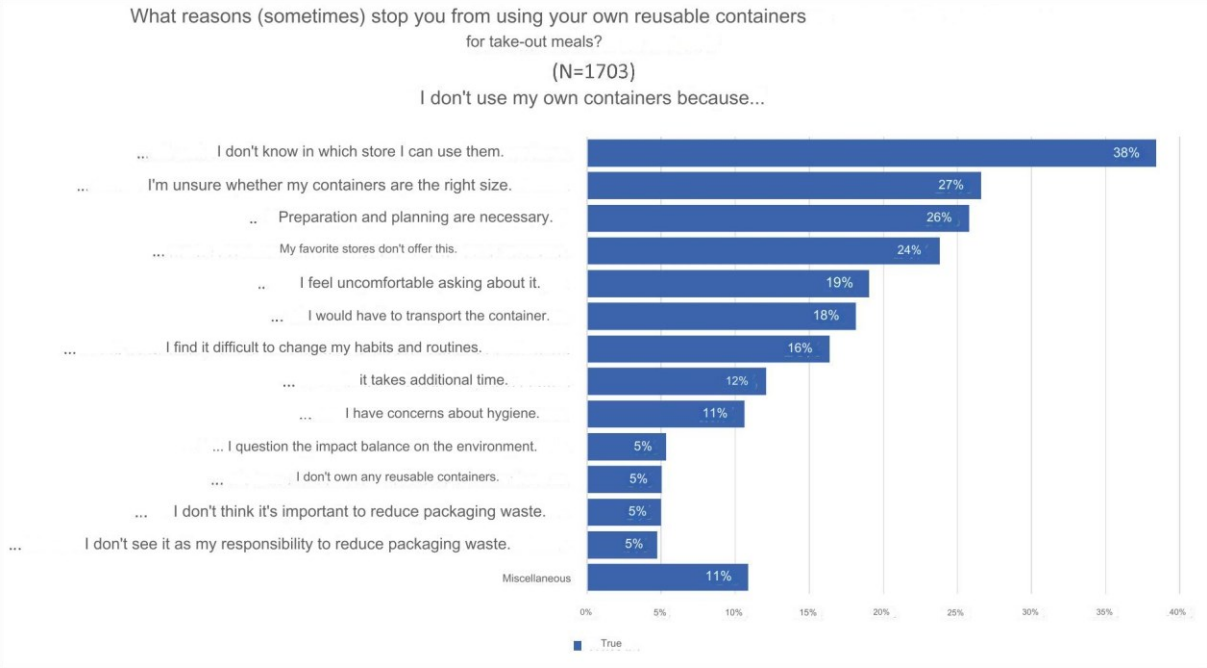

Figure 23: Barriers of using own reusable containers for takeaway meals (Source: own illustration)

3.3 Use of borrowed reusable containers for takeaway food

This section sheds light on the utilization of reusable containers from pooling systems such as Vytal, Rebowl or Relevo. Depending on the reusable system, a deposit is charged upon purchasing the meal (e.g. amounting to five euros), or no deposit is charged, but the container must be purchased in case of late return (e.g. for ten euros).

3.3.1 The frequency of using reusable containers

More than two-thirds (71 %) of the respondents (N=1,860) stated that they "never" (54 %) or "rarely" (17 %) use reusable containers for takeaway food. Less than one-third (29 %) of the respondents "sometimes" (20 %) or "always" (9 %) borrow a reusable container from the food service businesses to take meals away (see Figure 24).

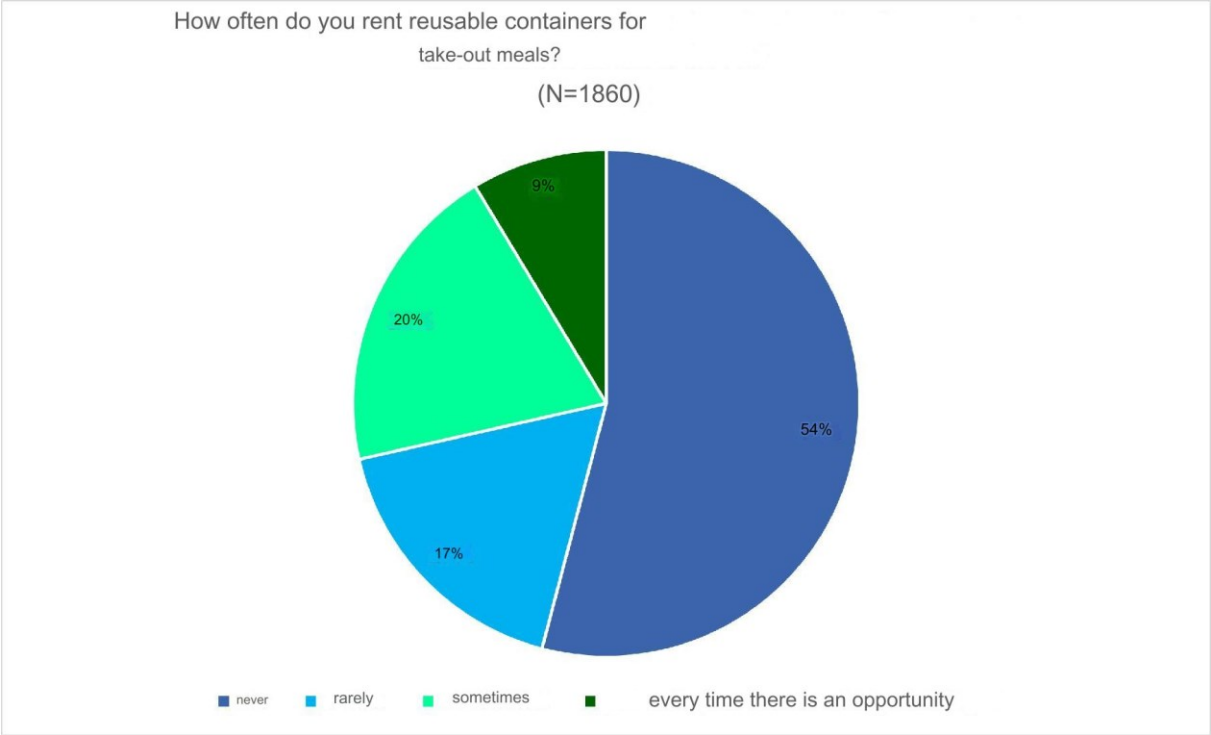

Figure 24: Rental frequency of reusable containers for the consumption of takeaway meals (Source: own illustration)

The results show that reusable containers for borrowing are used even less frequently than own reusable containers for takeaway consumption (see section 3.2.3). The following questions were only posed to individuals who had borrowed a reusable container for takeaway food at least once.

3.3.2 Context of use reusable containers

The surveyed individuals (N=848) use reusable containers for takeaway meals in various contexts. During working hours and on the way to work, a total of 66 percent use these containers "frequently," "mostly," or "always." Similar high usage rates are reported for trips (65 %), travel (59 %), and leisure (57 %). Reusable containers are slightly less frequently used at events: 46 percent of respondents indicated that they use these containers "frequently," "mostly," or "always," while 48 percent stated that they "never" or "rarely" use them in this context. The results indicate that borrowed reusable containers are particularly prevalent in the contexts of work, leisure, and travel (see Figure 25).

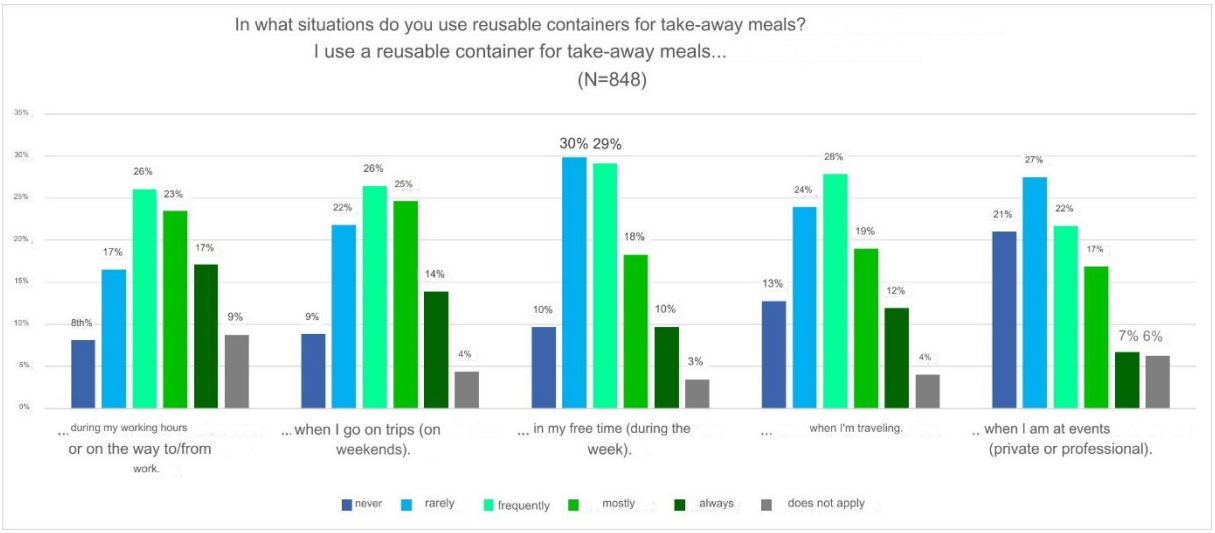

Figure 25: Context of using reusable containers (Source: own illustration)

Note: For this question about usage context, there were three response options towards positive expressions (frequent, mostly, always), but only two towards negative expressions (rarely, never). This could have led to a bias in response behavior towards positive expressions.

3.3.3 The transportation of reusable containers

Reusable containers are transported in various ways by the surveyed individuals (N=848): 70 percent stated that they use their own car for this purpose, but they are also transported by walking (37 %), cycling (35 %), or using public transportation (32 %). An additional two percent of respondents exclusively use the reusable containers at home and therefore do not transport the containers at all (see Figure 26).

