

Consumer perceptions and behaviors around date labeling, packaging, and dairy food waste: A qualitative photo-elicitation study

Lotte Hallez^{*}, Tine Bulcaen, Louise Glenisson, Hannah Boen, Tim Smits

Lab for Media, Information and Persuasion, KU Leuven, 3000 Leuven, Belgium

ARTICLE INFO

Keywords:

Food waste
Consumers
Food packaging
Date labeling
Package size
In-depth interviews
Photo-elicitation

ABSTRACT

Dairy products are a major source of consumer food waste and a significant contributor to greenhouse gas emissions, making them a critical target for waste reduction efforts. Food packaging, as the primary point of contact between consumers and products, serves as a crucial communication tool that shapes perceptions and behaviors. This study investigates how consumers interpret and use packaging in their purchasing, consumption, and disposal decisions for dairy products. We conducted in-depth interviews with 33 Belgian adults, using a photo-elicitation method. Over the course of one week, participants photographed dairy products they encountered in-store and at home, and these images were later used as prompts during the interviews to facilitate discussion. A thematic analysis of the interviews reveals a complex relationship between packaging and food waste in the mind of consumers, centered on two key cues: date labeling and package size. Participants expressed frustration with the current 'best before' and 'use by' labels, believing they contribute to food waste. However, they responded positively to 'Look, Smell, Taste' labels, which validated their reliance on sensory evaluation and were seen as a positive influence on others' behavior. Package size introduced notable trade-offs, with consumers balancing the desire to reduce waste against the perceived cost savings of larger packages. These findings provide actionable insights for policymakers and industry stakeholders seeking to design packaging communication that supports food waste reduction and aligns with ongoing EU date labeling reforms.

1. Introduction

Food waste has become a critical global sustainability challenge. The scale of the problem is immense: approximately 40 % of all food produced for human consumption is lost or wasted worldwide (Lipinski, 2024). Food waste is a major contributor to global warming, accounting for 8–10 % of global greenhouse gas (GHG) emissions (IPCC, 2019). The waste of animal-based products, such as dairy, contributes disproportionately to this environmental impact (Sala et al., 2023). On a social level, the amount of food discarded each day would be sufficient to feed all individuals affected by hunger worldwide (United Nations Environment, 2024). In light of these concerns, the United Nations' Sustainable Development Goal 12.3 aims to halve food waste by 2030, a target that, if achieved, would reduce global GHG emissions by 5 %. However, despite national strategies and public awareness campaigns, current progress remains insufficient to meet this goal (Lipinski, 2024). This suggests that information in itself is not enough; understanding how people interpret, negotiate and respond to information related to food

waste is also crucial.

Waste occurs in all stages of the food supply chain, from production to consumption. For instance, producers may need to throw away food due to overproduction or issues with product appearance or quality (Van Bommel and Parizeau, 2020). In developed countries, however, the majority of food waste occurs at the consumer level, where households account for more than half of total waste (Eurostat, 2024). On average, each individual discards 79 kg of food each year, an amount exceeding the body weight of an average adult (United Nations Environment, 2024). While the retail sector directly contributes to only 8 % of total food waste (Eurostat, 2024), it also plays an indirect communicative role by shaping consumers' preferences and purchasing behaviors through its marketing, labeling and packaging strategies (Aschemann-Witzel et al., 2023; Gruber et al., 2016). For instance, promotional strategies such as discounts on large packages may encourage over-buying, subsequently leading to avoidable food waste at home (Tsalis et al., 2021).

As consumers' primary point of contact with the product both in-store and at home, packaging plays a crucial yet often overlooked role

^{*} Corresponding author: Parkstraat 45, bus 3603, 3000 Leuven, Belgium.

E-mail addresses: lotte.hallez@kuleuven.be (L. Hallez), louise.glenisson@kuleuven.be (L. Glenisson), hannah.boen@kuleuven.be (H. Boen), tim.smits@kuleuven.be (T. Smits).

<https://doi.org/10.1016/j.fufo.2026.100989>

Received 28 November 2025; Received in revised form 11 March 2026; Accepted 12 March 2026

Available online 14 March 2026

2666-8335/© 2026 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

in shaping how people perceive, use and relate to food (Hallez et al., 2020). Despite its central position, research on packaging has received little attention compared to studies focusing on behavioral determinants of food waste, such as household routines and meal planning (Chan, 2022). This research gap is noteworthy, given that packaging (unlike deeply ingrained consumer routines) offers more direct opportunities for change through design innovations or policy initiatives related to packaging. It is estimated that packaging causes between 20 % and 25 % of total consumer food waste (Williams et al., 2012), and a recent review identified date labeling and large package sizes as the two main features contributing to this food waste (Chan, 2022). Consumers rely particularly heavily on packaging for product categories they perceive as sensitive, such as dairy (Anthesis, 2018; Parker et al., 2024). Consequently, the most effective interventions proposed for reducing dairy waste involve improved date labeling and adjusted package formats (Wikström et al., 2019; Wilson et al., 2017). To successfully develop and implement these interventions, it is essential to understand how consumers interact with and perceive both date labels and package sizes for dairy products. Since some other packaging cues can play an important role in how consumers manage date labeling and package sizes (e.g., resealable features may help avoid waste associated with large packages), it is important to also consider how consumers experience these related elements.

While the influence of packaging on consumer behavior is increasingly recognized, not much is known about how consumers interpret, understand and use specific packaging cues in their everyday food practices (Brennan et al., 2023). Most existing studies rely on quantitative methods, such as surveys that capture self-reported attention, awareness and behavior related to packaging (Llagas et al., 2025; Mahmoudi et al., 2025). However, qualitative research is crucial to understand the interpretative processes underlying these outcomes (Langley et al., 2021). Interventions related to date labeling and package size may help mitigate dairy food waste, but their success depends on consumer acceptance and recognition of their benefits. To address this, the present study adopts a qualitative approach incorporating photo-elicitation, an innovative method in which photos are incorporated into research interviews (Harper, 2002). Earlier studies have shown that this technique helps researchers gain more specific insights into how consumers perceive and use packaging by giving them concrete images that facilitate and stimulate discussion (Chu et al., 2022; Srinivasapura Venkateshmurthy et al., 2021). This approach is particularly useful in our study, as the photos help participants reflect on their use and understanding of specific packaging cues, specifically date labeling and package size, related to dairy products. Our study has three core objectives:

1. To understand consumers' attention to, attitudes toward, and behavior related to date labeling and package size.
2. To explore the considerations and trade-offs consumers face when making decisions regarding packaging and food waste.
3. To identify consumers' recommendations for improving date labeling and package size to minimize food waste.

Thus, this study makes several important contributions to the field. First, it offers a much needed qualitative understanding of how consumers use and interpret packaging cues that are known to influence waste (i.e., date labeling and package size). Second, it provides recommendations from consumers to improve these packaging cues, thereby supporting the development of interventions aimed at reducing dairy waste. Finally, it demonstrates the value of photo-elicitation as a methodological tool, showing how visual prompts can help participants articulate their experiences and reflections in qualitative research.

2. Literature review

Household food waste is a complex issue shaped by multiple factors,

including product characteristics and packaging design. Although many studies have investigated food waste at the household level, relatively few have examined how packaging shapes consumer purchase and waste behavior within specific product categories. Targeting specific food groups can provide actionable insights, as consumer decision-making processes vary across categories (Parker et al., 2024). To achieve meaningful reductions in overall food waste, it is strategic to prioritize categories with a high contribution to greenhouse gas (GHG) emissions. Dairy products represent one such category, as they possess a significant GHG footprint and are frequently purchased and wasted by consumers (Sala et al., 2023). Dairy is considered a high-risk product category, which means that consumers are often careful or skeptical about the safety and quality of these products (Melgaard et al., 2024; Neubig and Roosen, 2024). Compared to low-risk categories (e.g., bread, fruits and vegetables), consumers have been found to rely more strictly on packaging (e.g., date labeling) to evaluate dairy, contributing to unnecessary food waste (Parker et al., 2024). Dairy has been identified as the product category in which packaging exerts the greatest influence on food waste (Williams et al., 2020). Several packaging-related factors contribute to dairy waste, such as when packages are too large or difficult to empty. However, date labelling appears to be the main contributor to dairy food waste, specifically when consumers discard dairy due to passing its 'best before' date (Chan, 2022; Williams et al., 2020). As a result, innovations such as improved date labelling and information accompanying date labelling are considered promising strategies for reducing dairy waste (Wikström et al., 2019).

