Final Report

Helping people to reduce fresh produce and dairy waste: **Citizen insights on the influence of packaging and date labels on disposal decisions**

Insights on the influence of visual deterioration on citizens' choices to use or dispose of dairy and uncut fresh produce items, and the effect of the presence of packaging and date labels on their decision.

Project code: POS102_002
Research date: January – June 2021 **Date:** 24th February 2022

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Our mission is to accelerate the move to a sustainable resource-efficient economy through re-inventing how we design, produce and sell products; re-thinking how we use and consume products; and re-defining what is possible through re-use and recycling.

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Document reference (please use this reference when citing WRAP's work):
WRAP, 2022, Banbury, Citizen insights on food disposal, packaging, and date labels

Written by: Jayne Cox (Brook Lyndhurst), Rachel Devine (WRAP), Phil Downing (Icaro), Tom Quested (WRAP), Helen White (WRAP), Estelle Herszenhorn (WRAP)

Front cover photography: Person checking fridge

Executive summary

This research report is published alongside two other reports. Together, they describe a programme of research initiated to investigate the impact of selling fresh fruit and vegetables, loose or packaged on household food waste. However, the research also encompassed other, related facets of household food waste and packaging, for fresh produce and for dairy products. These include the impact of storing food items in ambient conditions versus in the refrigerator, the role of fridge temperatures and people's interactions with date labels.

This report focuses on the factors that influence citizens' choices to use or dispose of certain dairy and uncut fresh produce items, including the level of visual deterioration of the food item and whether or not the food item has a date label.

Why are we doing this research?

The food system accounts for up to 37% of global greenhouse gas (GHG) emissions and up to 40% of food produced is wasted. Food production uses a significant amount of land, energy, and water, and when food is wasted, so are the resources that went into producing it. In the UK, around 70% of post-farm gate food waste comes from households at a total value of £14 billion per year and 23 million tonnes of GHG emissions. According to WRAP, 41% of food thrown away from households that could have been eaten arises from products that are 'not used in time', where food is thrown away because it has gone off or has passed a date label.

The UK has committed to achieving Sustainable Development Goal (SDG) 12.3, and to reflect that Courtauld 2030 has a target to reduce food waste (post-farm gate) by 50% per person by 2030 against a 2007 baseline. The Courtauld Commitment brings together organisations from across the UK food system to make food and drink production and consumption more sustainable. At the heart of this voluntary agreement is a commitment to identify priorities, develop solutions and implement change to cut the waste and greenhouse gas emissions associated with food and drink, and protect critical water resources. To help deliver the Courtauld food waste target, WRAP and IGD have developed and led the Food Waste Reduction Roadmap, which is an industry-wide programme of work to equip food businesses to work towards UN Sustainable Development Goal 12.3.

Plastic pollution has also become a prominent environmental issue in recent years. Plastic is found in nearly every terrestrial and marine ecosystem, damaging wildlife, and littering the natural world. The UK Plastics Pact is transforming the way that the UK makes, uses and disposes of plastic, moving away from a linear plastics economy towards a circular system where we capture the value of plastics material – keeping plastic in the economy and out of the oceans. Launched in 2018, the UK Plastics Pact brings together governments, businesses, local authorities, citizens and NGOs behind a common vision and commitment to a set of ambitious targets:

- Eliminate problematic or unnecessary single-use packaging through redesign, innovation or alternative (re-use) delivery models

- 100% of plastics packaging to be re-usable, recyclable or compostable
- 70% of plastics packaging effectively recycled or composted
- 30% recycled content across all plastic packaging

Whilst industry have fed back that sales of packaged fruit and vegetables have increased during the coronavirus (COVID-19) pandemic, in general attitudes towards plastic packaging have become more negative in recent years. Previous WRAP research suggests that the way in which citizens interact with food packaging in the home could contribute to the amount of food that is wasted. At present it is not known whether the presence of plastic packaging, irrespective of other information on the packaging, such as a date label, influences whether citizens throw away food. Fresh produce and dairy are in the top ten most highly wasted food categories in UK homes. Understanding the reasons why citizens throw them away is essential to be able to design and implement effective food waste prevention measures.

The findings of this research have been integrated with the results of shelf-life experiments commissioned by WRAP to quantify whether plastic packaging extends the shelf-life of certain food products. The results from this research and the shelf-life study have been used in WRAP's Household Food Waste Simulation Model to estimate the amount of food waste generated across UK households when fresh produce items are sold packaged or loose. These two reports are available here.

Project scope

The purpose of this research is to understand the point at which most citizens discard certain fresh produce and dairy items, and the extent to which that decision is influenced by:

- The level of visual deterioration of the food item
- Whether or not the food item has a date label
- Whether or not the food item is loose or in plastic packaging (fresh produce only).

This research also provides analysis and evaluation of the reasons why citizens throw these products away, focussing on apples, bananas, broccoli, cucumber, potatoes, cheese, milk, and yogurt.

What research did we do?