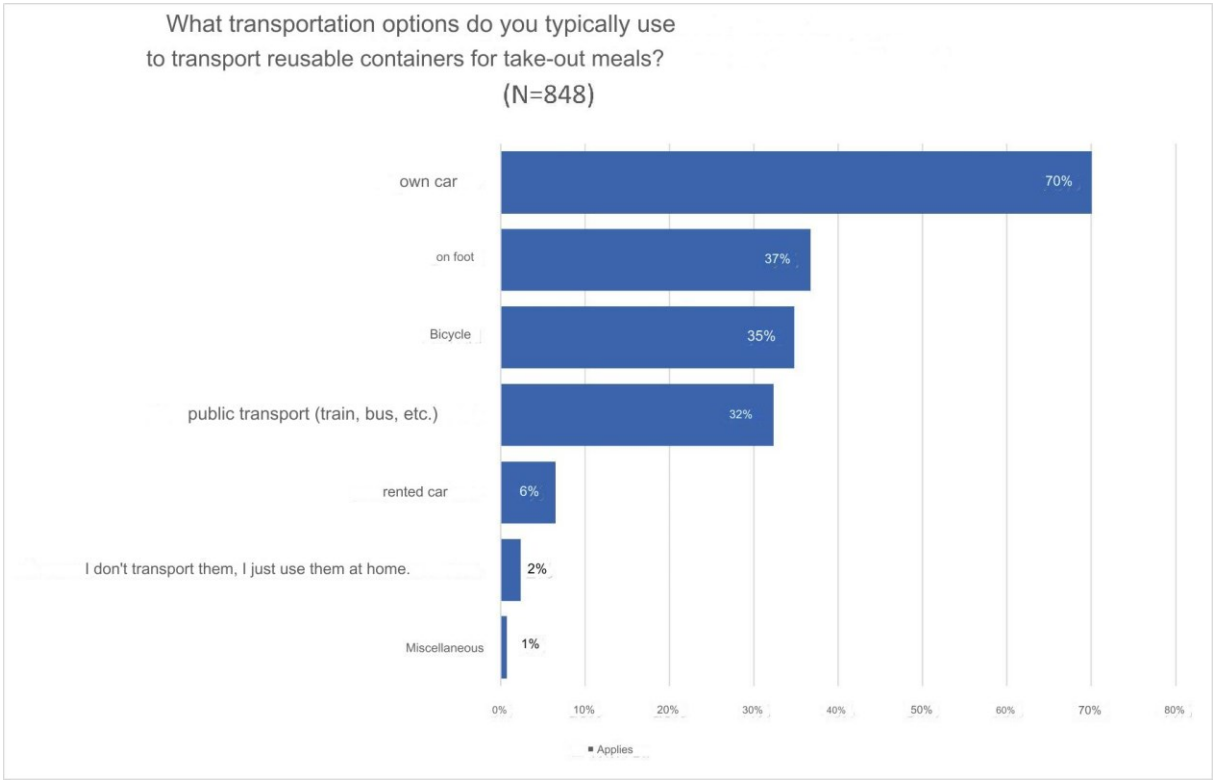

Figure 26: Transport of reusable containers (Source: own illustration)

Note: Since the reusable containers must be transported at least once, namely after purchasing the takeaway meal, the response option "I do not transport them, but only use them at home" for this question is inaccurate. This would only apply to those who exclusively have takeaway meals delivered in reusable containers.

3.3.4 The duration of using reusable containers

The results show that the majority of respondents (N=848) return the reusable containers within two weeks (82 %). This corresponds to the specified deadlines and allows for the smooth return of the containers to the reusable cycle. Upon closer examination, it becomes clear that nine percent of respondents return the containers on the same day, while approximately one-third (35 %) do so within two to five days. Another 38 percent of respondents keep the containers for one to two weeks. Only a minority of eleven percent keep the containers for longer than two weeks, and seven percent do not return the containers at all (see Figure 27).

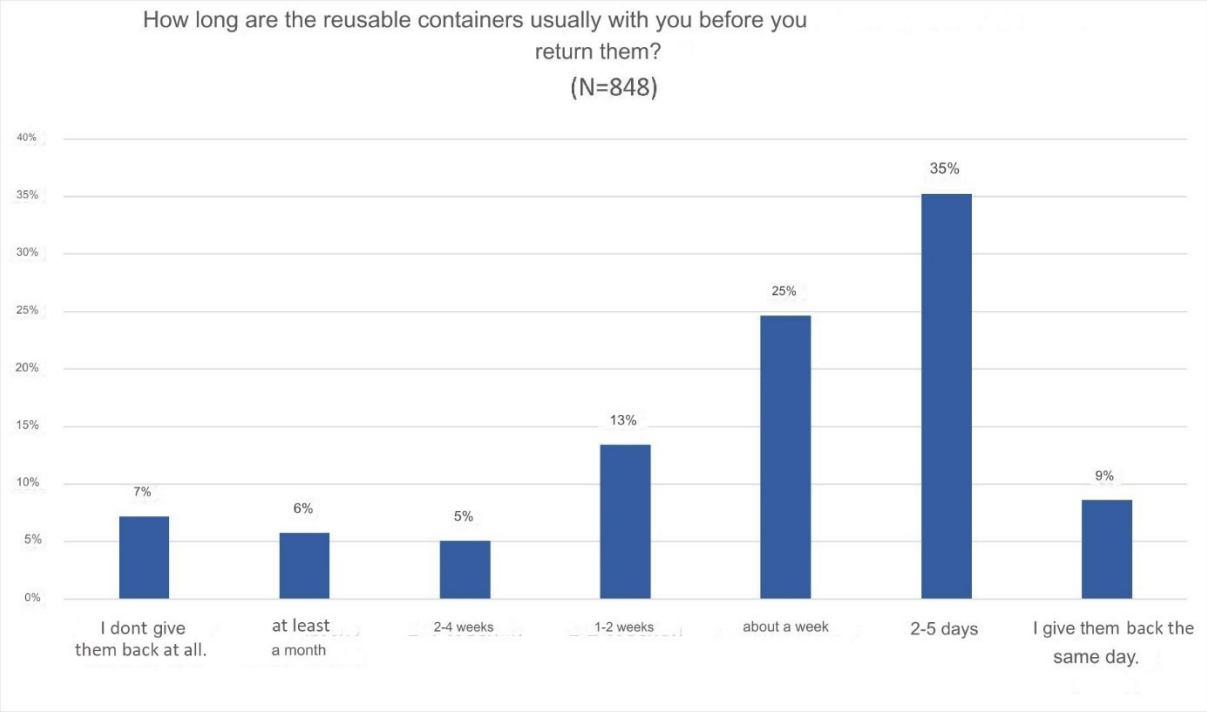

Figure 27: Utilisation time of the reusable containers (Source: own illustration)

3.3.5 The inventory of reusable containers

Just over half (54 %) of the respondents (N=848) reliably return their reusable containers so that they can be reintegrated into the cycle. All others (46 %) indicated that they have missed returning a reusable container on time at least once, and therefore now possess one (29 %) or several (15 % "two to three," 2 % "more than three") reusable containers that they use for private purposes (see Figure 28). These containers do not return to the cycle and cannot be reused by the systems.

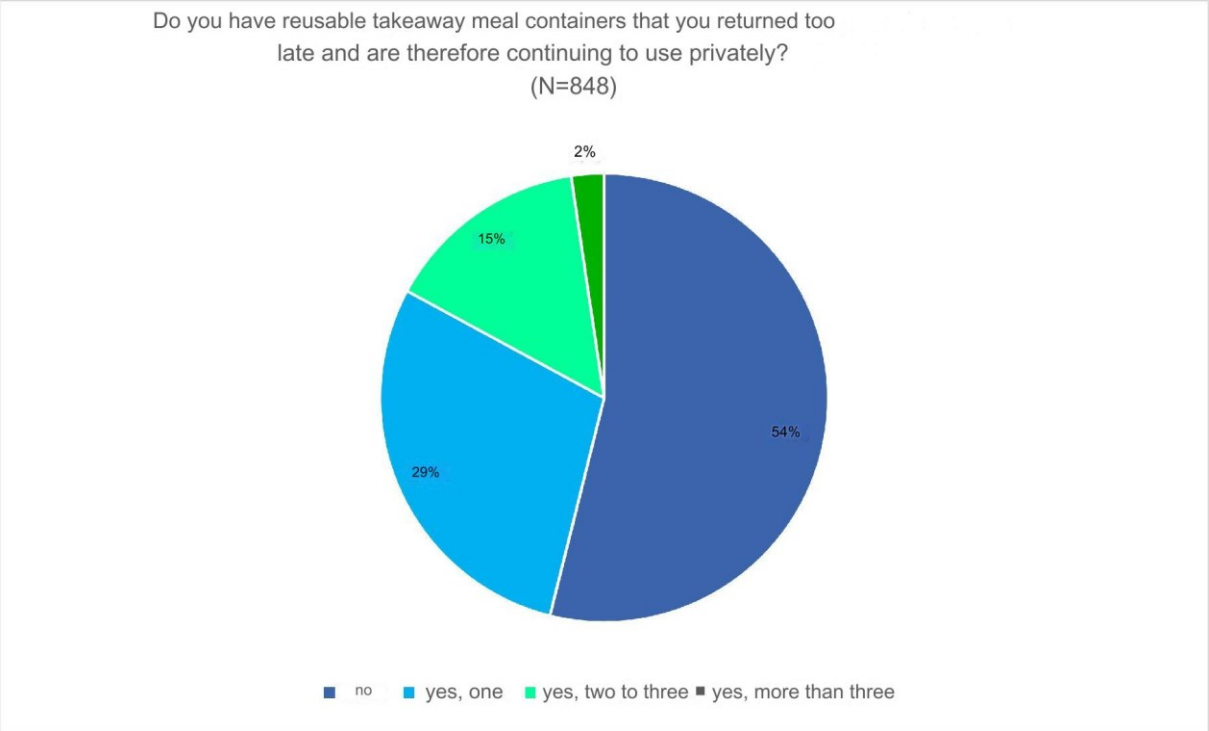

Figure 28: Inventory of reusable containers for take-away meals (Source: own illustration)

3.3.6 The storage location of cleaned reusable containers

The results indicate that the majority of participants (N=848) store cleaned reusable containers at home, especially in kitchen cabinets and shelves (61 %) or in a storage room (35 %). Additionally, the containers are also stored in shopping bags (17 %), in the car (13 %), or in the garage (3 %) (see Figure 29). This diversity underlines the adaptation of storage habits to the individual needs and life situations of the surveyed individuals.