2.1. Date labeling

Labeling plays an important role in informing consumers and promoting the safe and sustainable consumption of food products. In the European Union (EU), Regulation No 1169/2011 requires all packaged products to display a 'best before' or 'use by' date label (European Commission, n.d.). Crucially, these two labels communicate distinct information. The 'best before' date is a quality indicator, meaning that the product remains safe to consume after this date, though quality may decline. In contrast, the 'use by' date is a safety indicator, beyond which the product should not be consumed due to potential health risks (European Court of Auditors, 2024).

It is important to explore consumers' understanding of and attitudes towards these date labels, as this can impact their purchase, consumption and waste behaviors related to dairy. Previous studies indicate that consumers frequently misunderstand or misuse date labels. Survey studies show that a significant percentage of European consumers do not understand the distinction between 'best before' and 'use by' dates. Specifically, confusion was reported by 30 % of survey respondents in Belgium (Van Boxstael et al., 2014), over 50 % in Poland (Zielińska et al., 2020) and 25 % across a wider European sample (Cliceri et al., 2025). This lack of clarity, coupled with negative attitudes toward dairy products past their 'best before' date (Neubig and Roosen, 2024), can lead consumers to discard dairy products that are still safe to consume (Melgaard et al., 2024; Szenderák et al., 2025). These issues with date labeling are severe, as they are estimated to cause up to 10 % of consumer food waste in the EU (Anthesis et al., 2018).

In response to the widespread confusion and misinterpretation of date labels, the EU has announced that they will revise date labeling as part of its Farm to Fork Strategy (European Commission, 2020). However, concrete action is lagging, possibly due to insufficient evidence on effective interventions (European Parliament, 2024). The primary focus of their revision is to adjust the terminology, format and visual presentation of the 'best before' date to enhance consumer clarity. One proposed intervention involves incorporating references to 'look, smell, taste', encouraging consumers to use their senses to evaluate products past their 'best before' date (Consumers, Health, Agriculture and Food Executive Agency, 2021). These so-called 'Look, Smell, Taste' (LST) labels are already becoming increasingly common on (dairy) food

packaging, although their use remains largely voluntary and is often driven by brands adopting the version developed by the anti-food-waste company *Too Good To Go* (“[Too Good To Go Date Labelling | Look-Smell-Taste](#),” 2025). Despite their growing presence, there is limited empirical research on consumers’ attitudes toward LST labels. As research indicates that they may not effectively change consumer behavior for dairy products (Wallnoefer et al., 2024), more insights on consumers’ relationship with these labels is needed. More broadly, insights are needed into consumers’ perspectives and recommendations for improving date labeling, particularly in the context of the ongoing EU revisions.

2.2. Package size

In addition to date labeling, package size is widely recognized as a significant contributor to consumer food waste (Chan, 2022; Wikström et al., 2019). Oversized packages often result in avoidable food waste, as consumers purchase more than they can consume before the product spoils. Retailers influence this dynamic by promoting bulk purchases and offering lower unit prices for larger packages. Research shows that such promotional strategies for large packages often correlate with increased household food waste (Tsalis et al., 2021). Consumers may also choose larger packages for practical reasons, such as convenience or the reassurance of having sufficient food at home (Ghosh, 2017). Nevertheless, research suggests that some consumers are aware of their own responsibility in managing food waste and acknowledge the importance of making mindful decisions in-store (Aschemann-Witzel et al., 2023). Anticipating that large (dairy) packages may lead to waste, some consumers adjust their purchasing behavior by opting for smaller, more appropriate package sizes (Petit et al., 2020).

Recognizing the link between package size and food waste, several innovations have been proposed including smaller packages, resealable designs and multi-portion formats. Smaller packages allow consumers to purchase quantities that better match their consumption needs, thereby reducing the likelihood of spoilage (Wikström et al., 2019). Resealable designs help preserve product freshness after opening larger packages, extending shelf life and thus reducing household food waste (Chan, 2023). Multi-portion formats, where larger packages are made of individually sealed portions such as single-serve yoghurts, can also prevent spoilage because only part of the product is opened at a time (Frojan et al., 2023). These packaging innovations are particularly effective for perishable items such as dairy, where perceived freshness and safety play a critical role in consumption decisions (Parker et al., 2024). However, their success depends on consumer acceptance, which can be shaped by trade-offs and perceived costs.

One key consideration or trade-off concerns package size and product price. Because larger packages are usually sold at a lower price per unit, consumers often perceive them as offering better value for money (Kim et al., 2024), leading to a preference for larger package size. At the same time, consumers are aware that larger packages may lead to greater waste (Wilson et al., 2017), which can encourage them to shift to smaller packages (Petit et al., 2020). Another important trade-off involves the relationship between food waste and packaging waste. Many innovations, such as multi-portion or resealable packaging, include using additional (typically plastic) materials to maintain product freshness. For high GHG products such as dairy, this is a good strategy, because the environmental burden of food waste is higher than that of the packaging waste (Wikström et al., 2019). However, many consumers tend to see this the other way around (Brennan et al., 2023; Langley et al., 2021), which can complicate sustainable decision-making. More nuanced insights are needed to understand how consumers balance these conflicting considerations, and the consequences that this has for their behaviors.

3. Methods

3.1. Participants

Participants were recruited through the researchers’ personal networks and subsequent snowball sampling. Two members of the research team reached out to eligible participants and carried out the interviews. To be eligible, individuals had to be over 18 years old, be actively involved in their household’s shopping and frequently consume dairy products. Interested individuals completed a short registration form that screened for eligibility and provided information about the study’s purpose. A total of 37 individuals registered who met the eligibility criteria, of whom 33 then started and completed the study. This sample size is comparable to (and somewhat larger than) other photo-elicitation studies in the field (Chu et al., 2022; Srinivasapura Venkateshmurthy et al., 2021). Data saturation was achieved, as no new themes emerged in the final interviews.

An overview of the participants and their socio-demographic information is available in the appendix (see [Table A1](#)). The sample consisted of 27 women and 7 men, with ages ranging from 23 to 60 years ($M = 34.4$, $SD = 10.8$). All participants lived in Flanders, Belgium. Their household situation varied: most participants lived with a partner, either with children also living in the home ($n = 11$) or without children ($n = 12$). The remaining participants lived alone ($n = 5$), with their parents ($n = 3$), with friends ($n = 1$), or in a single-parent household with children ($n = 1$).

3.2. Participant-driven photo-elicitation

This study used a Participant-Driven Photo-Elicitation (PDPE) method. PDPE is a qualitative method in which participants document aspects of their everyday lives through photographs, which then serve as concrete reference points during interviews. Participants receive guidelines for taking and submitting photos, after which the researcher selects images that will support the interview process. Compared with traditional interviews or focus groups, PDPE improves the quality and reliability of qualitative data because the images provide concrete reference points and facilitate better memory recall (Harper, 2002). It also allows participants’ own environments and interactions to shape the conversation, going beyond the researcher’s own frame of reference (Bates et al., 2017). PDPE has recently gained traction in consumer behavior research, including studies to understand consumer perceptions of packaged processed foods (Srinivasapura Venkateshmurthy et al., 2021) and the role of packaging in healthy eating (Chu et al., 2022). Consistent with PDPE guidelines (Bates et al., 2017), our research followed several steps: 1) participant briefing, 2) photo taking and sharing, 3) in-depth interviews with photo prompts and 4) data-analysis. A visual overview of our study procedure can be found below in [Fig. 1](#).