A fundamental part of this research, and what sets it apart from previous research in this area, is its methodological design. It uses a combination of traditional survey questions – to examine what participants *say they do* and *would do* – as well as an Implicit Association Test (IAT) which indicates how emotionally certain they are about their answer.

Previous research on how citizens interact with date labels and plastic packaging, and the way in which these factors influence their decision to dispose of food, has largely been gathered using traditional survey techniques that rely on citizens' claimed behaviour (explicit response). Whilst widely applied, traditional survey questions assume that all respondents can observe, understand, and perfectly recall their own behaviour, which some people may not be able to do accurately or even at all.

To test the participants' claimed behaviour, an IAT was used. An IAT includes people's explicit response to a question but also tracks their implicit response by measuring their reaction time. The test is based on the principle that a faster response indicates the participant is emotionally certain about their answer.

Participants were shown a carousel of randomised images of the various food items at different stages of visual deterioration. Participants were then asked to select whether they would 'Use' or 'Dispose' of the item. Those that answered quickly were more certain about their answer. Three separate tests were run where participants either saw images of food items packaged with a date label, packaged without a date label, or unpackaged (for fresh produce items and cheese only).

This research is the first application of an IAT to understand citizen behaviours around household food waste.

What are the key findings?

This research provided valuable insights about the effect of date labels, plastic packaging, and product deterioration on citizens' decisions to dispose of fresh produce and dairy items.

Date labels and food waste

For uncut fresh produce items:

- The most significant finding from this research is the clear influence of the date label on disposal decisions for a substantial minority of the population. This is consistent with previous evidence, using a range of methods to explore how date labels can influence disposal decisions.
- Products are typically good to eat after the Best Before date has passed. However, this research demonstrates that when citizens were shown photos of identical products, the number that chose to discard them significantly increased when a Best Before date in the past was used (albeit when other quality cues were not provided). This finding is true for all products and stages of deterioration except for the most deteriorated image of a Cucumber, where the effect of a Best Before date was not statistically significant.
- The Best Before date had the greatest impact on disposal when the photos of the products were slightly less than perfect with only minor, if any, signs of visual deterioration.
- Substantially more citizens indicated that they would throw away fresh produce items in the IAT than those that said they had recently thrown the item away. This suggests that the Best Before date affects people's decisions much more than is indicated by a traditional survey that asks what people have done in the recent past. Therefore, surveys that ask about recent behaviour likely underestimate the 'true' impact of the Best Before date on disposal.

There are a few important considerations associated with the findings on date labels. The key limitations are:

- Date labels on food are intended to help consumers select food that meets their needs and to use food when it is at its best. This survey was not able to test the

extent to which date labels achieved this objective, i.e., the degree to which the presence of Best Before dates influences people's decisions on what to eat, when, and how much. Therefore, evidence on the extent to which Best Before dates influence people's *consumption* of fresh produce is lacking – from this research, and the wider literature.

- Even though significantly more participants said that they would throw away perfectly edible food when it has a date label, some of the Best Before dates were quite far in the past.

- The survey was conducted online and so participants could not interact with the product beyond assessing a photo on-screen. The test therefore could not replicate real-life encounters with products including other important sensory factors, such as smell and touch. It would be useful to further explore this topic using a range of research methods to better understand real life behaviour.
- Although, the survey was not able to test potential confounding variables, such as what else was left in the fridge and when the next shopping day was, this was explored in one of the accompanying reports (Modelling the impact of selling products loose or in packaging).

These limitations are discussed in more detail on page 12 of the Executive Summary. Food retailers and suppliers of fresh produce may also use Best Before dates in the supply chain. These considerations are discussed in Evidence and insights: Reducing household food waste and plastic packaging.

Table ES1: Percentage that chose to 'Dispose' of slightly less than perfect fresh produce, with and without a date.

Product and relevant sample image	Percentage that chose to dispose when shown image of slightly less than perfect fresh produce		Percentage point difference: 'Best Before impact'	Number of days beyond the Best Before date
	Without a date	With a date		
Apples 	7%	46%	+39	24 days beyond the Best Before
Bananas 	2%	29%	+27	13 days beyond the Best Before
Broccoli 	36%	69%	+33	12 days beyond the Best Before
Cucumber 	63%	82%	+19	13 days beyond the Best Before
Potatoes 	7%	30%	+23	12 days beyond the Best Before

For dairy items:

- Propensity to waste products was significantly increased by the presence of a date.
- This finding is true for all dairy products that were beyond the date, irrespective of whether the product was in perfect condition, had minor deterioration or advanced deterioration.
- However, for the products with a Use By date (milk and yogurt), propensity to waste products was significantly *reduced* by the presence of the date when the product was *before* the date. In these instances, the date provided a level of reassurance that the product was safe to eat.
- Similarly, for yogurt that had some surface liquid, propensity to waste was significantly *reduced* by the presence of the date – but only when the yogurt was *on* the date. For yogurt *on* the date, the presence of the date provided a level of reassurance that the product was safe to eat, despite the surface liquid.
- The greatest influence of the date on disposal was for products beyond the Use By date that are in perfect condition. The Use By date was signalling to participants to dispose of fresh-looking products.
- Substantially more citizens chose to throw away dairy items in the IAT than in the survey questions that examined claimed behaviour. What the results of this research suggest is that the Best Before date (for cheese) and the Use By date (for milk and yogurt) affects people's decisions much more than is indicated by a traditional survey. Therefore, surveys that examine claimed behaviour likely underestimate the 'true' impact of the Best Before/Use By date on disposal.
- This research provides clear evidence that Best Before dates on cheese, and Use By dates on milk and yogurt act as a key signal to citizens to dispose of these products. Actions to prolong the available life of dairy products should be prioritised where it is safe to do so.

Table ES2: Percentage that chose to 'Dispose' of dairy products with and without a date. Results shown for products that were either on, or beyond the date.

Product image	Percentage that chose to dispose when shown image of dairy product		Percentage point difference: 'Date impact'	Number of days beyond date
	Without a date	With a date		
Cheese 	54%	76%	+22	40 days beyond the Best Before
Fresh milk 	2%	13%	+11	On the Use By
	2%	53%	+51	4 days beyond the Use By
Gone off/split milk 	49%	76%	+27	6 days beyond the Use By
Fresh yogurt 	13%	54%	+41	5 days beyond the Use By
Yogurt with surface liquid 	38%	25%	-13	On the Use By
	38%	62%	+24	5 days beyond the Use By

Following the IAT, questions were asked to capture explicit responses about certain behaviours relating to Use By and Best Before dates. These responses provided additional context for the IAT results, showing what citizens say they generally do when they are prompted directly to think about it, rather than when they react instinctively to the IAT images.

Respondents were asked to state to what extent they rely on judgement or date labels, or a mixture of both, to make decisions about when to eat or throw away food. When comparing between the three IATs, the results suggest there may have been a priming effect from the IAT itself. Stated reliance (entirely or mostly) on date labels was greater in the test that showed products carrying a date label compared to the tests that didn't show date labels. This finding is interesting in itself; it suggests that some participants who saw a date on products in the IAT may have been primed by that experience to feel that they rely on dates more generally when they answered the later survey question, and more than they would have done if they had not seen dates. If such a priming effect from seeing dates exists in real-world settings, it is possible that date labels could influence disposal decisions both directly through the information on the label and indirectly by sending signals to rely on the date rather than personal judgement (e.g. for Best Before dates). This is a tentative insight and would need to be investigated further.

Plastic packaging and food waste

This research found no significant and consistent influence of packaging on disposal decisions across all the products and deterioration stages that were tested (cheese and all uncut fresh produce items). The impact of packaging varied by product and stage of deterioration and for all products there was a negligible and/or inconclusive influence of the packaging on citizens' decisions about when they would throw the products away. A key learning from this research was that the images of packaged products used in the test may have impacted some of the participants' answers. It is possible that the packaging may have obscured the view of the product, making it difficult to assess whether it was good enough to eat. Therefore, the results could just as likely be a product of the images used in the survey as opposed to any direct influence of the packaging itself.

Level of product deterioration and food waste

For some fresh produce and dairy items, citizen's decision to dispose were highly sensitive to even small signs of visual deterioration – in particular, for broccoli, cucumber, milk, and yogurt. For apples and potatoes, there was less sensitivity.

Conclusions/recommendations

Date labels (uncut fresh produce): Alongside previous studies, this research provides evidence that Best Before dates do not support citizens' ability to judge when dispose of their fresh produce. In particular, the research indicated that a sizable minority of the population were influenced, in this hypothetical situation, by the presence of Best Before dates on fresh produce (once the date has passed). Consistent with this, when asked directly, a minority indicated that they mainly used Best Before dates to make disposal decisions for fresh produce items. These two findings indicate that a section of the UK population appear to treat Best Before dates on fresh produce as disposal dates, thus throwing items away which are still in good condition. Therefore, selling uncut fresh

produce without any date label could reduce household food waste. This recommendation should be viewed in light of the limitations of the research described on page 12.

Date labels (dairy): For milk and yogurt, the Use By date appears to provide a protective measure when products are within date, but when products are on, or after the date, they prompt higher disposal – the latter being in line with official guidance: citizens should not consume food or drink after the Use By date. However, some citizens dispose of milk and yogurt on the Use By date, even though food can be safely consumed right up to and including the Use By.

The findings also suggest there is scope to reduce waste of dairy products by – where it is safe to do so – extending the Best Before date of cheese and the Use By dates of milk and yogurt to give citizens more time to consume products before they pass or reach the date.

Plastic packaging: There is inconclusive evidence that the presence of plastic packaging influences citizen's decision about when to throw uncut fresh produce away. The results from this research should not be used in isolation to inform whether plastic packaging should be removed from uncut fresh produce. Therefore, research that investigates any effect of plastic packaging on product life will be important. This is explored further in WRAP's Shelf-Life Report[1] and Modelling Report[2] published alongside this report, available here.