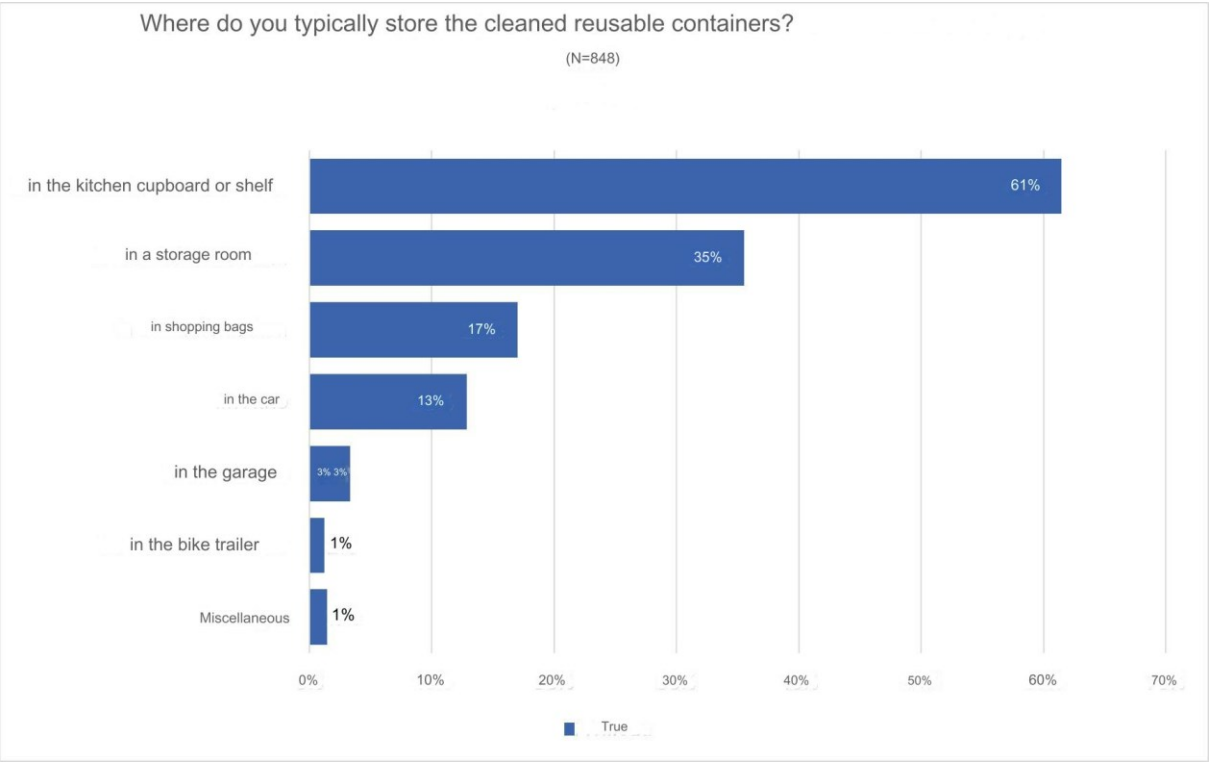

Figure 29: Storage location of the cleaned reusable containers (Source: own illustration)

3.3.7 Cleaning of reusable containers

Approximately half (49 %) of the surveyed individuals (N=848) clean the reusable containers after use in the dishwasher, while 41 percent clean them by hand. A small group of respondents (9 %) stated that they only clean the containers roughly before returning them by tapping them out or scraping out the food residues, for example. A minority of one percent indicated that they do not clean their containers at all (see Figure 30).

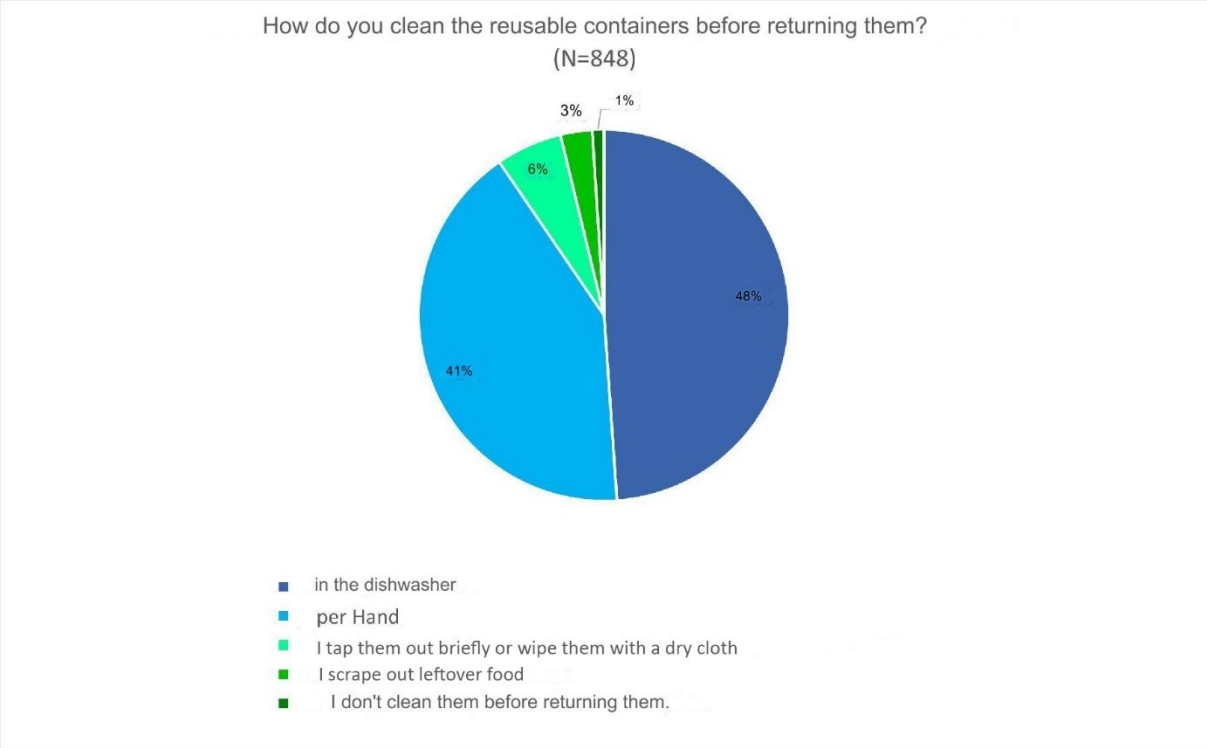

Figure 30: Cleaning types of reusable containers (Source: own illustration)

The results show that a large portion of surveyed individuals cleans their containers too thoroughly, as rinsing with cold water is usually sufficient (Vytal 2024).

3.3.8 Characteristics of reusable containers

The survey results reveal that certain characteristics of reusable containers are particularly important to the respondents (N=2,101). Primarily, leakage-safety which plays a "very big role" for 70 percent of respondents and a "rather large role" for 22 percent. Similarly, easy cleaning is important to the respondents, with 56 percent considering it "very important" and 32 % "rather large role." Adequate capacity (45 % "very big role," 43 % "rather large role"), durability (53 % "very big role," 33 % "rather large role"), and shatter resistance (53 % "very big role," 33 % "rather large role") are also crucial characteristics.

In contrast, other features are less important to the respondents: child-friendly design (53 % "doesn’t matter," 22 % "rather small role"), the number of compartments in the container (24 % "doesn’t matter," 34 % "rather small role"), and aesthetic appearance (23 % " doesn’t matter,” 33 % "rather small role") (see Figure 31).

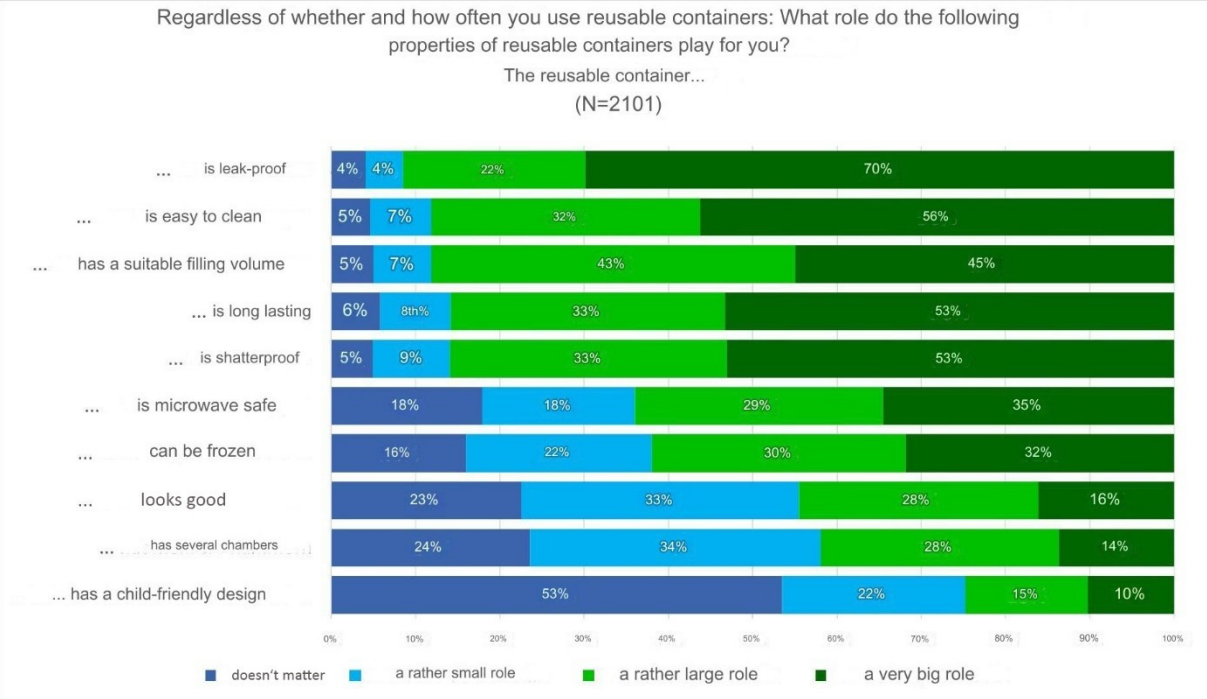

Figure 31: Properties of reusable containers (Source: own illustration)

Overall, borrowed reusable containers, similar to one's own containers, should primarily be practical (e.g., leak-proof) and durable while causing minimal effort, such as cleaning. Design and appearance play a minor role.

3.3.9 Awareness of reusable container providers

A majority of the surveyed individuals (60 %) stated that they have no knowledge of providers of reusable containers. The other participants (N=639) were able to name up to three providers of reusable containers. Reusable container providers were referred to in the questionnaire as companies that distribute reusable containers to stores. This was an open-ended question, meaning there were no predefined answer options. Additionally, there was an extra field for those who only know reusable container providers for takeaway drinks.

Interestingly, storage containers such as Tupperware (400), Emsa (42), Lock and Lock (42), Mepal (14), and Curver (11) were mentioned more frequently than providers of borrowed reusable systems such as Recup/Rebowl (49), Vytal (22), or Relevo (7). Additionally, gastronomy businesses that provide reusable systems but are not reusable system providers were frequently mentioned, such as Ikea (32), McDonald's (31), Burger King (11), and Starbucks (7). Furthermore, 14 individuals mentioned Amazon. Other providers received fewer than five mentions and are therefore not considered in the analysis. Participants who exclusively reported knowledge of reusable cups for takeaway drinks (N=113) mainly mentioned Tupperware (60) and Recup/Rebowl (24). They are also not considered in the analysis (see Figure 32).