3.3. Procedure

Following participant recruitment, we initiated the briefing. Individuals who completed our registration form were contacted via email and invited to an online introductory session (via Microsoft Teams) with a member of the research team. After informed consent was obtained, participants received both oral and written instructions for the PDPE task. The materials for this study (including the photo task instructions) are available on the [Open Science Framework \(OSF\)](#). Participants were asked to take photos of packaged dairy products over the course of one week, including milk, cream, cheese, yogurt, butter, and dairy-based desserts. Photos of dairy alternatives (e.g., plant-based milks and yogurts) were also accepted because some questions in the interview explored whether consumer thinking differs for these alternatives. Participants could photograph packaged items found at home and in stores, capturing both the front and back of the packaging. Products could be opened or unopened, as long as they were still in their original

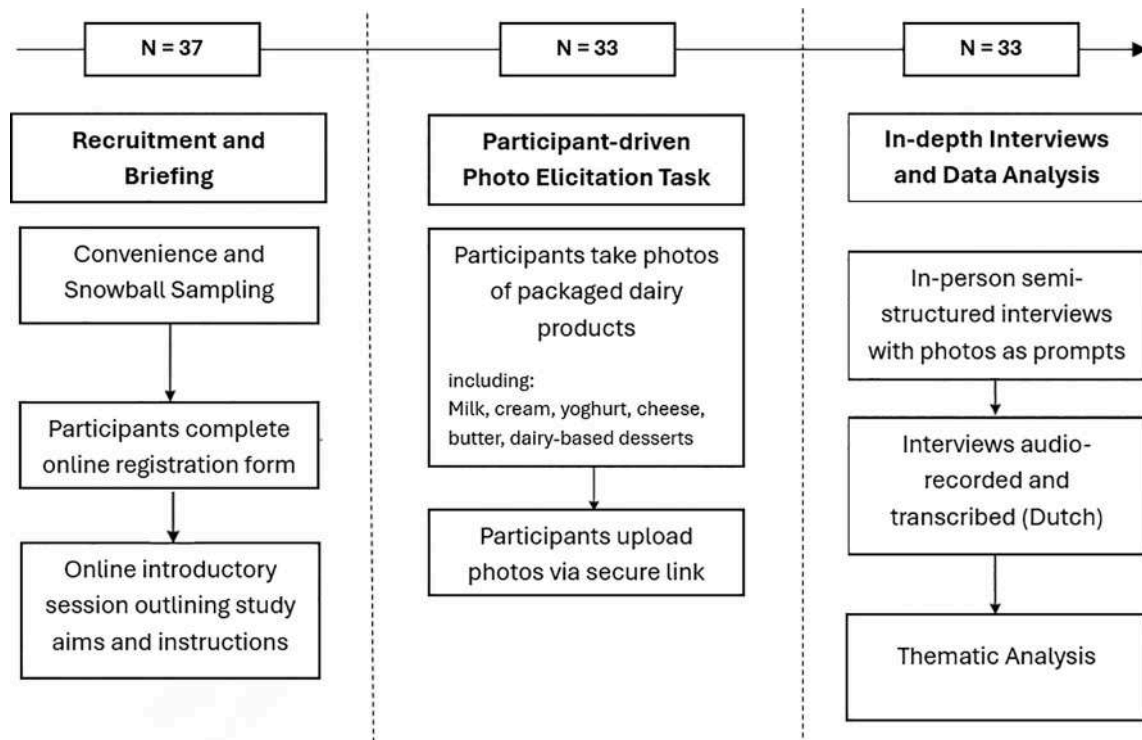


Fig. 1. Visual overview of the study procedure.

packaging. Participants uploaded their images to a secure folder through a personal online link. They shared 48 products on average over the course of the week and provided multiple photos for each product. After the photo task, the research team selected relevant images from each participant's collection to be used as prompts during the interviews.

Participants took part in an in-person interview with a member of the research team, typically within one week of completing the PDPE task. The interviews took place between March and May 2024. Each interview was conducted face-to-face at a location where the interviewee indicated to feel most comfortable, and lasted 60 min on average. The interviews followed a semi-structured format. A similar interview guide was used across participants, but their own photos were incorporated into a slideshow to support and facilitate the discussion. For instance, when discussing date labels, participants were shown photos of date labels they had taken themselves. When relevant cues were not present in a participant's own photo collection (e.g., LST label), images from other participants were occasionally used to facilitate discussion of these elements.

The interviews began with a general discussion of participants' views on sustainability and food waste (e.g., "How do you feel towards food waste?"), their buying and storage behaviors related to dairy (e.g., "Do you keep dairy products in their original packaging in the fridge?"), followed by a more focused exploration of packaging. The interview guide included questions on date labeling and package size, as well as related innovations, such as LST labels, multi-portion packaging and resealable packaging. In line with research objective 1, we assessed participants' attention to, attitudes toward, and behaviors regarding these packaging cues. Each time a packaging cue was introduced, a corresponding slideshow with photo prompts was displayed to structure and support the discussion. Some questions relied directly on the photo prompts (e.g., "I have here photos you uploaded showing a 'best before' and 'use by' label. What do you think each of these labels means?"; "How clear do you find this information on the packaging?"). Other questions were not explicitly tied to the images but were discussed with the slideshow visible on the screen (e.g., "Do you pay attention to date labeling in-store?"). For research objective 2, we explored the considerations and

trade-offs consumers perceive when making decisions related to packaging and food waste (e.g., "What are your reasons for buying large packages in-store?"; "Do you prefer individual packages with more plastic, or larger packages that may leave leftovers?"). Regarding research objective 3, participants were asked for recommendations to improve these packaging cues (e.g., "Looking at these photos you uploaded, what recommendations would you make to improve these date labels on dairy packaging?"; "What do you think about offering a larger variety of packaging sizes in-store?").

The interview guide was adapted iteratively during the data collection process to incorporate specific points of interest raised by participants. Finally, part of the interviews included questions related to drivers and barriers of buying suboptimal dairy products in-store (e.g., in-store location, presentation, price promotions). These data are not reported here, as they pertain to a different research focus.

3.4. Data analysis

The interviews were audio-recorded and transcribed verbatim in Dutch by two research team members, in line with transcription guidelines provided by their university. During transcription, all identifying information was removed and replaced with pseudonyms (i.e., R1, R2, ...). Using NVivo 14, we carried out a thematic analysis on all interview transcripts to identify, analyze and report recurrent patterns and themes. One member of the research team (the first author) carried out the primary coding, generating an initial codebook. This codebook was subsequently reviewed and refined by two other team members to enhance reliability and reduce individual bias. We followed common steps for thematic analysis (Ahmed et al., 2025; Braun and Clarke, 2006). First, the first author familiarized themselves with the data through careful reading of the transcripts. Then, they generated initial codes inductively from the data, and subsequently structured them into broader themes and subthemes. This resulted in an initial codebook with (sub)themes, code names and code descriptions. This preliminary codebook was then discussed with two other team members to evaluate the clarity and distinctiveness of themes and codes. As a result, some

subthemes and codes were removed (e.g., “importance of packaging cues in-store,” which overlapped with existing codes). Finally, the codebook was further refined through collaborative discussions among the three research team members. The final version of the codebook is available on OSF.

4. Results

4.1. Consumer responses to date labeling

This section examines how participants engage with date labels on dairy products. Table 1 provides a selection of photos and quotes illustrating key patterns.

We begin by presenting our findings related to research objective 1 (understanding consumers’ attention, attitudes, and behavior) and research objective 2 (exploring consumer considerations and trade-offs). Many participants reported checking date labels in-store. They explained that they check labels to select dairy products with the furthest expiration date. As one participant noted: *“In that sense, I am like the typical Flemish person who checks the expiration date and reaches to the back of the shelf”* (R26; male, 31 years). Aside from indicating a personal preference, this comment also highlights a descriptive social norm surrounding the preference for dairy products with a longer shelf life. However, this preference was not universal across all products. Participants mostly check date labels for dairy products that they use less frequently (e.g., cheese, cream) or intend to use at a later date, as one participant noted: *“if I’m making a dish with cheese on Sunday and I’m going to the store on Monday, I know the cheese still needs to be good for another seven days. So then I’ll have a look at the date”* (R16; female, 26 years). In contrast, participants are less likely to check labels for dairy products that they consume frequently (e.g., milk, yoghurt), generally have a long shelf life or that they intend to use shortly after purchase, as they are more confident that these items will be consumed in time.