Citizen behaviour: The findings from this research suggests that changes relating to Best Before dates could reduce food waste in the home. The WRAP/Defra/FSA Food labelling guidance for uncut fruit and vegetables identifies that Best Before dates should be removed from many uncut fresh produce items to reduce HHFW.

Actions to increase optimum storage in the home could help to further reduce food waste, especially for items where sensitivity to deterioration is high and product life is shorter, such as for cucumber, broccoli, milk, and yogurt.

There is also scope to reduce household food waste by developing behavioural solutions to increase consumption or freezing of fresh produce that looks slightly less than perfect before it reaches more advanced stages of deterioration.

Behavioural solutions designed to increase the freezing of dairy products before, and on, the Use By date is another initiative that could help reduce dairy waste in the home. Targeted messaging that dairy products are safe to consume on the Use By – as well as before the date – is also an area where food waste reduction initiatives could be focussed. Where dairy products can have a Best Before date applied rather than a Use By date may also have potential, and this is investigated further in research to be published later in 2022.

[1] *The impact of packaging and refrigeration on shelf life, WRAP, 2022*

[2] *Modelling the impact of selling products loose or in packaging, WRAP, 2022*

Limitations

The research design of this project is robust, as it uses large sample sizes, has strong adherence to quota targets and weighting efficiency, and the sample characteristics are matched across the three tests to enable reliable comparisons between them. Nevertheless, all research projects are subject to limitations, and there are some key issues to consider in relation to this study.

This research provides compelling evidence about the influence of date labels on disposal decisions and supports practical recommendations for on-pack labelling changes for uncut fresh produce. However, an important consideration relating to removing Best Before dates from fresh, uncut produce is whether date labels significantly influence when and how much people consume items and people may use date labels to a greater or lesser extent for a whole range of decisions. For example, on the one hand, people may use these dates to manage the food within their homes, helping them to eat up items before they go off; this dynamic could mean the Best Before date helps people to reduce household food waste in these instances. On the other hand, for some people, seeing an item in their home with a Best Before date in the near future could lead people to consider the quality deteriorating and reduce consumption, leading to more household food waste in these instances. Reliable information on the extent of these mechanisms is lacking. This is further explored in the accompanying Modelling Report.

Even though many research participants said that they would throw away perfectly edible food when it had a date label, some of the Best Before dates were quite far in the past. This is because the selection of dates was driven by the time taken for items to reach certain stages of deterioration in our own tests, rather than for investigating the dates themselves. This means that insights about citizens' sensitivity to date labels that are just before, on and just after the date label are limited in this research. This research would benefit from investigation of a more granular set of dates, particularly for dairy products. This would allow quantification of the precise number of days beyond the date label at which most citizens would throw the product away.

Another important consideration is that the survey was conducted online. So participants could not interact with the product beyond assessing a photo on-screen. The test therefore could not replicate real-life encounters with products including other important sensory factors, such as smell and touch. This research would therefore benefit from additional sensory-based evaluations from participants that can interact with the products in real-life. This would demonstrate the degree to which the findings presented in this report are accurate – further supporting the case for action.

While every effort was made to reduce any influence arising from differences in visibility between the packaged and unpackaged images, it is possible that some of the signs of deterioration were less visible in some of the packaged images or that dark areas within the packaging could have been misinterpreted as signs of deterioration.

The packaging of the food shown might not necessarily reflect how each participant would actually purchase and store it in real life. For example, some respondents in the

packaged tests may only ever purchase broccoli unpackaged. Likewise, there may have been a disconnect between respondents' everyday experience and the exact type of food, or the exact type of packaging shown. For example, a red apple was chosen to represent apples (even though it is conceivable that some citizens may only eat green apples). Likewise, the image of milk was shown in a glass bottle, to make the visual deterioration clear (even though most citizens purchase milk in plastic bottles).

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Glossary

Best Before date: "The best before date is about quality and not safety. The food will be safe to eat after this date but may not be at its best. Its flavour and texture might not be as good."[3] Best Before dates are not legally required on fresh, uncut produce. However, many such products do carry Best Before dates in the UK.

Fresh produce: fresh fruit and vegetables

Household food waste (HHFW): Household food waste is any food item purchased for human consumption but not consumed by humans. Therefore, it covers any food disposed of via the following routes: the general waste bin (residual waste), separate food-waste collections, mixed food and garden collections, via the sewer, and home composting.

Implicit Association Test (IAT): Implicit testing is an advanced research tool that is used to measure emotional resonance and, by extension, propensity to change behaviour. The test presents participants with one or more target attributes and captures the speed of response – in milliseconds – as a way of understanding levels of certainty and obtaining a more reliable assessment. The premise is that the faster people answer a question, the more emotional certainty they have in the answer they have given.

Not used in time: food that has been thrown away because it has gone off (mouldy, mushy or rotten) or because it has passed a date label (e.g., 'use by' or 'best before').