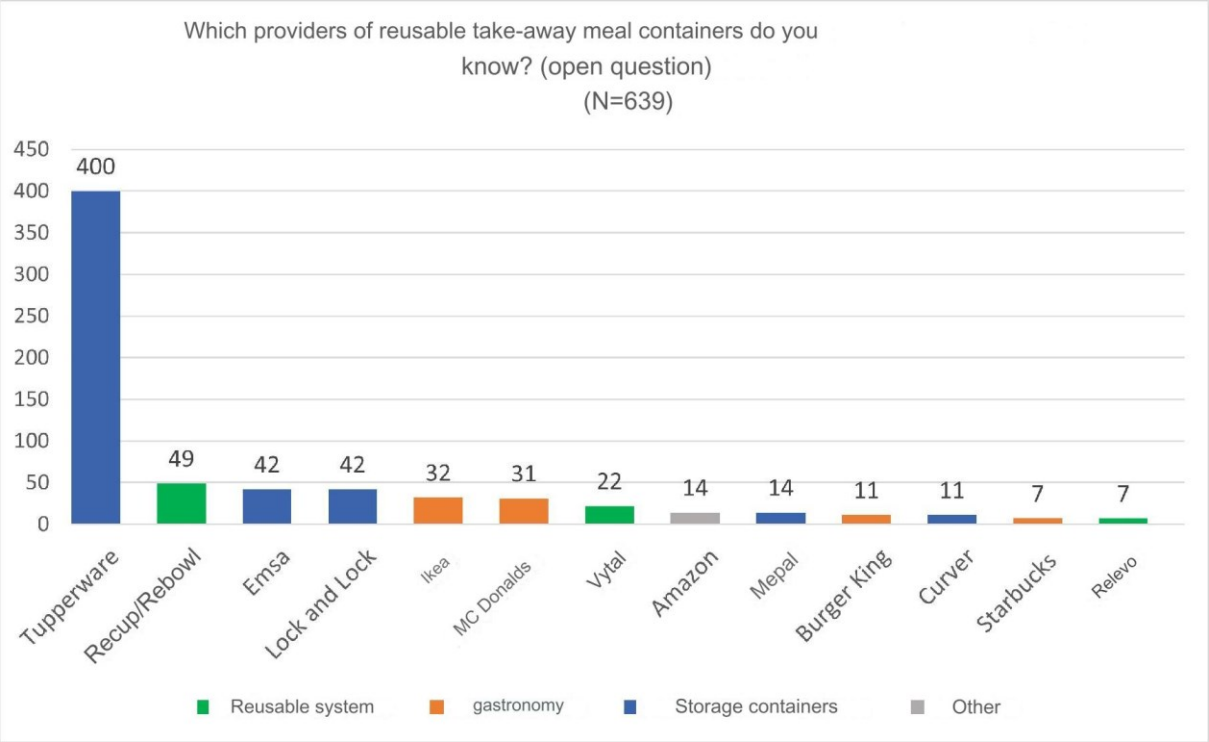

Figure 32: Providers of reusable containers (Source: own illustration)

Overall, twelve percent of the surveyed individuals who answered the question (N=639) were able to actually name a reusable system provider. Of the total sample (N=2,101), this is four percent of all respondents. This low percentage suggests that reusable pooling systems are little noticed and known in consumers' daily lives; hence, the surveyed individuals mostly provided names of companies that sell them known reusable containers or storage boxes or offer them for rent. However, it could also be attributed to the questionnaire design, as the first part of the questionnaire asked about the handling of storage containers.

Note: The result might have been different if the names of the reusable providers had been provided as options instead of an open-ended question, as this would require less mental effort. Additionally, it should be noted that only providers mentioned at least five times were included in the analysis. Furthermore, companies not specialized in reusable containers, such as "Amazon," were also included because respondents provided this answer.

3.3.10 Evaluation of reusable offerings in the area

The evaluation of reusable offerings in the area varies greatly among the respondents (N=1,544): approximately one-third (34 %) of the surveyed individuals rate the offerings as "good" to "very good." Another third (35 %) rates the reusable offerings in the area as "sufficient" to "satisfactory," while the final third (31%) perceives the offerings as "poor" to "unsatisfactory." The most frequently given ratings were "good" (24 %), "satisfactory" (22 %), and "inadequate" (20 %) (see Figure 33). The average grade for the reusable offerings in the area is 3.4 (American C-).

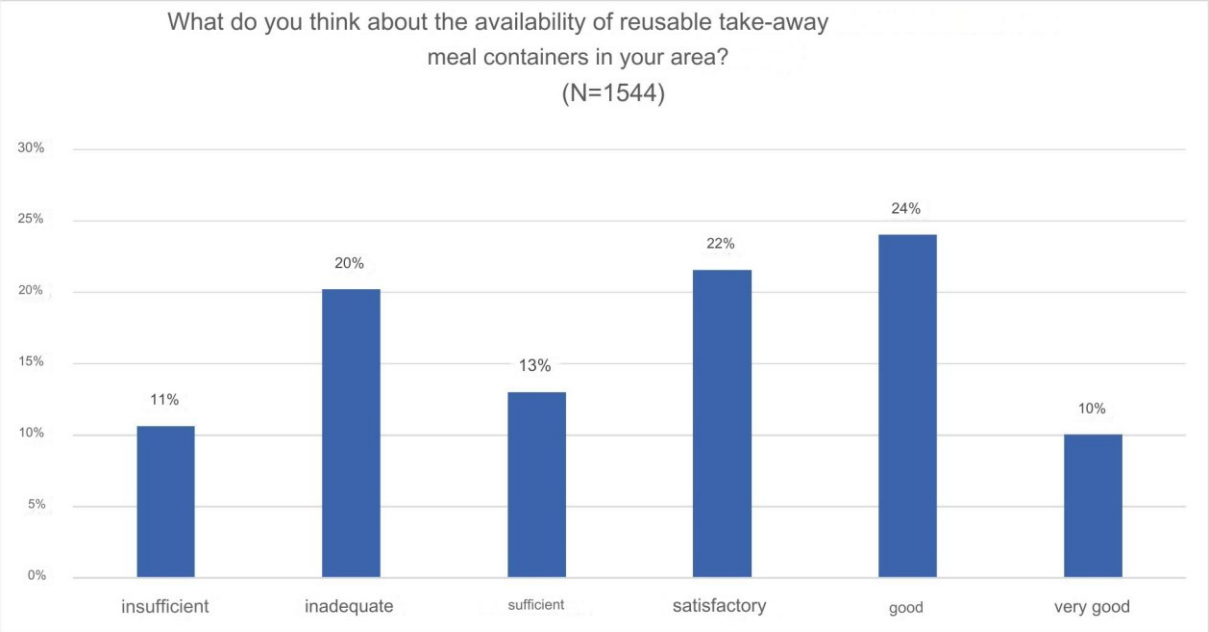

Figure 33: Rating of the availability of reusable containers in the neighbourhood (Source: own presentation)

3.3.11 Awareness of reusable offerings in the area

The analysis of the sample (N=2,101) shows that many people are not aware of reusable options for takeaway food in their area. For all indicated purchase locations (supermarkets, restaurants, food stands, or delivery services), approximately half of the respondents stated that they are not aware of any offerings for borrowing reusable containers for takeaway meals. About 20 percent to 30 percent of respondents are aware of "some" businesses in their local area that offer reusable options. Only a small percentage of respondents (6-7 %) indicated that there is widespread availability of reusable options for takeaway food in their area (see Figure 34).

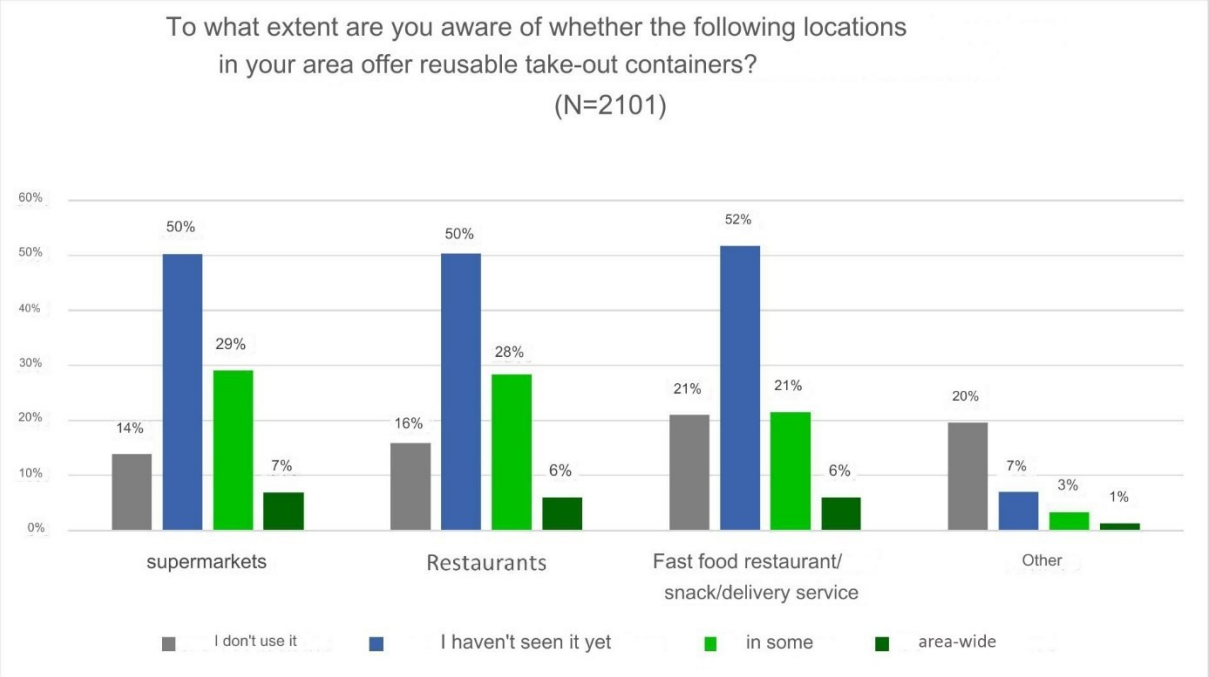

Figure 34: Awareness of reusable offerings in the area (Source: own illustration)

Overall, the knowledge about the availability of reusable options for takeaway food in the respondents' area is rather limited and does not differ according to the place of purchase (supermarkets, restaurants, food stands/fast food). The results suggest that reusable offerings are not yet widely spread or that the existing offers are inadequately promoted.