At home, most participants considered expiration dates to be less important. They indicated that they still check date labels, but don’t strictly adhere to them. For dairy products that have been opened or that have passed their printed expiration date, participants rely mostly on their senses (i.e., sight, smell, taste) to assess whether products are still edible. As one participant explained: *“I just look at the date, and even then I don’t strictly follow it. If it still looks and smells good, I’ll base myself more on that rather than on the date alone”* (R4; female, 25 years). This was echoed by another participant: *“If it’s within a week or two after that date, I’m definitely going to rely more on my senses than on the fact that the date has passed”* (R28; female, 36 years). Participants described a sequential approach: first checking appearance, then smell, and only tasting if these aspects were acceptable. As one participant explained: *“By the time I actually taste it, it looks good, it smells good. It’s not like I really let the date guide me”* (R32; male, 32 years). In contrast, participants generally trusted unopened products that were still within their expiration date, relying on the label rather than performing a sensory check.

When shown the two types of date labels, i.e., ‘best before’ and ‘use by’, most participants could correctly explain their meanings, though many needed a moment to reflect. One participant illustrated this thought process: *“Best before. Yeah, Okay. ‘Use by’... How does that go again? It’s not the same, right, but I can’t remember at the moment. Yes, ‘use by’ is, I think, really the last day. Yes. Yes. ‘Best before,’ you can maybe take a bit more leeway, a little more margin.”* (R10; male, 37 years). Despite understanding the difference, participants reported paying little attention to these phrases on dairy packaging: *“I know that there is a difference, but I don’t actually look at the text above the date”* (R31; female, 44 years). As a result, participants tend to treat both labels as flexible guidelines, although they acknowledged that ‘use by’ dates allow for less flexibility. One participant noted that they would still consume a product *“one day after passing the ‘use by’ date, if it still looks and smells fine, and if I know that I have been storing it correctly”* (R7; female, 27 years), whereas many said they would eat dairy products weeks past the ‘best before’ date if

they appeared acceptable. Attitudes toward the potential health risks of consuming dairy after the ‘use by’ date varied. Some felt relaxed due to past experience: *“I have things at home that say ‘use by’. Then you open it. And then... I’m still going to eat it. And I’m telling you, I’ve never died”* (R7; female, 47 years). Others were more cautious, citing negative health experiences like food poisoning as reasons to adhere strictly to the label. See Table 1a for photos and complementary quotes from participants related to the ‘best before’ and ‘use by’ date labels.

Overall, participants expressed a complex and often frustrated relationship with date labels, believing they contribute to food waste. This was observed in two distinct ways. First, consumers’ tendency to check date labels in-store and select products with the longest shelf life means that *“items that need to be consumed sooner are left behind and ultimately thrown away”* (R15; female, 23 years). Second, participants believed that while they themselves would consume dairy products beyond the ‘best before’ date, most other consumers would not. As one participant noted: *“I am convinced that many people adhere strictly to that date and will, for that reason, no longer use the product”* (R4; female, 25 years). This perception often led to frustration, with one participant admitting, *“I even get a little angry that people throw something away just based on that date. I really can’t deal with that very well”* (R30; female, 52 years). While most participants acknowledged the value of ‘best before’ labels as a guideline, they also viewed them as conservative and indicated that they should not replace common sense: *“It is good that it was introduced, but it is still up to the consumer to decide how they deal with it. It is useful, but you should not use it too literally”* (R33; male, 60 years). Frustration with date labels was also linked to their presentation on packaging, with small fonts and inconsistent placement making them difficult to use (see Table 1b).

We now turn to our findings related to research objective 3 (identifying consumers’ recommendations). Participants offered several recommendations to improve date labeling. They emphasized that labels should be easier to locate, using larger fonts and consistent placement, ideally on the top of the product. Participants also reacted positively to the ‘Look, Smell, Taste’ (LST) label when it was shown during the interview (see Table 1c). Participants believed that this label would validate their own practice of using sensory checks: *“For me, it does feel safer to consume a product when it says ‘still safe after the expiration date.’ Then I think: ‘it still tastes fine, nothing bad is likely to happen.’”* (R22; female, 27 years). They also felt it could positively influence other consumers to use their senses more often. As one participant explained, *“If the supplier were to say that the ‘best before’ date is just a guideline and that consumers should check the product’s appearance... I believe this would influence consumer behavior, and it would certainly work for me.”* (R27; female, 30 years). Despite this enthusiasm, most had never noticed the LST label before and doubted its real-world visibility: *“I don’t think many people look at a yogurt tub and think, ‘what’s actually on the packaging?’ Because it’s already so full”* (R13; female, 24 years). Participants suggested placing the LST label more prominently and supporting it with a government awareness campaign. One participant proposed using more engaging visuals, such as a *“cartoon figure smelling and laughing”* to make the message stand out (R7; female, 47 years).

4.2. Consumer responses to packaging size

This section explores how participants relate to package size for dairy products. Table 2 presents a selection of participant photos and quotes that reflect key considerations.

We begin again by presenting our findings related to research objective 1 (understanding consumers’ attention, attitudes, and behavior) and research objective 2 (exploring consumer considerations and trade-offs). All participants reported paying attention to package sizes in-store, taking the needs and habits of their household into account. As one participant explained: *“I stop and think, ‘are we really going to eat all of this in the next couple of weeks?’ And if not, I’ll choose a smaller size”* (R29; female, 44 years). However, some participants expressed

Table 1a
Participant photo(s) and quotes related to ‘best before’ and ‘use by’ date labels.




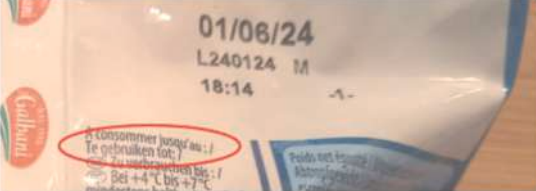


Participant photo(s)	Participant quotes
 <p>‘Best before’ date label</p>	<p>“For dairy products, if it still tastes good, I’ll always eat it, even if it’s past the ‘best before’ date” (R21; female, 26 years).</p> <p>“I support the ‘best before’ label, but it should be more clearly different from ‘use by’” (R16; female, 26 years).</p>
 <p>‘Use by’ date label</p>	<p>“People don’t actually read that. They just look at the date” (R21, female, 26 years).</p> <p>“Those products with a ‘use by’ date, you might be a bit more cautious if they’re a few days past that date. But again, it’s a matter of opening them, then tasting and smelling. I would still eat them.” (R32; male, 32 years)</p>

Table 1b
Participant photo(s) and quotes related to practical frustrations with date information.

Participant photo(s)	Participant quotes
	<p>“What bothers me most is that you often have to search for a long time. Where is it here? You have to look at it from all sides. It’s not in the most logical place. With another product it is again in a different place.” (R7; female, 47 years)</p>
	<p>“But putting that in such a small print. Who’s going to read that?” (R10; male, 37 years)</p>
	<p>“They’re all noted in different ways. A dot in between, a dash in between, sometimes there’s a code after it, and sometimes you just think, ‘is that the production code now?’ I find it very confusing.” (R3; female, 52 years)</p>

frustration that certain products are only sold in large sizes, leaving them feeling forced into purchases that might lead to waste. Price also

Table 1c
Participant photo(s) and quotes related to LST labels.