Shelf life: as used in this report, the length of time after purchase that an item is still consumed. This varies by product, by storage location and between people (i.e., the point in the deterioration of a product when it is no longer consumed varies between people).

Use By date: "A use-by date on food is about safety. You can eat food until and on the use-by date but not after. After the use-by date, don't eat, cook or freeze your food. The food could be unsafe to eat or drink, even if it has been stored correctly and looks and smells fine."[3] The term 'Use By' should only be applied on foods which, from a microbiological point of view, are highly perishable and are therefore likely, after a short period, to constitute an immediate danger to human health.

This report was published alongside the two other closely related reports, both on the topic of helping people to reduce fresh produce and dairy waste:

- **Modelling the impact of selling products loose or in packaging**. Referred to as "The Modelling Report" for short.

[3] Food Standard Agency: https://www.food.gov.uk/safety-hygiene/best-before-and-use-by-dates, accessed 14th July 2021.

- **The impact of packaging and refrigeration on shelf life**. Referred to as "The Shelf-Life Report" for short.

These two reports can be downloaded at: https://wrap.org.uk/resources/report/helping-people-reduce-fresh-produce-waste

Acknowledgements

This research benefitted from project management and project support from Valérie Leney, Hayley Reynolds, Kirsty Hine and Deanne Roche. Alun Thomas photographed all the products used in this report. In addition, many colleagues provided input, guidance, and review to the project, including Mark Roberts, Leah Wistrand, Sam Hubble, Gen Bassett, Aggelina Doriza.

We would also like to thank staff at Department for Environment, Food and Rural Affairs (Defra) for reviewing the reports and their useful feedback.

We would also like to thank members of the industry task force, who provided valuable input to support this project. It should be noted that this report was not reviewed or approved by members of this group prior to publication.

1.0 Introduction

The food system accounts for up to 37% of global greenhouse gas (GHG) emissions[4] and up to 40% of food produced is wasted[5,6]. Without intervention, by 2050 GHG emissions associated with the food system are likely to increase by 30 - 40%[7]. Food production uses a significant amount of land, energy, and water, and when food is wasted, so are the resources that went into producing it. Even if food waste does not end up in landfill and is used to generate compost or create energy, the GHG emissions associated with its production, processing, transport, retail, and storage are still wasted. Reducing food waste is a key part of tackling climate change and the United Nations Sustainable Development Goal 12.3 has set a target to halve per capita global food waste at the retail and consumer levels, by 2030.

In the UK, around 70% of post-farm gate food waste comes from households at a total value of £14 billion per year[9]. WRAP estimates total annual household food waste arisings in the UK at 6.6 million tonnes, equating to 100kg per person, or £500 per year for the average household[9]. The environmental impacts are considerable, and the total GHG emissions associated with wasted food and drink in UK households each year account for approximately 23Mt CO_2e[8]. Due to the vast environmental and financial costs of food waste, one of WRAP's core areas of work is household food waste prevention.

According to WRAP, 41% of food thrown away from households that could have been eaten arises from products that are 'not used in time', where food is thrown away because it has gone off or has passed a date label[9]. The cost of purchasing this food is around £6 billion each year. To minimise the amount of 'not used in time' food waste from UK households, WRAP engages with citizens and industry stakeholders to ensure that food is safely consumed for as long as possible.

Fresh produce and dairy are two of the most highly wasted food categories in UK homes costing over £4.5 billion per year[9]. Food products in these categories are the focus of this research as is understanding the reasons why citizens throw them away. Specifically, this research aims to understand the influence of three factors on disposal decisions: the stage of (visual) deterioration i.e. the point at which citizens are no longer prepared to eat dairy and fresh produce items; to what extent the presence of a date label influences this; and, to what extent the presence of plastic packaging influences this (for the uncut fresh produce items only).

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[4] *Special Report on Climate Change and Land, Chapter 5. Food Security; IPCC.* https://www.ipcc.ch/site/assets/uploads/sites/4/2021/02/08_Chapter-5_3.pdf

[5] *Driven to Waste: Global Food Loss on Farms, WWF and Tesco.* https://wwf.panda.org/discover/our_focus/food_practice/food_loss_and_waste/driven_to_waste_global_food_loss_on_farms/

[6] *UNEP Food Waste Index Report, 2021.* https://www.unep.org/resources/report/unep-food-waste-index-report-2021

[7] *Estimate includes emissions from agriculture, land use, transport, packaging, processing, retail, consumption, food loss and waste. Special Report on Climate Change and Land, Chapter 5. Food Security; IPCC* https://www.ipcc.ch/site/assets/uploads/sites/4/2021/02/08_Chapter-5_3.pdf

[8] *UK Food System GHG emissions, WRAP, 2021* https://wrap.org.uk/resources/report/uk-food-system-ghg-emissions

[9] *Household food waste: restated data for 2007-2015.* https://wrap.org.uk/sites/default/files/2021-03/WRAP-Household-food-waste-restated-data-2007-2015_0.pdf

The reasons why citizens throw away food are complex and interconnected and understanding citizen behaviours is essential to design and implement effective food waste interventions.