3.3.12 Barriers of using reusable containers

According to respondents (N=2,101), the use of reusable containers for takeaway food is hindered by various barriers. The biggest obstacle cited by 35 percent is a lack of awareness of the availability of reusable containers, while 25 percent stated that their preferred stores do not offer such containers. Transporting the containers after use until returning them is also an obstacle for 20 percent of respondents. In comparison, lack of environmental consciousness or low priority on waste reduction are not significant barriers. Only five percent of respondents question the negative environmental impacts of single-use packaging, and only four percent do not feel responsible for reducing single-use packaging (see Figure 35).

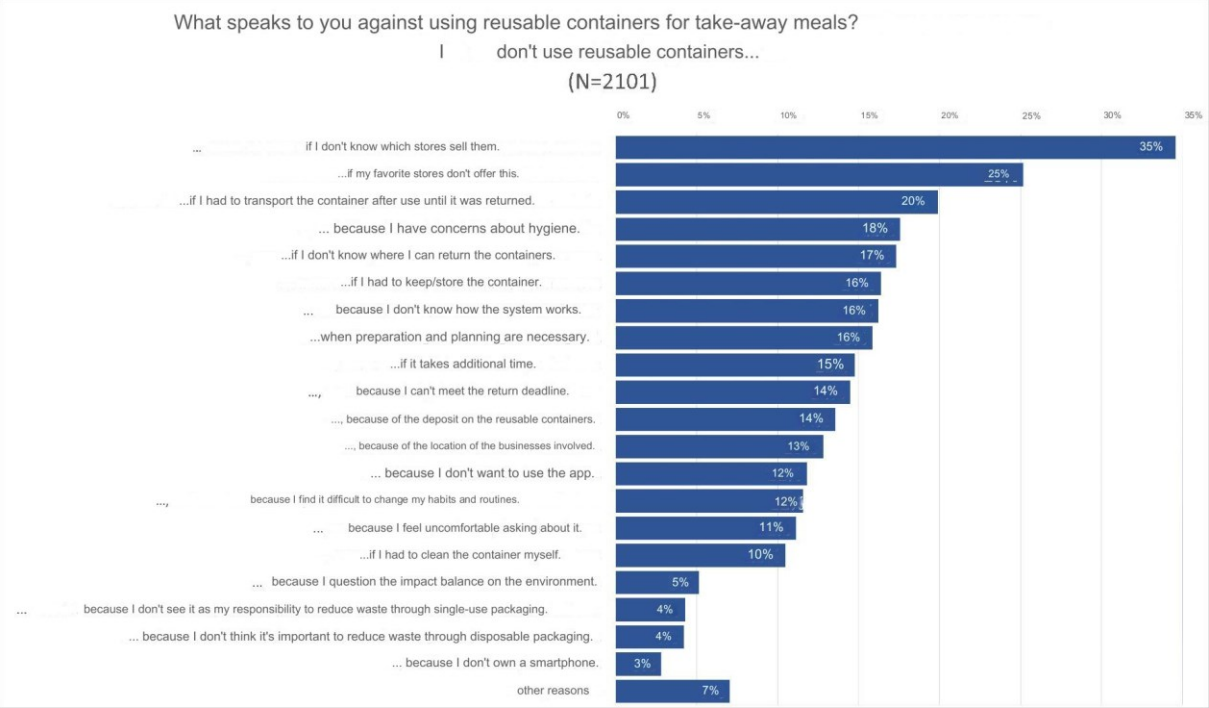

Figure 35: Barriers of using reusable containers (Source: own illustration)

To ensure that more people use reusable containers in the future, it is therefore important to communicate better and provide information about which stores offer reusable containers. Additionally, it is crucial to create simple and convenient return options.

3.4 The use of delivery services

The following section deals with the habits of the respondents when ordering takeaway meals from delivery services. This includes both ordering directly from a gastronomy business (e.g., restaurant) as well as ordering through third-party platforms (e.g., DoorDash, Lieferando).

3.4.1 The frequency of using delivery services

Out of the 2,101 respondents, 60 percent stated that they order meals from delivery services at least once a month. Of these, 17 percent of respondents order one to two times a week, while six percent order three times or more per week. 21 percent of respondents indicated that they use delivery services at least once a year, but less than once a month. In contrast, 19 percent of respondents stated that they never order meals from delivery services (see Figure 36).

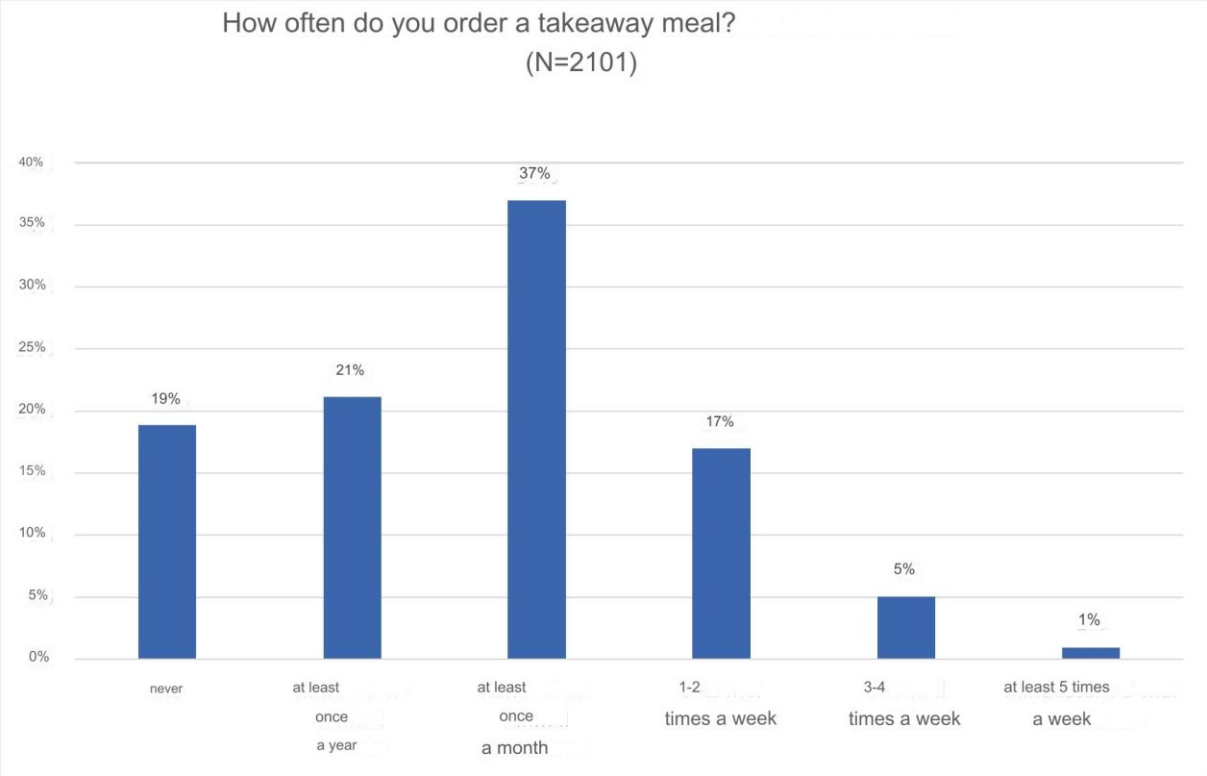

Figure 36: Frequency of ordering takeaway meals (Source: own illustration)

These results indicate that the use of delivery services in Germany is widespread, but is not represent a regular consumption pattern for many people.

3.4.2 Occasions for using delivery services

The respondents (N=1,704) cited various reasons for ordering meals through delivery services. In particular, three occasions found significant agreement among more than half of the respondents: having a craving for a specific meal was mentioned by 72 percent of respondents as a reason for using delivery services. These respondents indicated that this was "always" (12 %), "most of the time" (33 %), or "often" (27 %) the reason for placing an order. The desire of household members to order food was agreed upon by 57 percent of respondents. Here, respondents stated that this was "always" (8 %), "most of the time" (22 %), or "often" (27 %) the reason for placing an order. A lack of desire to cook was cited by 54 percent of respondents as a reason for ordering meals from delivery services. In this context, respondents stated that this was "always" (9 %), "most of the time" (22 %), or "often" (23%) the reason for using a delivery service (see Figure 37).

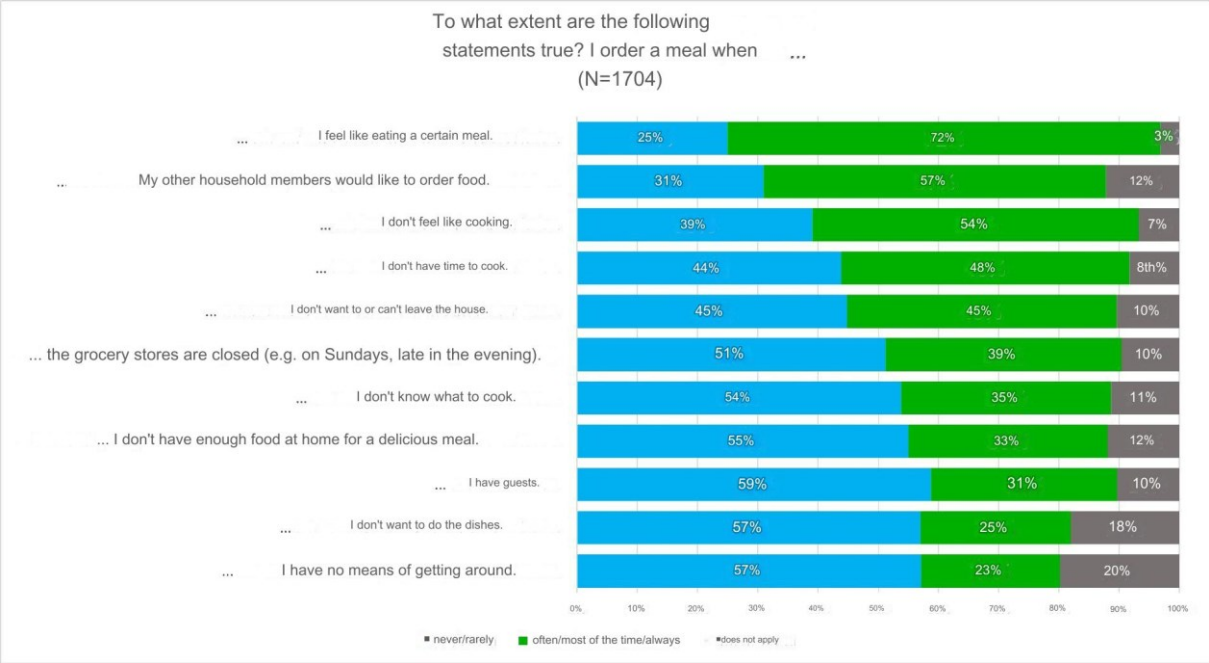

Figure 37: Reasons for ordering a meal (Source: own illustration)

Note: For this question about usage context, there were three response options toward positive expressions (frequent, mostly, always), but only two toward negative expressions (rarely, never). This could have led to a bias in the response towards positive expressions.