Participant photo(s)	Participant quotes
 <p>'Look, Smell, Taste' label</p>	<p>"I think with those icons there, I think eventually they'll become recognizable; you'll see them from a distance, and I think that's a good campaign. I think it's great, to be honest, I just haven't paid attention to it yet." (R10; male, 37 years)</p> <p>"I like that icon. It's more accessible to different age groups and just a larger part of the population." (R15; female, 23 years)</p>

seemed to be an important factor. For many participants, larger packages were seen as more cost-efficient. As one person mentioned, "I often look at the price per volume, and the bigger you go, the better the deal" (R26; male, 31 years). When asked about the trade-off between price and food waste, participants showed mixed responses. Most stated that they prefer to buy a smaller, more expensive package to avoid waste, citing the shame and financial cost of throwing food away. Others, however, would choose larger packages if they believed waste would be minimal: "We often choose a large package if we think we can consume it with minimal waste" (R20; male, 25 years). They acknowledged that large, cheaper packages are "tempting," even though they try to avoid them (R18; female, 25 years). Participants perceived a broader social norm where other consumers would likely prioritize the larger, cheaper option: "Of course people are going to look at the price, right. And if it's in a large package... and you can't finish it, well, that's food waste" (R12; female, 27 years). See Table 2a for photo(s) and complementary quotes from participants related to large packaging.

Participants also discussed the advantages and disadvantages of larger packages made up of multiple sealed portions (i.e., multi-portion packaging) (see Table 2b). They recognized that the individually sealed portions help reduce food waste, as unopened portions stay fresh longer. One participant noted, "If it's still fully sealed, we're quicker to think, 'that's still good.' So... I'll usually throw away less" (R20; male, 25 years).

Table 2a
Participant photo(s) and quotes related to large package sizes.




Participant photo(s)	Participant quotes
	<p>"If I buy a big tub of yogurt like this, I always think for a moment, 'okay, what do the next few days look like for me? Will I finish it?' Otherwise, it will go bad. It usually works out, but it is really difficult, because sometimes a big package is even cheaper than a small one." (R17; female, 25 years)</p> <p>"In the past, we used to buy larger tubs of yogurt for financial reasons, and as a result, we ended up wasting much more." (R29; female, 44 years)</p>

Table 2b
Participant photos and quotes related to multi-portion packaging.

Participant photo(s)	Participant quotes
	<p>"It's better if multi-packs are offered, because they stay fresh longer. You don't open all the packages at once, but you still have the same amount." (R4; female, 25 years)</p> <p>"But on the other hand, okay, that might help with food waste... but it's not exactly ecological either, because it means more plastic." (R15; female, 23 years)</p> <p>"With all those individual wrappings, I find that such excessive packaging. I wouldn't buy that either; I think that's overpackaging, really. I am not that enthusiastic about it" (R33; male, 60 years)</p>
	

However, at the same time, nearly all participants raised environmental concerns about the increased packaging waste. As one person described this dilemma, "The biggest disadvantage is the environment. A lot of plastic, much more packaging. It's a trade-off, isn't it: throwing away less, but using more packaging" (R26; male, 31 years). When asked about this trade-off, most participants prioritized avoiding packaging waste over reducing food waste, viewing the environmental impact of packaging as more severe. One participant explained their view: "It's a huge waste of food, but that food is biodegradable, and the problem is gone in a week. Creating extra packaging waste where it's not needed; I think that's even worse" (R32;

male, 32 years). Overall, many participants appeared to underestimate the ecological impact of food waste, with some admitting they lacked knowledge on the topic and would like more information to make better decisions.

Turning to research objective 3 (identifying consumer recommendations), some participants suggested that stores should provide a wider variety of package sizes for dairy products, especially smaller formats for single-person households that struggle to finish standard packages before they expire. As one participant explained: *“It allows people to choose. They can assess their own household and determine which packaging best suits their lifestyle. Yes. I find that to be a very positive thing”* (R4; female, 25 years). Others, however, worried that expanding the range of sizes could increase food waste at the retail level. Participants also discussed the potential benefits of resealing systems (e.g., adhesive strips, zippers) for large packages. While participants recognized that resealable packaging can help reduce food waste, it is not a key factor in their purchase decisions: *“I will never think: I am going to purchase this because I can reseal it. When I open it at home, I might think that it is convenient. But I’ll find another method to seal it if I need to”* (R5; female, 26 years). At home, most participants use their own materials (e.g., rubber bands, food clips) to keep dairy products fresh and avoid food waste. Opinions on existing resealing systems were mixed, with some (e.g., plastic lids) seen as useful and others (e.g., adhesive stickers) viewed as inconvenient (see Table 2c).

5. Discussion




The present study aimed to deepen our understanding of how packaging shapes consumers’ purchase, consumption and in turn their food waste behaviors. Specifically, it examined consumers’ responses toward two packaging features commonly identified as contributing to food waste: date labeling and package size (Chan, 2022). In doing so, the study also examined how consumers navigate the trade-offs and meanings associated with these features and offered their perspectives on how they can be improved to minimize food waste.

First, our research sheds light on consumers’ attention to date labels and the consequences for food waste. Participants reported checking date labels in-store, mostly to select products with the longest remaining shelf life, especially for items used less frequently. This reflects a common preference for ‘optimal’ over ‘suboptimal’ products (i.e., those nearing their expiration date) among consumers (Aschemann-Witzel, 2018; Llagas et al., 2025). There was also a perceived social norm surrounding these products, as many participants believed that others also favor items with longer shelf life. Such perceptions are important, as social norms are known to influence individual decision-making, consistent with frameworks like the Theory of Planned Behavior (Ajzen, 1985; Ravis and Sheeran, 2003). In this context, the belief that others prefer optimal dairy products may strengthen one’s own tendency to do the same. Importantly, this collective preference shifts the burden of food waste to retailers, who need to discard products left behind on store shelves. To tackle this issue, research should investigate the strategies that retailers can use to promote the purchase of suboptimal dairy products among consumers.

At home, participants indicated relying more on sensory evaluation than date labels to assess edibility. This contrasts with evidence that consumers often discard food that is still safe to eat because the indicated date has passed (Szenderák et al., 2025), especially for high-risk products such as dairy (Parker et al., 2024). In our study, many participants expressed a more relaxed attitude, and were willing to consume these products as long as they passed a sensory check. At the same time, they believed that other consumers likely follow date labels strictly, contributing to unnecessary food waste. This seems to reflect a Third Person-Effect (Perloff, 1999), in which individuals see “others” as being more influenced by certain cues (in this case, date labels) than themselves. It is possible that participants underestimated how much food they actually discard and the extent to which they are influenced by date

Table 2c

Participant photos and quotes related to resealable packaging.

Participant photo(s)	Participant quotes
	<i>“I think it’s pretty nice that it has a closure, but sometimes that also makes it a lot more expensive. And then I think: I’d maybe rather throw away the bit that ends up expiring than pay three times as much.”</i> (R29; female, 44 years).
	<i>“An adhesive system, that rarely works well. But it’s good that it exists. But... those packs of cheese. I’ve never opened one where it actually worked.”</i> (R17; female, 25 years) <i>“I think it’s good that they are experimenting with it, but they’re not all really that great.”</i> (R28; female, 36 years)
	<i>“What’s also useful is that when something is open, I use those clips.”</i> (R29; female, 44 years) <i>“My fridge is actually full of those little clips. I have them lying around, so I use them to close my cheese. And then I feel like it will stay good a bit longer.”</i> (R18; female, 24 years)

labels. Consistent with their perception, participants responded positively to the concept of ‘Look, Smell, Taste’ (LST) labels on dairy packaging, which they believed could reinforce confidence in their own good practice of sensory evaluation and encourage similar behavior in others.

Furthermore, our study provides more insight into consumers’ understanding of ‘best before’ and ‘use by’ labels, which are mandatory on EU packaging. Previous surveys suggest that 25–30 % of consumers struggle to distinguish between the two (Cliceri et al., 2025; Van Boxstael et al., 2014). In our qualitative study, most participants were able to explain the meaning of both labels, although they often needed a moment to reflect on the distinction. This suggests that the difference was not immediately intuitive and may require cognitive effort to articulate. Given the qualitative nature of our study, these findings should not be interpreted as representative of the wider population. Rather, they offer a deeper insight into how consumers reflect on and articulate their understanding of date labels. Our findings suggest that the key issue with these labels may not be comprehension but attention: while many participants could explain the distinction, they admitted looking mostly at the date and not so much to the accompanying text.