The way in which citizens use date labels to make decisions on storage, consumption, and disposal of food can also impact the amount of food that is wasted in the home. Research consistently shows that the very presence of a date label of any type does influence behaviour, making people less likely to discard food before the date and more likely to discard after the date[10],[11]. However, the extent of date-driven disposal varies by product and by individual since some people rely on dates more than others and some people rely on dates for certain products, but not for others.

An example of date-related disposal is treating the Best Before date - a mark of product quality - as a mark of product safety, which can lead to higher disposal of food that is perfectly safe to eat. Understanding the way in which citizens rely on date labels versus using their own judgement is an important element of designing effective food waste prevention measures. This research focuses on the impact of date labels on decisions to discard uncut fresh produce and dairy products, and how reliance on date labels changes when food products are at different stages of deterioration.

Another element of this research looks at whether the presence or absence of plastic packaging, irrespective of whether it has a date label, impacts citizens' decisions to throw food away. Previous WRAP research suggests that the way in which citizens interact with food packaging in the home could contribute to the amount of food that is wasted. For example, even though packaging is often designed with the aim of keeping food fresher for longer, almost six in 10 (59%) agree that keeping food in its original packaging makes it "sweat" and go off quicker. Indeed, for fresh produce items, almost two-thirds of UK citizens unpack or do something to the bag (e.g. pierce it) prior to storage[12] thus reducing any effectiveness of the packaging[13]. Only 36% of UK citizens agree that 'packaging helps to reduce food waste'.

WRAP research suggests that attitudes towards plastic packaging have become more negative in recent years[13]. This is largely related to the environmental impacts of plastic packaging, specifically the pollution of marine and terrestrial ecosystems across the globe. Negative perceptions of plastic packaging may have unintended consequences for food waste, as there are situations where plastic packaging may protect the food product or help to extend shelf life. However, for fresh produce items, the relationship between packaging and shelf-life extension is not always clear. A review by WRAP in 2018 suggested there was little evidence in the academic and grey literature to support the effect of plastic packaging on significant shelf-life extension for most fresh produce

[10] *Consumer insight: date labels and storage guidance. WRAP, 2011.* *https://wrap.org.uk/resources/report/consumer-insight-date-labels-and-storage-guidance*

[11] *Consumer behaviour, date labels and food waste. WRAP, 2019. Unpublished.*

[12] *Data relates to apples, bananas and carrots: Consumer Attitudes to Food Waste and Food Packaging, WRAP 2013.* *https://wrap.org.uk/sites/default/files/2020-12/Consumer-attitudes-to-food-waste-and-packaging.pdf*

[13] *UK survey on citizens' attitudes & behaviours relating to food waste, packaging and plastic packaging, INCPEN & WRAP, 2019.* *https://wrap.org.uk/sites/default/files/2020-08/WRAP-citizen-attitudes-survey-food-waste-and-packaging.pdf*

items[14]. This finding was replicated in The Shelf-Life Report[15], which found limited shelf-life extension from plastic packaging for most products tested.

This research supports two areas of WRAP's work: household food waste prevention and the elimination of problematic and unnecessary plastic packaging. The findings of this research have been integrated with the results of the Shelf-Life Report. The results from both pieces of research inform The Modelling Report[16] to quantify the food waste generated across the UK when food is sold packaged or loose.

Following on from this research WRAP commissioned another piece of research to understand whether the specific *type* of date label applied to dairy products (yogurt and milk) influences citizens' decision to throw the food away. This will be published later in 2022.

1.1 Date labels and labelling guidance

The key purpose of date labels is to communicate to citizens the quality and safety of food products. In the UK, uncut fresh produce is not required to have any date label applied, whereas dairy products must have one of two date labels: a "Best Before" or a "Use By" date. A Best Before date provides an indication as to how long a product will remain at its best quality, whereas a Use By date communicates how long a product is safe to consume. Within the EU, all EU member states follow the same food safety legislation and general principles to ensure that food is safe and fit for human consumption. In the UK, the Food Information Regulations 2014[17] enforce several provisions of EU law such as Regulation (EU) No. 1169/2011 on the provision of food information to consumers[18]. These requirements remain - and there are additional labelling rules - following the UK's exit from the EU.

In the UK, some retailers also use stock control dates such as Display Until dates for uncut fresh produce. It should be noted these date labels are not legally required and in recent years have become far less prevalent for the products used in this research, with the majority of retailers now using Best Before dates on uncut fresh produce (Chapter 3 of The Modelling Report[16]. For dairy products, both Use By and Best Before dates are applied, though Use By dates are the most prevalent. However, there remains variation in the application of Use By and Best Before between different products and by retailers, brands, and manufacturers. Inconsistencies in the application of date labels may cause confusion amongst citizens leading to consumption of food that is unsafe to eat and disposal of food that is perfectly safe to consume.