3.4.3 Attitudes towards delivery service

The respondents (N=1,704) have different attitudes towards delivery services: for a majority of 68 percent, ordering from delivery services means “treating yourself”, with just under a third agreeing with this statement partially (23 %), “disagree partially” (5 %) or “disagree completely” (2 %). With regard to environmental aspects, respondents are unsure what impact delivery services have on the environment: 27 percent believe that delivery services are (rather) bad for the environment; 40 percent agree to some extent; however, another 27 percent say that delivery services are (rather) not harmful to the environment; 6 percent say they do not know. The majority of respondents (58 %) are in favor of delivery services offering more reusable containers, of which 27 percent “completely agree” and 31 percent “somewhat agree”. A further quarter are not sure (25 % “partially agree”) and twelve percent do not think it is necessary for delivery services to increase their reusable offerings (7 % ”disagree partially”, 5 % “completely disagree”). With regard to the packaging of the delivered food, most respondents consider it important that the food is as practical as possible and packaged as little as possible: practical packaging is very important to 24 percent of respondents and somewhat important to 43 percent, for 24 percent it is partly important, five percent it is not very important and two percent it is not important at all. 51 percent of respondents confirm that it is important for delivery services to use as little packaging material as possible (19 % “completely agree”, 32 % “agree somewhat”). 30 percent of respondents said that it is important to some extent to receive food with as little

packaging as possible. For 16 percent, the amount of packaging is less important (11 % “agree partially”, 5 % “completely disagree”). Even though it is important for the majority of respondents that the food is packaged practically and with little packaging, it is not so important for many to know about the packaging options in advance: 43 percent would like to know “(rather) nothing” about the options in advance, 26 percent agree “partially”, 17 percent agree “somewhat” and nine percent agree “completely” that they would like to know the packaging options for the food (see Figure 38).

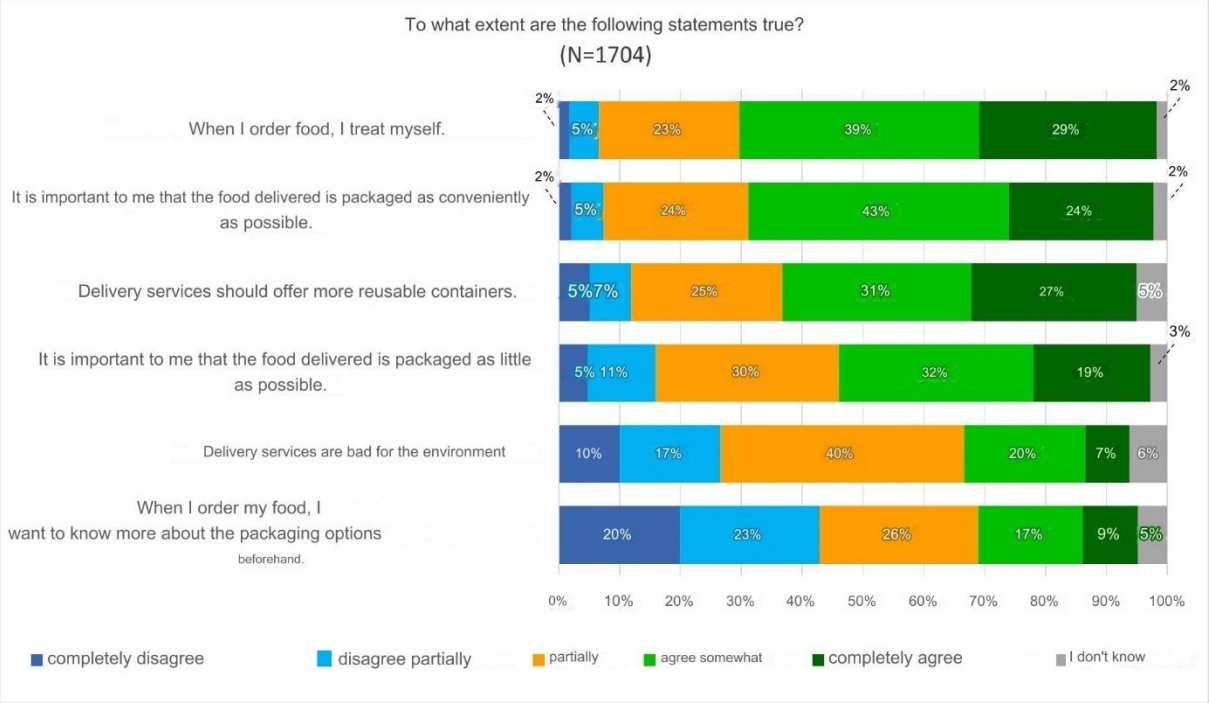

Figure 38: Attitudes towards delivery services (Source: own illustration)

3.5 Attitudes towards reusable systems for takeaway meals

This section describes the respondents' overall attitude towards reusable systems for takeaway meals, regardless of whether or how often they have actually used or regularly use reusable containers.

3.5.1 Willingness to use reusable containers for takeaway meals in general

Based on the survey results, central factors can be identified that have the potential to increase the willingness to use reusable containers. Respondents (N=2,101) indicated that they would be willing to use reusable containers for takeaway meals under the following conditions: if…

- … no cleaning was necessary (37 %),
- … the containers had a nice appearance for private reuse (28 %),
- … they were practical for private reuse (15 %),
- … the deposit was not too high (15 %).

The first factor that would increase the willingness of respondents to use reusable containers is already fulfilled: thorough cleaning of the reusable containers is not necessary in most cases; it is often sufficient to roughly clean the containers (Vytal 2024). To convince more people to use reusable containers, it is important to educate potential customers about cleaning. Better communication is also important for the second and third point: Reusable containers should not be reused privately, but should be returned to the cycle for reuse (as quickly as possible). Instead of making private use of the containers more attractive, the containers are being developed to be reused as often as possible in in the gastronomy sector.

One aspect that could further increase the willingness to use is point four: the deposit for the containers should not be too high. For 15 percent of potential users, a reasonable deposit amount could make reusable offerings more attractive. The appropriate deposit amount is shown in section 3.5.3. However, other aspects that are generally assumed to increase usage frequency were not decisive for respondents' willingness to use. More than half of the respondents stated that they would not (use more) reusable containers if the containers could be returned at every restaurant and supermarket (56 %), if more were offered (53 %), or if there were return machines (50 %). An overview of all responses can be found in Figure 39.

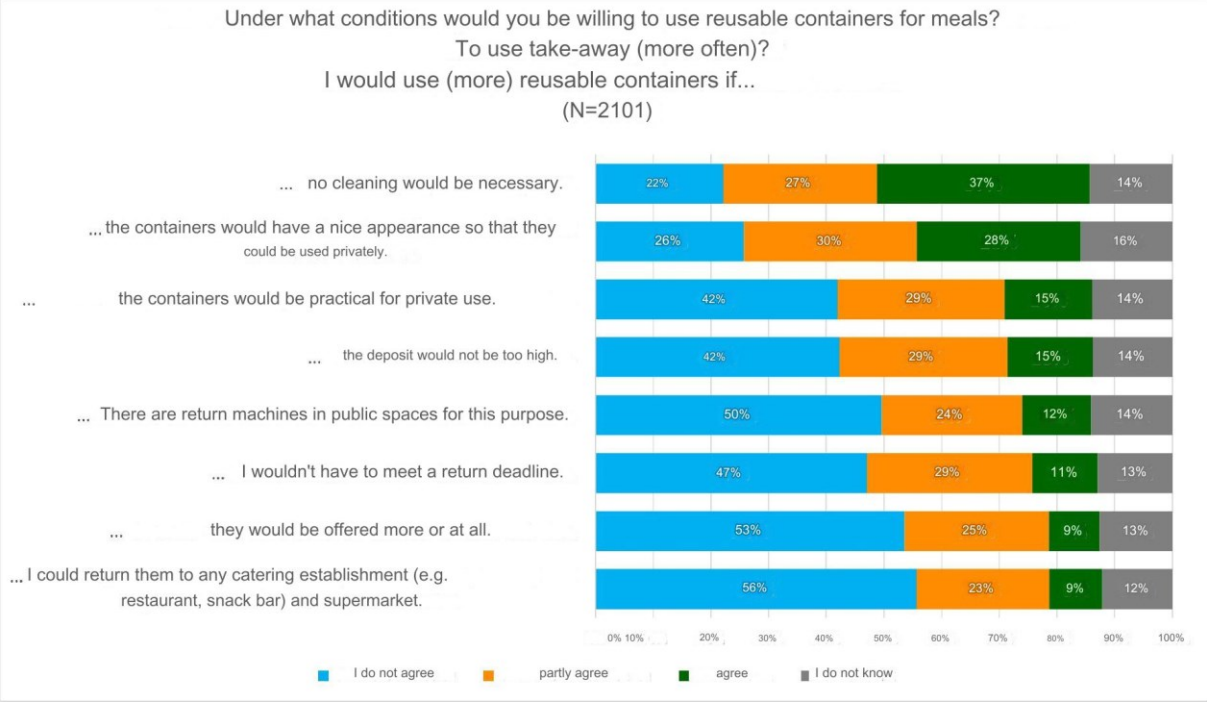

Figure 39: Requirements for (more frequent) use of reusable containers for takeaway meals (Source: own illustration)

There seems to be a perceived contradiction: On the one hand, respondents desire more options (see 3.4.3), yet they also indicate that they would not use reusable containers more often if there were more on offer. However, it should be noted that only individuals who have ever used reusables answered question 3.4.3, while all participants answered this question (including non-users). Therefore, the responses may indicate that individuals who are not interested in reusables cannot be persuaded to use them even with key incentives.

3.5.2 Willingness to use reusable containers with delivery services

The usage of reusable containers by delivery services also contributes to reducing packaging waste, but is still relatively uncommon. Therefore, respondents were asked to indicate what they would pay attention to if they were offered a reusable container when ordering from a delivery service (N=2,101).

The respondents would be most likely to ensure that

- … the containers are collected from them again (27 %),
- … there is no additional cleaning effort (23 %),
- … there is also a disposable option (22 %).

In contrast, the majority of respondents would not pay attention to the fact that

- … there is an additional expense due to registration (56 %),
- … a return deadline must be met (56 %),
- … the return is possible in any restaurant or supermarket (59 %),
- … the return is possible with the next order (64 %).

An overview of all responses can be found in Figure 40.