This aligns with eye-tracking research showing that consumers attend more to the numeric date than to the phrasing (Badiger et al., 2023) and conclusions from a review that the date exerts greater influence on decision-making (Szenderák et al., 2025). In light of ongoing EU revisions of date labeling (Consumers, Health, Agriculture and Food Executive Agency, 2021), our findings suggest that rather than revising label wording, innovations that help consumers quickly and clearly interpret date information (e.g., by using visual cues) may be more useful. Participants also indicated that they prefer a consistent placement and bigger font for date information on product packaging.

Turning to packaging size, participants recognized the link between large packages and food waste. While most participants try to avoid large packages that would likely result in (excessive) food waste, consistent with previous findings that anticipated waste can discourage purchase (Petit et al., 2020; Wilson et al., 2017), they also noted the strong appeal of larger packages for their perceived cost-efficiency. Similar to previous findings (Kim et al., 2024), participants explained that larger packages often offer a lower unit price, creating a tension between financial considerations and the desire to minimize waste. Most participants explained that they prefer to buy smaller, more expensive packages to avoid waste or will choose larger ones only when anticipated waste is minimal. However, previous research among Belgian consumers suggest that price considerations can sometimes outweigh motivations for more sustainable choices (Hallez et al., 2024). A Third-Person Effect also appeared in our study, as participants believed that most “others” would buy larger (cheaper) packages resulting in food waste. This Third-Person Effect may indicate that participants underestimate the effect of large packages on themselves, or overestimate the impact on others (Perloff, 1999).

Another prominent trade-off involved food waste versus packaging waste. While participants recognized that some innovations (e.g., multi-portion packages) can help reduce food waste, they also expressed concern about the additional (plastic) materials required for these innovations. Many valued the extended freshness provided by individual portions but were simultaneously worried about plastic waste. Participants in our study generally perceived (plastic) packaging waste as a greater environmental problem than food waste, consistent with previous findings (Brennan et al., 2023; Langley et al., 2021). However, for high-impact products like dairy, the environmental impact of food waste actually exceeds that of packaging (Heller et al., 2019; Wikström et al., 2019). This perception may discourage consumers from choosing more sustainable options designed to minimize waste.

Participants proposed several practical solutions to minimize food waste from large packages, including offering a wider variety of package sizes and improving resealable features. Participants also acknowledged potential downsides of such innovations, for instance that a wider variety of package sizes would increase waste at the retailer side. Although resealable packaging was seen as useful to reduce food waste, they were not decisive in the participants’ purchasing decisions. Participants expressed various barriers, such as opinions that some types of resealable packaging were clumsy or not worth the extra cost. This is noteworthy given that resealable packaging has strong potential to prevent food waste by maintaining product freshness (Chan, 2022). These findings suggest that future packaging innovations should focus on improving the usability and perceived value of resealable features to overcome consumer skepticism and enhance their adoption.

5.1. Limitations and suggestions for future research

While this study offers valuable qualitative insights into consumers’ relationships with food packaging and food waste, several limitations should be acknowledged. First, the sample composition presents a limitation. The study included a higher proportion of women than men, which may have influenced the perspectives shared during interviews, for instance because women tend to show stronger motivation to reduce food waste compared to men (Brennan et al., 2023). In general, people

with a stronger interest in the research topic may have been more likely to participate, potentially shaping the composition of the sample. Moreover, the study focused exclusively on consumers living in Belgium, making the findings specific to the European cultural and regulatory context. This is relevant because packaging practices (e.g., date labeling) vary across regions, and cultural factors also shape consumers’ food waste behaviors (Heng and House, 2022). Future research could extend this work by exploring how consumers in other countries or cultural contexts perceive and interact with packaging, providing a comparative qualitative perspective on date labeling and package size. Such studies could also include more vulnerable consumer groups, such as individuals with lower socioeconomic status, who are often underrepresented in studies assessing sustainability topics (Boen et al., 2025).

Additionally, participants were recruited through the researchers’ personal networks, meaning that many interviewees had some type of rapport with the interviewers. While this rapport facilitated recruitment and encouraged open discussion, the interviewers remained attentive to potential bias to ensure that participants’ responses reflected their genuine experiences rather than social desirability.

Finally, the study’s focus on dairy products limits the transferability of findings to other food categories. Consumers often pay closer attention to packaging when dealing with high-risk products such as dairy, relying on it more heavily in their purchasing and disposal decisions (Anthesis et al., 2018; Parker et al., 2024). Future qualitative research could investigate these dynamics across a broader range of food categories to better understand how packaging influences consumer behavior in diverse contexts.

5.2. Implications

The present study offers valuable insights into how packaging shapes consumer behavior and food waste, drawing on in-depth interviews supported by participant-driven photo-elicitation (PDPE). Methodologically, the study demonstrates the value of PDPE for capturing participants’ real-world exposures and encouraging deeper discussion and reflection during interviews. This was clear in our data, as participants often used the photos as concrete examples to explain their thoughts. By asking participants to share photos from their everyday interactions with dairy products and to reflect on their decisions, PDPE generates rich insights that go beyond what traditional interviews, surveys or experiments typically reveal. At the same time, some difficulties or drawbacks of this method should be taken into account. First, the photos introduce an additional effort and time burden for participants, as they were asked to take photos for one week prior to taking part in the interview. This can complicate recruitment, as we also experienced during our research. Second, using photos may lead participants to reflect more deeply on certain elements than they would in everyday life. For instance, while most participants could not spontaneously explain the difference between “best before” and “use by” labels, after looking at the photos, many were able to articulate the distinction correctly. While PDPE has great value, future research should take these methodological considerations into account.

Beyond this methodological contribution, our study also offers valuable recommendations for policy and industry regarding packaging design. First, it provides insights into consumers’ understanding of and relationship with date labeling, which is especially relevant for ongoing policy initiatives, such as the EU’s revision of date labeling to reduce consumer confusion (European Commission, 2020). Most participants in our study were able to distinguish between ‘best before’ and ‘use by’ labels, but reported paying limited attention to this phrasing in their daily life. This is notable, as current policy efforts largely focus on revising this wording (Consumers, Health, Agriculture and Food Executive Agency, 2021). Instead, participants expressed more favorable attitudes toward ‘Look, Smell, Taste’ labels that encourage consumers to rely on their senses to evaluate products. Many participants particularly appreciated the visual aspect of these labels, noting that the pictograms

serve as useful reminders and see potential in enlarging their effect when combined with a broader information campaign through media channels. These findings suggest that sensory-based, visually oriented labeling may be a promising direction for future revisions. Given the limited empirical evidence on LST labels (Wallnoefer et al., 2024), more research is highly needed.

Second, our study highlights the role of package size in shaping consumer behavior. Participants were motivated to select appropriate package sizes to avoid waste, but faced conflicting motivations, as larger packages were seen as more cost-efficient. Retailers and manufacturers could support sustainable consumption by offering a broader range of package sizes or adjusting their price strategies, for instance promoting smaller packages at competitive unit prices. Participants recognized that resealable or multi-portion formats can further reduce waste, but there were also various obstacles to consider. Participants' preference to minimize packaging waste over food waste underscores the need for interventions and education that clarify the relative environmental impacts of food and packaging. Many participants even expressed interest in receiving such information to guide their purchasing decisions. These insights suggest that future strategies should address both the structural and informational aspects of packaging, ensuring that innovations not only reduce waste but are also perceived as practical and valuable by consumers.

Funding

This research was supported by funding from the European Union as part of the CUES project (grant number: 101136507). Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European

Appendix

Table A1

Table A1
Socio-demographic overview of participants ($n = 33$).