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[14] *Evidence Review: Plastic Packaging and Fresh Produce, WRAP, 2018.* https://archive.wrap.org.uk/sites/files/wrap/Evidence%20Review%20Plastic%20Packaging%20and%20Fresh%20Produce%20171218.pdf

[15] *The impact of packaging and refrigeration on shelf life, WRAP, 2022:* https://wrap.org.uk/resources/report/helping-people-reduce-fresh-produce-waste

[16] *Modelling the impact of selling products loose or in packaging, WRAP, 2022:* https://wrap.org.uk/resources/report/helping-people-reduce-fresh-produce-waste

[17] *Food Information Regulations 2014 (FIR 2014)* https://www.legislation.gov.uk/uksi/2014/1855/contents/made

[18] *For further information on Food law and regulations see WRAP Labelling guidance. Best practice on food date labelling and storage guidance, WRAP, 2019.* https://wrap.org.uk/sites/default/files/2020-07/WRAP-Food-labelling-guidance.pdf

In 2017, WRAP/Defra/FSA published industry-facing Food Labelling Guidance (which was subsequently updated in 2019)[19]. The guidance sets out best practice for citizen food waste prevention in terms of changes to products, packs and labels whilst maintaining strict food safety principles. The key recommendations applicable to date labels are:

- Only apply Use By where there is a food safety reason to use it.
- Make use of Best Before or, in the case of uncut fresh produce, no date (unless used to help consumers use up rather than waste highly perishable products).
- Only have one date label on a single product/item.
- Maximise product 'open' and 'closed' life.
- Only apply *use within X days* open life where there is a specific safety reason not already covered by a Use By date.

1.2 Research Aims

The aims of this research are to understand the point at which most citizens discard certain dairy and uncut fresh produce food items, and the extent to which that decision is influenced by:

- The level of visual deterioration of the food item
- Whether or not the food item has a date label
- Whether or not the food item is loose or in plastic packaging (fresh produce only)

In addition, this research aims to understand the reasons why citizens dispose of certain food items that are unpackaged or packaged, with or without a date label.

The information from this research will:

- Provide further understanding of the drivers of household food waste.
- Enable WRAP to update guidance to industry on the use of date labels on fresh produce and dairy items.
- Inform discussions on the elimination of plastic packaging on certain uncut fresh produce items, in line with Target 1 of the UK Plastics Pact[20] to "Eliminate problematic or unnecessary single-use packaging through redesign, innovation or alternative (reuse) delivery model".
- Inform the effective delivery of WRAP's Love Food Hate Waste campaign and other behaviour-change interventions to reduce household food waste.
- Improve WRAP's modelling of UK household food waste using the Household Simulation Model[21], allowing more accurate disposal decisions to be modelled.

1.3 Research design

[19] *Label Better, Less Waste: Food Labelling Guidance, WRAP, 2019.* https://wrap.org.uk/sites/default/files/2020-07/WRAP-Food-labelling-guidance.pdf

[20] *The UK Plastics Pact, WRAP.* https://wrap.org.uk/taking-action/plastic-packaging/the-uk-plastics-pact

[21] *a modelling approach developed by WRAP, which is used to understand how food waste is influenced by a range of decisions and actions by householders alongside attributes of food, such as shelf life. The model simulates the journey of food into and through a home, focusing on 'not used in time'. More details of the model can be found in: Using discrete event simulation to explore food wasted in the home, Kandemir et al. (2020). Journal of Simulation.* https://doi.org/10.1080/17477778.2020.1829515

A fundamental part of this research, and what sets it apart from previous WRAP research in this area, is its methodological design. Previous WRAP research on how citizens interact with date labels and plastic packaging, and the way in which these factors influence their decision to dispose of food, has largely been gathered using traditional survey techniques that examine claimed behaviour (explicit response). Whilst commonplace, traditional survey questions can have limitations that may affect the reliability of the findings. By their very nature, survey questions assume that all respondents can observe, understand, and perfectly recall their own behaviour, which some people may not be able to do accurately or even at all.

To overcome this assumption, the research uses implicit testing - to measure the respondents' reaction time based on the principle that a faster response indicates the respondent is emotionally certain about their answer - combined with more traditional (explicit) survey questions.

The unique approach of using implicit testing alongside explicit enables the explicit response to be tested, thus providing a degree of reliability to the findings. To the best of the authors' knowledge, this is the first application of implicit testing to understand citizen behaviours around household food waste. Further details on previous research and implicit testing are presented in Chapters 2.0 and 3.0 respectively.

1.4 Choice of food items

The food items used in this research are split into two categories: uncut fresh produce and dairy. According to WRAP, around 2.5 million tonnes of fresh vegetables, salad, and fresh fruit are wasted by UK households, costing £3.8 billion, a year. Similarly, around 470,000 tonnes of dairy and egg are wasted by UK households, costing £750 million[22] per annum.