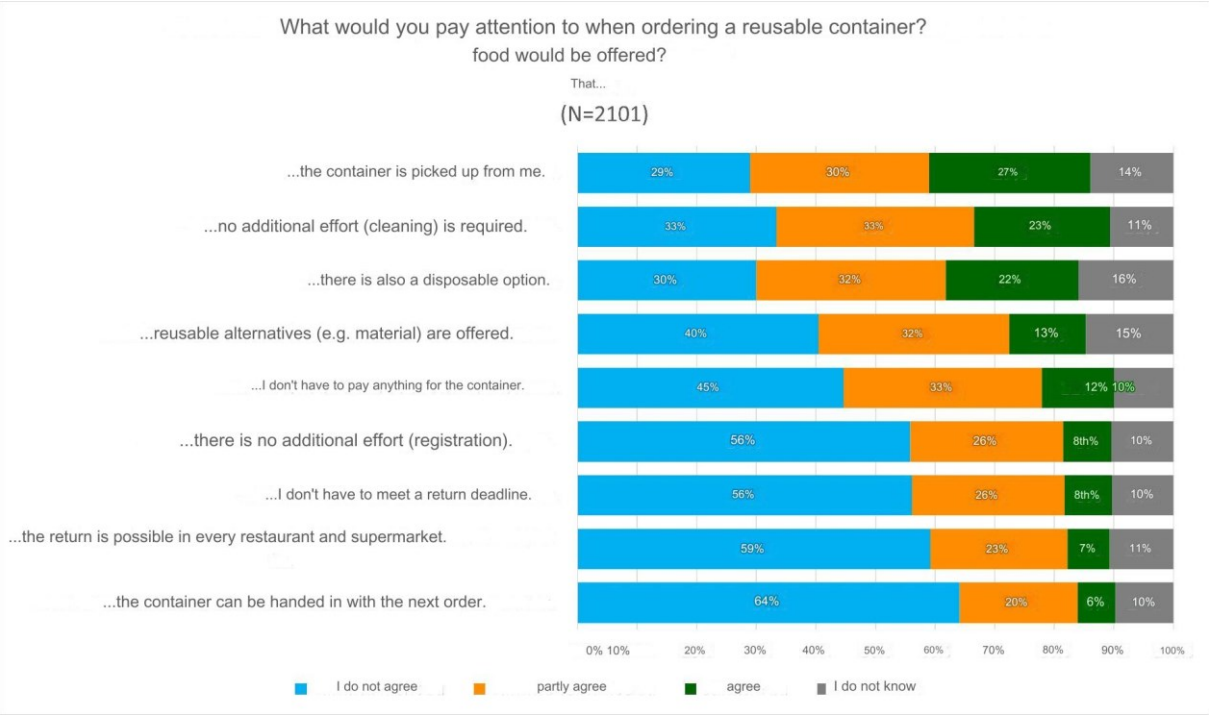

Figure 40: Requirements for ordering delivered meals with reusable containers (Source: own illustration)

Overall, there was little agreement and much disagreement with the response options. This could be an indication that respondents have paid little attention to the topic so far. Additionally, there is no systematic pattern behind the responses. The options regarding individual additional efforts (cleaning and registration) are rated very differently.

3.5.3 Deposit for reusable containers

Respondents were also asked to indicate how much they thought the deposit on reusable containers should be so that they would use reusable containers for takeaway meals. 35 percent would accept a deposit amount below two euros, 42 percent would be willing to pay between two euros and a maximum of five euros deposit, and seven percent would even be willing to pay more than five euros deposit. Only 16 percent would use reusable containers only if they did not have to pay any deposit.

The results show that the majority of respondents (84 %) would be willing to pay a deposit amount for reusable containers (see Figure 41).

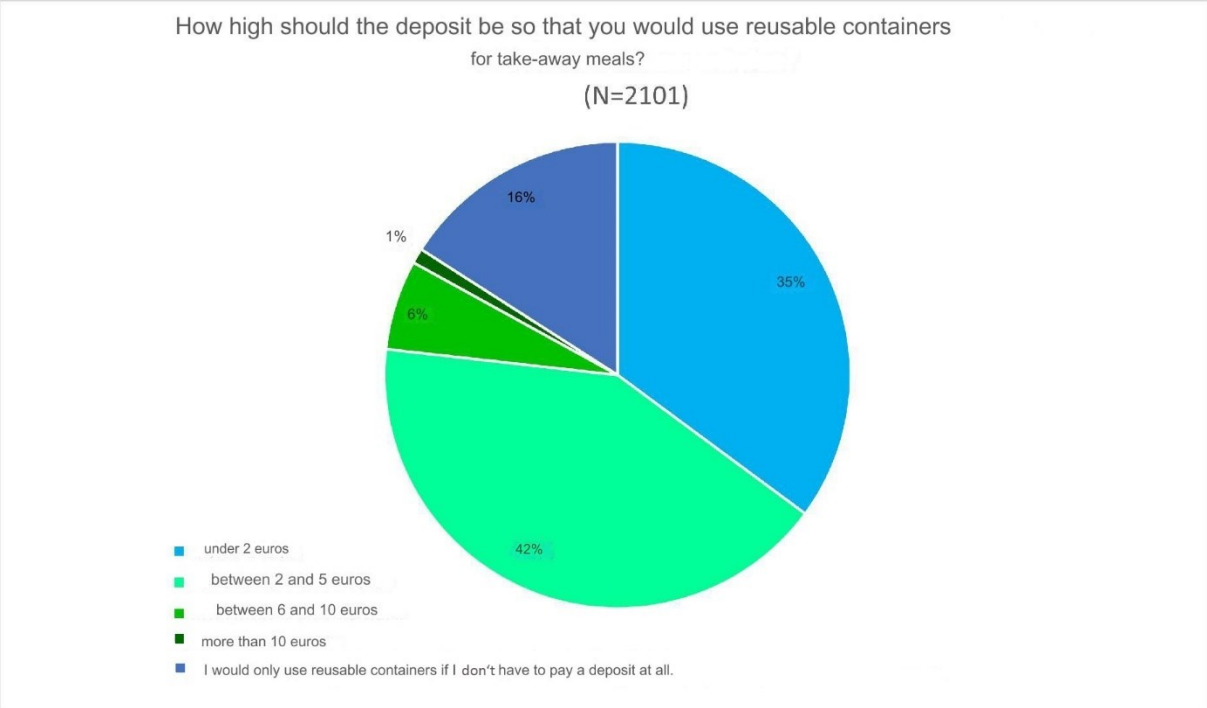

Figure 41: Deposit (amount) for reusable containers for takeaway meals (Source: own illustration)

Note: The result may be biased due to the response options. The possible deposit amounts set an anchor, but were not based on literature. If there had been a free response format, or if the possible amounts had been higher (e.g. 5 euros, 10 euros, 15 euros), respondents might have answered differently.

3.6 Precycling behavior

The respondents also provided general information about their handling of food packaging, known as precycling behavior. This refers to behavior that help to minimize or avoid waste from food packaging, thereby conserving resources. Precycling involves consciously purchasing unpackaged food, avoiding unnecessary packaging, and actively trying to reduce

packaging waste (Wenzel and Süßbauer, 2021). Respondents indicated their agreement or disagreement with five statements on a scale of 1 to 7. The average agreement with all five statements was 4.19, indicating a moderate to positive level of agreement. Thus, respondents tend to agree that they try to avoid packaging waste.

4. Results of inferential statistical analysis

We were interested in understanding the factors influencing the usage of reusable containers and how various variables are interconnected. In this chapter, we present the results of the inferential statistical analysis. Inferential statistics is a branch of statistics that draws conclusions about the population (in this case, the German population) based on sample data (results of the representative survey) using various analytical tools. The correlation analyses conducted below allow for the examination of statistically significant relationships and drawing conclusions that would not be possible with descriptive statistics alone.

Specifically, the following questions interested us:

- What factors influence satisfaction with the availability of reusable options in the area?
- Which demographic groups are more likely to use reusable containers for takeaway meals?
- What is the usage of own or borrowed containers generally correlated with?
- Which sociodemographic variables influence the container inventory?
- Which individuals use delivery services (without reusable options) to order takeaway meals?

The choice of inferential statistical procedures depends on the available sample data. Specifically, the scale level[4] of the variables determines the appropriate procedure. Since the Pearson correlation (r) is only used with two metrically scaled variables, the Spearman correlation was applied in four out of six analyses. However, the Pearson correlation was used for the remaining two correlation analyses.

Initially, potential relationships were explored using correlation analyses, followed by the identification of sociodemographic influencing factors on the stock of own containers through multiple linear regression analysis, examining their precise effects. Only statistically significant results are presented.

[4] The scale level describes the properties and measurement accuracy of a scale used to categorize data, with different levels of measurement ranging from nominal, ordinal to metric scaled.

4.1 Satisfaction with reusable options in the vicinity

We were interested in what influences satisfaction with the availability of reusable options in the area and whether there are differences based on residential location (urban/rural). The descriptive analysis revealed that satisfaction with reusable options is relatively low, with an average rating of "satisfactory" (see section 3.3.10). The correlation analysis indicates a slight, significantly negative correlation between settlement structure and satisfaction with reusable options (rho = -0.09, $p < .001$). This suggests that individuals living in urban areas tend to have slightly higher satisfaction with reusable options compared to those residing in rural areas.

4.2 Usage of reusable containers for takeaway meals

Furthermore, we wanted to understand the factors influencing the usage of borrowed containers from reusable system providers (e.g., Rebowl, Vytal, Relevo). Here, working hours play a lesser role. Therefore, we correlated the variables "awareness of reusable options in the area" (see section 3.3.11) and "frequency of usage of reusable containers" (see section 3.3.1). The analysis revealed a moderate, significantly positive correlation between awareness of reusable options and the frequency of usage of borrowed containers (rho = 0.44, $p < .001$). This confirms our assumption that individuals who have more information about reusable container options in their area also use borrowed containers more frequently.

4.3 Usage of own and borrowed containers

Own containers for self-prepared meals

The descriptive analysis showed that working consumers frequently bring their meals in own containers to their workplace (see section 3.1.2). Therefore, we examined the correlation between weekly working hours and the frequency of usage of own containers for transporting self-prepared meals through correlation analysis. The analysis reveals a slight but significantly positive correlation between working hours and the frequency of usage of own containers ($r = 0.14$, $p < .001$). This indicates that respondents who work more hours per week tend to use their own containers more frequently for transporting their self-prepared meals.

Own and borrowed containers for self and externally prepared meals

We were also interested in whether precycling behavior correlates with the usage of reusable containers (for self or externally prepared meals). Using correlation analysis, we confirmed that general precycling behavior positively correlates with all three reusable practices:

- The more frequently own containers are used for self-prepared meals, the more pronounced the precycling behavior is ($r = 0.188$, $p < 0.001$).
- The more frequently own containers are used for externally prepared meals, the more pronounced the precycling behavior is ($r = 0.310$, $p < 0.001$).
- The more frequently individuals use borrowed containers, the more pronounced the precycling behavior is ($r = 0.225$, $p < 0.001$).