ID	Age	Gender	Household composition
R1	53	Female	Couple with children
R2	28	Female	Couple with children
R3	52	Female	Couple with children
R4	25	Female	Single-person household
R5	32	Male	Couple with children
R6	28	Female	Couple without children
R7	47	Female	Single-person household
R8	25	Female	Living with parents
R9	41	Female	Couple with children
R10	37	Male	Couple with children
R11	50	Female	Single parent with children
R12	27	Female	Couple with children
R13	24	Female	Living with parents
R14	31	Female	Couple with children
R15	23	Female	Living with parents
R16	26	Female	Single-person household
R17	25	Female	Other multi-person households
R18	24	Female	Couple without children
R19	49	Female	Couple without children
R20	25	Male	Couple without children
R21	26	Female	Couple without children
R22	27	Female	Couple without children
R23	27	Female	Couple without children
R24	25	Female	Couple without children
R25	29	Male	Couple without children
R26	31	Male	Couple without children
R27	30	Female	Couple with children
R28	36	Female	Single-person household

(continued on next page)

Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them. These funding bodies were not involved in the study design, collection, analysis or interpretation of the data.

Ethical statement

The protocol was reviewed and approved by the ethical review board of the authors' university (G-2023-7413-R2). Informed consent was obtained from all individual participants prior to data collection.

CRediT authorship contribution statement

Lotte Hallez: Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tine Bulcaen:** Writing – review & editing, Methodology, Investigation. **Louise Glenisson:** Writing – review & editing, Validation. **Hannah Boen:** Writing – review & editing, Validation. **Tim Smits:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors gratefully acknowledge Julie Decock for her valuable contributions to the study design and assistance with data collection.

Table A1 (continued)

ID	Age	Gender	Household composition
R29	44	Female	Couple without children
R30	52	Female	Couple with children
R31	44	Female	Couple without children
R32	32	Male	Couple without children
R33	60	Male	Couple with children

Data availability

The data that has been used is confidential.

References

- Ahmed, S.K., Mohammed, R.A., Nashwan, A.J., Ibrahim, R.H., Abdalla, A.Q., M. Ameen, B.M., Khdir, R.M., 2025. Using thematic analysis in qualitative research. *J. Med. Surg. Public Health* 6, 100198. <https://doi.org/10.1016/j.glmedi.2025.100198>.
- Ajzen, I., 1985. From intentions to actions: a theory of planned behavior. In: Kuhl, J., Beckmann, J. (Eds.), *Action Control: From Cognition to Behavior*, SSSP Springer Series in Social Psychology. Springer, Berlin, Heidelberg, pp. 11–39. https://doi.org/10.1007/978-3-642-69746-3_2.
- Anthesis, Brook Lyndhurst, ICF, WRAP, 2018. Market Study on Date Marking and other Information Provided on Food Labels and Food Waste Prevention. Publications Office of the European Union. https://food.ec.europa.eu/system/files/2018-07/fw_li_b_srp_date-marking.pdf.
- Aschemann-Witzel, J., 2018. Consumer perception and preference for suboptimal food under the emerging practice of expiration date based pricing in supermarkets. *Food Qual. Prefer.* 63, 119–128. <https://doi.org/10.1016/j.foodqual.2017.08.007>.
- Aschemann-Witzel, J., Randers, L., Pedersen, S., 2023. Retail or consumer responsibility?—Reflections on food waste and food prices among deal-prone consumers and market actors. *Bus. Strategy Environ.* 32, 1513–1528. <https://doi.org/10.1002/bse.3202>.
- Badiger, A., Katz, T., Simons, C.T., Roe, B.E., 2023. When considering whether to waste food, consumers focus attention on food label dates rather than phrases. *Waste Manag.* 168, 230–234. <https://doi.org/10.1016/j.wasman.2023.06.006>.
- Bates, E.A., McCann, J.J., Kaye, L.K., Taylor, J.C., 2017. Beyond words”: a researcher’s guide to using photo elicitation in psychology. *Qual. Res. Psychol.* 14, 459–481. <https://doi.org/10.1080/14780887.2017.1359352>.
- Boen, H., Glenisson, L., Hallez, L., Smits, T., 2025. Byte into sustainability: a scoping review of digital food environment attributes that shape consumers’ sustainability perceptions, attitudes, intentions, and behaviours. *Int. J. Behav. Nutr. Phys. Act.* 22, 132. <https://doi.org/10.1186/s12966-025-01832-6>.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* <https://doi.org/10.1191/1478088706qp063oa>.
- Brennan, L., Francis, C., Jenkins, E., Schivinski, B., Jackson, M., Florence, E., Parker, L., Langley, S., Lockrey, S., Verghese, K., Phan-Le, N., Hill, A., Ryder, M., 2023. Consumer perceptions of food packaging in its role in fighting food waste. *Sustain* 15. <https://doi.org/10.3390/su15031917>.
- Chan, R.B.Y., 2023. Drivers of divergent industry and consumer food waste behaviors: the case of recyclable and resealable packaging. *J. Clean. Prod.* 412, 137417. <https://doi.org/10.1016/j.jclepro.2023.137417>.
- Chan, R.B.Y., 2022. A review of packaging-related studies in the context of household food waste: drivers, solutions and avenues for future research. *Packag. Technol. Sci.* 35, 3–51. <https://doi.org/10.1002/pts.2611>.
- Chu, R., Tang, T., Hetherington, M.M., 2022. Attention to detail: a photo-elicitation study of salience and packaging design for portion control and healthy eating. *Nutr. Bull.* 47, 501–515. <https://doi.org/10.1111/nbu.12588>.
- Cliceri, D., Pedrotti, M., Endrizzi, I., Gasperi, F., 2025. European consumers’ involvement with date labels and implications for household food waste. *Food Qual. Prefer.* <https://doi.org/10.1016/j.foodqual.2025.105522>.
- Consumers, Health, Agriculture and Food Executive Agency, 2021. Consumer research study to identify new ways of expressing date marking that meet consumers’ information needs whilst minimising food waste. https://food.ec.europa.eu/system/files/2022-02/fw_eu_actions_dm_20211130_report_1.pdf.
- European Commission, 2020. Farm to fork strategy: for a fair, healthy and environmentally-friendly food system. https://food.ec.europa.eu/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf.
- European Commission, n.d. Mandatory food information [WWW Document]. https://food.ec.europa.eu/food-safety/labelling-and-nutrition/food-information-consumers-legislation/mandatory-food-information_en (accessed 6.3.25).
- European Court of Auditors, 2024. Special report 23/2024: food labelling in the EU. https://www.eca.europa.eu/ECAPublications/SR-2024-23/SR-2024-23_EN.pdf.
- European Parliament, 2024. Proposal for a regulation revising the rules on date marking (‘use by’ and ‘best before’ dates) on food products | legislative train schedule [WWW Document]. Eur. Parliament. URL. [https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-eu-rules-on-date-marking-\(use-by-an-d-best-before-dates](https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-eu-rules-on-date-marking-(use-by-an-d-best-before-dates) (accessed 10.20.25).
- Eurostat, 2024. Food waste and food waste prevention - estimates [WWW Document]. URL https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates (accessed 3.20.25).
- Frojan, J., Bisquert, P., Buche, P., Gontard, N., Boone, L., Nhu Thuy, T., Vermeulen, A., Ragaert, P., Dewulf, J., Guillard, V., 2023. Scoring methodology for comparing the environmental performance of food packaging. *Packag. Technol. Sci.* 36, 439–463. <https://doi.org/10.1002/pts.2720>.
- Ghosh, A.K., 2017. The influence of price and promotion on package size propensity. *Am. J. Bus.* 32, 93–103. <https://doi.org/10.1108/AJB-10-2016-0032>.
- Gruber, V., Holweg, C., Teller, C., 2016. What a waste! exploring the Human reality of food waste from the store manager’s perspective. *J. Public Policy Mark.* 35, 3–25. <https://doi.org/10.1509/jppm.14.095>.
- Hallez, L., Qutteina, Y., Raedschelders, M., Boen, F., Smits, T., 2020. That’s my cue to eat: a systematic review of the persuasiveness of front-of-pack cues on food packages for children vs. Adults. *Nutrients* 12, 1062. <https://doi.org/10.3390/nu12041062>.
- Hallez, L., Spruyt, B., Boen, F., Smits, T., 2024. How consumers value sustainable packaging: an experimental test combining packaging material, claim and price. *Br. Food J.* 126, 3566–3583. <https://doi.org/10.1108/BJF-01-2024-0069>.
- Harper, D., 2002. Talking about pictures: a case for photo elicitation. *Vis. Stud.* 17, 13–26. <https://doi.org/10.1080/14725860220137345>.
- Heller, M.C., Selke, S.E.M., Keoleian, G.A., 2019. Mapping the influence of food waste in food packaging environmental performance assessments. *J. Ind. Ecol.* 23, 480–495. <https://doi.org/10.1111/jiec.12743>.
- Heng, Y., House, L., 2022. Consumers’ perceptions and behavior toward food waste across countries. *Int. Food Agribus. Manag. Rev.* 25, 197–209. <https://doi.org/10.22434/IFAMR2020.0198>.
- IPCC, 2019. Climate Change and Land: an IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. https://www.ipcc.ch/site/assets/uploads/sites/4/2022/11/SRCCL_Full_Report.pdf.
- Kim, Youngjun, Kim, Youngju, Kim, H.-J., 2024. Impact of product packaging messages on consumer perceptions and choice: the role of health claims and bonus pack promotions. *Appetite* 200, 107555. <https://doi.org/10.1016/j.appet.2024.107555>.
- Langley, S., Phan-Le, N.T., Brennan, L., Parker, L., Jackson, M., Francis, C., Lockrey, S., Verghese, K., Alessi, N., 2021. The good, the bad, and the ugly: food packaging and consumers. *Sustain* 13, 12409. <https://doi.org/10.3390/su132212409>.
- Lipinski, B., 2024. SDG Target 12.3 on food loss and waste: 2024 progress report. <https://champions123.org/sites/default/files/2024-09/champions-12-3-2024-progress-report.pdf>.
- Llagas, B.R., Jenkins, E.L., Brennan, L., Parker, L., Schivinski, B., Lockrey, S., 2025. Consumer perceptions of date labelling and storage advice and its relationship with food waste: a systematic scoping review of the academic & grey literature. *Future Foods* 11, 100577. <https://doi.org/10.1016/j.fufo.2025.100577>.
- Mahmoudi, M., Mashayekhan, M., Bunch, B., Joodaky, A., 2025. Rethinking packaging for food waste prevention: a scoping review of consumer behavior and design opportunities. *Sustain* 17, 5213. <https://doi.org/10.3390/su17115213>.
- Melgaard, C.V., Voss, E., Hansen, M.F., Lassen, M., Hvidtfeldt, M., Pandey, S., Rasmussen, M.A., Thomsen, M., 2024. Danish consumers’ knowledge about and willingness to buy dairy products close to the best-before-date. *Food Front* 5, 494–507. <https://doi.org/10.1002/fft.2337>.
- Neubig, C.M., Roosen, J., 2024. Can I still eat this? Using implicit and explicit measures to explore consumer behavior toward food products with date labels. *Appetite* 200, 107556. <https://doi.org/10.1016/j.appet.2024.107556>.
- Parker, L., Schivinski, B., Jenkins, E.L., Llagas, B.R., Brennan, L.-M., Phan, T., Lockrey, S., 2024. Date Labelling and Storage Advice: Consumer Interviews: Insights Report (report). RMIT University. <https://doi.org/10.25439/rmt.28456244.v1>.
- Perloff, R.M., 1999. The Third Person Effect: a critical review and synthesis. *Media Psychol* 1, 353–378. https://doi.org/10.1207/s1532785xmep0104_4.
- Petit, O., Lunardo, R., Rickard, B., 2020. Small is beautiful: the role of anticipated food waste in consumers’ avoidance of large packages. *J. Bus. Res.* 113, 326–336. <https://doi.org/10.1016/j.jbusres.2019.10.003>.
- Rivis, A., Sheeran, P., 2003. Descriptive norms as an additional predictor in the theory of planned behaviour: a meta-analysis. *Curr. Psychol. Res. Rev.* 22, 218–233. <https://doi.org/10.1007/s12144-003-1018-2>.
- Sala, S., De, L.V., Sanye, M.E., 2023. Food consumption and waste: environmental impacts from a supply chain perspective. <https://publications.jrc.ec.europa.eu/repository/handle/JRC129245>.
- Srinivasapura Venkateshmurthy, N., Potubariki, G., Brown, K.A., Sharma, P., Ganpule-Rao, A., Prabhakaran, D., Mohan, S., Knai, C., 2021. A photovoice study to reveal community perceptions of highly processed packaged foods in India. *Ecol. Food Nutr.* 60, 810–825. <https://doi.org/10.1080/03670244.2021.1968853>.

- Szenderák, J., Fróna, D., Rákos, M., 2025. Expiration date label knowledge and food waste reduction: a synthesis and critical evaluation of policy recommendations. *Environ. Chall.* 20, 101269. <https://doi.org/10.1016/j.envc.2025.101269>.
- Too Good To Go Date Labelling | Look-Smell-Taste [WWW Document], 2025. URL <https://www.toogoodtogo.com/en-us/look-smell-taste> (accessed 10.14.25).
- Tsalis, G., Jensen, B.B., Wakeman, S.W., Aschemann-Witzel, J., 2021. Promoting food for the trash bin? A review of the literature on retail price promotions and household-level food waste. *Sustain* 13, 4018. <https://doi.org/10.3390/su13074018>.
- United Nations Environment, 2024. Food Waste Index Report 2024. Think eat save: tracking progress to halve global Food waste. <https://wedocs.unep.org/items/dbc2cd4c-8384-4636-8359-5847f42b9711>.
- Van Bommel, A., Parizeau, K., 2020. Is it food or is it waste? The materiality and relational agency of food waste across the value chain. *J. Cult. Econ.* 13, 207–220. <https://doi.org/10.1080/17530350.2019.1684339>.
- Van Boxstael, S., Devlieghere, F., Berkvens, D., Vermeulen, A., Uyttendaele, M., 2014. Understanding and attitude regarding the shelf life labels and dates on pre-packed food products by Belgian consumers. *Food Control* 37, 85–92. <https://doi.org/10.1016/j.foodcont.2013.08.043>.
- Wallnoefer, L.M., Meixner, O., Riefler, P., 2024. Look-smell-taste labels on food date marking: assessing their effectiveness for reducing food waste at a consumer level as part of the European Green Deal. *Food Qual. Prefer.* 120, 105253. <https://doi.org/10.1016/j.foodqual.2024.105253>.
- Wikström, F., Williams, H., Trischler, J., Rowe, Z., 2019. The importance of packaging functions for food waste of different products in households. *Sustain* 11, 2641. <https://doi.org/10.3390/su11092641>.
- Williams, H., Lindström, A., Trischler, J., Wikström, F., Rowe, Z., 2020. Avoiding food becoming waste in households – The role of packaging in consumers' practices across different food categories. *J. Clean. Prod.* 265, 121775. <https://doi.org/10.1016/j.jclepro.2020.121775>.
- Williams, H., Wikström, F., Otterbring, T., Löfgren, M., Gustafsson, A., 2012. Reasons for household food waste with special attention to packaging. *J. Clean. Prod.* 24, 141–148. <https://doi.org/10.1016/j.jclepro.2011.11.044>.
- Wilson, N.L.W., Rickard, B.J., Saputo, R., Ho, S.-T., 2017. Food waste: the role of date labels, package size, and product category. *Food Qual. Prefer.* 55, 35–44. <https://doi.org/10.1016/j.foodqual.2016.08.004>.
- Zielińska, D., Bilska, B., Marciniak-Lukasiak, K., Łepecka, A., Trzaskowska, M., Neffe-Skocińska, K., Tomaszewska, M., Szydłowska, A., Kotożyn-Krajewska, D., 2020. Consumer understanding of the date of minimum durability of food in association with quality evaluation of food products after expiration. *Int. J. Environ. Res. Public Health* 17, 1632. <https://doi.org/10.3390/ijerph17051632>.