The attempt to avoid packaging waste also correlates with various personal characteristics: respondents with higher age report significantly more precycling behavior ($p = 0.015$, $r = 0.076$). Gender also plays a role: the more likely the respondent is female or identifies as non-binary, the stronger the reported precycling behavior is ($p = 0.012$, $r = 0.054$). Additionally, individuals with higher educational qualification are more likely to agree to implement precycling behavior themselves ($p < 0.001$, $r = 0.11$). Another correlation exists between household income and reported precycling: the higher the household income, the more precycling is reported ($p = 0.015$, $r = 0.054$).

Overall, these results indicate that individuals who frequently use reusable containers also generally tend to consciously avoid packaging waste in their daily lives. Especially female and non-binary-identifying individuals, individuals with higher educational qualification, higher income, and older individuals consciously attempt to implement precycling in their daily lives – which also includes the usage of reusable containers (for self or externally prepared meals).

We were also interested in the influence of educational qualification on the frequency of usage of own containers for self-prepared meals and borrowed containers. The analysis regarding the frequency of usage of own containers revealed a slight but significantly positive correlation between educational qualification and the frequency of usage of personal containers for transporting self-prepared meals ($rho = 0.12$, $p < .001$). This suggests that individuals with higher educational qualification tend to use their own containers more frequently.

Interestingly, the correlation analysis regarding reusable container usage revealed a contradictory result. Here, the analysis showed a slight but significantly negative correlation between educational qualification and reusable container usage ($rho = -0.06$, $p < .001$). This means that individuals with higher educational qualification tend to borrow reusable containers for takeaway meals less frequently.

4.4 Container inventory

To identify factors influencing the number of owned containers owned (see section 3.1.3), we conducted a multiple linear regression analysis with various sociodemographic variables.

The results indicate that certain characteristics, such as age, gender, income, building type, and settlement structure, significantly influence the number of containers owned.

Particularly, there is a positive correlation between age and container stock, with older individuals tending to have a larger stock of containers (Beta (β): 2.321, $p < 0.01$). Gender also has a significant influence, with women having a higher average container stock (Beta (β): 9.053, $p < 0.01$). Income also positively influences the container stock (Beta (β): 1.673, $p < 0.01$); higher income correlates with a larger container stock. In contrast, building type shows a negative correlation, indicating that individuals living in larger multi-family buildings tend to have fewer containers (Beta (β): -1.134, $p < 0.05$). Settlement structure demonstrates a significant positive influence, suggesting that individuals in rural areas have a higher container stock (Beta (β): 2.715, $p < 0.01$). Overall, the model explains about 10.1 percent of the variance in container inventory ($R^2 = 0.101$), with the adjusted R^2 at 9.5 percent. The F-statistic indicates that the model as a whole is statistically significant (15.081, $p < 0.01$).

4.5 Usage of delivery services (without reusable options)

Lastly, we examined which demographic groups use delivery services for takeaway meals. Our hypothesis was that there is a correlation between weekly working hours and the frequency of using delivery services. In the survey, 50 percent stated that they use delivery services because they lack time to cook (see section 3.4.1 and 3.4.2). The correlation analysis revealed a slight but statistically significant positive correlation between working hours and the frequency of using delivery services (rho = 0.16, $p < .001$). This implies that individuals who work more hours per week tend to order takeaway meals from delivery services more frequently.

Furthermore, we were interested in whether delivery services are more commonly used by urban or rural populations. According to the correlation analysis, there is a significant negative correlation between the settlement structure and the frequency of using reusable containers (rho = -0.09, $p < .001$). This suggests that people living in rural areas tend to use delivery services less frequently.

Thus, the study demonstrates a measurable impact of weekly working hours on the use of both reusable containers (see section 4.3) and delivery services. However, since these are two very different practices, it is assumed that their usage occurs for different reasons. Packing lunchboxes for work is a practice that is inherently time-consuming but is often routinized due to the structured nature of weekdays (Süßbauer 2023), possibly also handled by other household members. On the other hand, delivery services are more likely to be used when individuals feel a lack of time – for example, when they work long hours.

One reason for the correlation between the usage of delivery services and urban residence could be the overall lower number of gastronomy businesses offering delivery services in rural areas. Our results may indicate a lower expansion of gastronomy businesses with delivery services in rural areas. However, it could also be related to the different modes of

transportation used in rural and urban areas. Perhaps in rural areas, individuals are more likely to use their own car to pick up takeaway meals, making delivery services unnecessary.

5. Summary of results and conclusions

The results of the representative study indicate that reusable food containers play different roles in the daily lives of consumers depending on whether they are used for self-prepared or externally prepared meals. Reusable food containers are routinely used for self-prepared meals: 77 percent of respondents stated that they regularly, i.e. at least once per week, use reusable containers for storing or transporting self-prepared meals. However, for takeaway meals prepared by others, the usage of food containers is not yet widespread: 41 percent have never brought their own container.

The usage of borrowed containers from reusable system providers (e.g. Vytal or Rebowl) is even less widespread: 54 percent of respondents have never borrowed a reusable container from a restaurant or supermarket. This could be partly due to perceived lack of availability. As the survey showed, half of the respondents are unaware of any reusable options available. This applies to supermarkets, restaurants, fast-food restaurants, and food stands equally, regardless of the location. Accordingly, almost one-third of respondents rated the availability of reusable options in their area as "insufficient" or "poor."

Another general reason for the limited usage of reusable containers in the food service industry could be the spontaneous nature of takeaway consumption. The survey revealed that takeaway meals are consumed irregularly and on occasions during leisure time: only a small proportion (6 %) consider takeaway consumption a daily habit. In contrast, the use of Tupperware for self-prepared meals is primarily embedded in routines during working hours: 68 percent reported using reusable containers regularly during working hours or while commuting to and from work.

Regarding the barriers to using reusable containers for takeaway consumption, respondents mentioned practical challenges of everyday life. These include the need to transport the container after usage (20 %), storage (16 %), and cleaning (10 %), necessary preparation and planning (16 %), compliance with return deadlines (14 %), and the additional time required (15 %). Furthermore, there are uncertainties among respondents regarding the functioning of reusable systems. These include concerns about the hygiene of the containers (18 %)[5], uncertainties about where the containers can be returned (17 %), and how the system operates (16 %). This also includes the fact that many people find it unpleasant to ask for reusable options in stores (11 %). In comparison, lack of environmental awareness or low personal priority for waste reduction are not significant obstacles: only five percent of

[5] The fact that hygiene concerns represent a barrier to reusable packaging is confirmed by other studies that show that consumers are less likely to choose reusable options if the containers show signs of use (Collis et al. 2023).

respondents, for example, question the negative environmental impact of disposable packaging. These results confirm other studies showing that motivation within the population to contribute to environmental protection is generally very high (Grothmann et al. 2023).

The results regarding preferred characteristics also demonstrate that reusable containers are primarily intended to be practical. Reusable containers for rent should especially be leak-proof, easy to clean, durable and shatterproof. A suitable filling volume is also important. Less important to respondents, however, are visual attributes such as a child-friendly design or aesthetic appearance.

Furthermore, our survey reveals knowledge gaps among those who have already used reusable containers from system providers. Approximately half of these respondents (49 %) clean the containers with a dishwasher, while another 41 percent clean them by hand. This indicates that a majority of respondents clean the borrowed containers too thoroughly, as they are typically industrially cleaned again in gastronomy establishments. Therefore, rinsing with cold water usually suffices, provided that the containers are returned on the same day (see, e.g. Vytal 2024). Thorough cleaning could also suggest that the reusable containers are not returned promptly but remain in households for relatively long periods. Almost half of the respondents (46 %) who have used a reusable pool system admitted to having missed returning a reusable container on time at least once, leading them to now own one (29 %) or several (17 %) reusable containers that they continue to use for private purposes. These containers often do not return to the circulation and cannot be passed on to other users by the systems. From an ecological perspective, rapid return would be the most environmentally sensible option (Kauertz et al. 2019).
Regarding the obstacles to bringing your own containers (BYO), uncertainties also arise. The main obstacle cited by respondents is not knowing which stores accept their own containers (38 %) or that their preferred stores do not allow it (24 %). Many are also unsure if their own containers are the right size (27 %) or feel uncomfortable asking if bringing their own containers is possible (12 %). Furthermore, consumers have concerns about hygiene (11 %). As everyday practical challenges, respondents mentioned the additional effort for preparation and planning (26 %), as well as the extra time (12 %) required to bring their own container compared to using disposable packaging. The need to transport their own containers is also an obstacle (18 %). Some also indicated that they find it difficult to change existing habits and routines (16 %).

6. Recommendations for the promotion of reusable packaging in the takeaway sector

Based on the results of the social survey, the following recommendations are derived for promoting the usage of reusable containers in the takeaway sector.

- The study demonstrates a measurable influence of awareness of offerings on the frequency of reusable container usage. Therefore, to increase the future adoption of reusable containers by more people, it is important to communicate and inform

better about which businesses offer reusable containers. This is particularly crucial to reach individuals who have not yet engaged deeply with the topic but are open to sustainable systems. This could be achieved, for example, through well-placed signs in food businesses, as well as through public advertising campaigns and prominent role models (such as well-known fast-food restaurants advocating for reusables). Additionally, to overcome everyday practical barriers, it is important to create simple and convenient return options.

- Furthermore, the service staff in respective businesses should be trained on the benefits and handling of reusable containers to assist consumers with questions or concerns and actively encourage them to use reusable containers. It is crucial to cultivate the perception that the usage of reusable containers in takeaway consumption is considered a "normal practice" by all parties involved.

- For borrowed reusable containers, the duration of stay in households must be reduced primarily by expanding return options (e.g. in gastronomy businesses, as well as in return machines in supermarkets). Simultaneously, incentives should be created to motivate timely return of borrowed containers; the deposit amount should not be too low in order to prevent the containers from becoming the private property of consumers and to encourage a rapid return to the cycle.

- Furthermore, misunderstandings about the cleaning of reusable containers should be clarified. It must be clearly communicated that a simple cleaning of the containers is usually sufficient, as they are professionally cleaned by gastronomy businesses upon return. Double cleaning should be avoided to improve the environmental balance of reusable containers.

- To promote the usage of Bring Your Own (BYO) containers, uncertainties on the part of consumers should be reduced through improved communication, similar to what is done with reusable systems. This includes training restaurant staff on hygienic handling of brought containers by the costumers. Many are unaware that with BYO, responsibility for hygiene and cleanliness lies with the end consumers. Especially economically weaker gastronomy businesses should be supported in conducting specific training on BYO and informed about financial and logistical advantages.

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