The specific uncut fresh produce items selected for this research are:

- apples,
- bananas,
- broccoli,
- cucumber and
- potatoes.

The dairy items are:

- cheese,
- milk and
- yogurt.

These products account for some of the most wasted foods from UK households.

[22] *Household food waste: restated data for 2007-2015.* *https://wrap.org.uk/sites/default/files/2021-03/WRAP-Household-food-waste-restated-data-2007-2015_0.pdf*

Table 1. Summary of UK household food waste for the products used in this research[23].

Product	Wasted Food (tonnes)			Cost (£ million)
	Edible parts	Inedible Parts	Total	
Potatoes	710,000	<1,000	710,000	£555
Milk	290,000	<1,0000	290,000	£270
Apples	63,000	38,000	100,000	£130
Yogurt	51,000	<1,000	51,000	£130
Broccoli	41,000	<1,000	41,000	£219
Bananas	47,000	270,000	320,000	£67
Cucumber	43,000	7,000	50,000	£77
Cheese	32,000	<1,000	32,000	£230

The fresh produce items - apples, bananas, broccoli, cucumbers, and potatoes - were chosen as they are a representative sample of different fruits and vegetables that are highly wasted in the UK (Table 1). These items were also selected because they are all popular products, are sold both loose and packaged, and they provide a cross-section of different types of fruits and vegetables (e.g. soft versus hard). These items also have the potential to be sold without a Best Before date or to be sold loose. Certain uncut fresh produce items are less suitable for selling loose as they are more prone to damage such as soft fruits like strawberries, raspberries and blueberries, and so these products were not included in this research.

The dairy items were chosen as they represent products where citizens are highly sensitive to date labels[24, 25]. The dairy items were included in the research to explore how citizens respond to dates and whether there is evidence of citizens consuming products beyond the date. In the case of yogurt and milk, there is the potential for manufacturers and retailers to use either a less conservative Use By date or switch to Best Before dates where safe to do so. Understanding how long citizens are prepared to eat these food items beyond the date, and the influence of the level of visual deterioration, are crucial parts of the discussion around date labels and will be key to informing WRAP's guidance in this area.

The results of this research will be integrated with the shelf-life experiments commissioned by WRAP to understand the effect of different storage conditions on the shelf-life of fresh produce and dairy items.

1.5 Report Structure

The following chapters in this report cover:

- Key research and knowledge gaps on citizen understanding and behaviours around food waste and food packaging (Chapter 2.0)
- Methodology and research design (Chapter 3.0)

[23] *Household food waste: restated data for 2007-2015, WRAP, 2018.* https://wrap.org.uk/sites/default/files/2021-03/WRAP-Household-food-waste-restated-data-2007-2015_0.pdf

[24] *Research into consumer behaviour in relation to food dates and portion sizes, Brook Lyndhurst, 2008.* https://wrap.org.uk/sites/default/files/2020-12/Research-into-consumer-behaviour-in-relation-to-food-dates-and-portion-sizes.pdf

[25] *Consumer insight: date labels and storage guidance. WRAP, 2011.* https://wrap.org.uk/sites/default/files/2020-12/Consumer-insight-date-labels-and-storage-guidance.pdf

- Results (Chapters 4.0 and 5.0)
- Discussion of the key findings and implications for WRAP's work (Chapter 6.0)
- Assumptions and lessons learned (Chapter 7.0)
- Conclusions (Chapter 8.0)

2.0 Previous research and knowledge gaps

The following sections present a summary of themes related to citizen understanding of food waste, date labels and food packaging. The chapter is split into two key research areas: "Dates and Food Waste" and "Packaging and Food Waste".

Under Dates and Food Waste the following themes are explored:

- Citizen understanding of date labels
- How citizens use date labels
- How citizen use of date labels varies by product
- Using date labels versus using own judgement

Under Packaging and Food Waste the following themes are explored:

- Citizen attitudes towards food packaging
- Understanding the role of packaging in reducing food waste

It should be noted that it is not in the scope of this work to conduct a systematic literature review of these themes; instead, the aim is to provide a series of summaries with a focus on work that WRAP has led or has been involved with in these areas, showing how this new research helps to fill the evidence gaps. Some examples from the academic and grey literature are used where necessary to supplement WRAP's work.

2.1 Dates and Food Waste

Date labels have consistently been an important factor for citizen food waste prevention. WRAP estimates that 48% (2 million tonnes) of food that could have been eaten but instead is thrown away is food that is "not used in time" and a date label is mentioned as the trigger for disposal in one-third of those instances[26]. This equates to around 660,000 tonnes, or 16% of all such 'avoidable' food waste, which is disposed of due to a date label. Whilst some citizens are prepared to eat food that is past the Best Before date on the label, some state that they simply will not; irrespective of whether it is perfectly safe and good enough to eat.

- In WRAP's "Date Labels and Storage Guidance" survey in 2011[27] 41% of respondents cited "it was after the date on the label" as a reason for throwing away products in their original packaging.
- An evidence review by WRAP in 2019[28] states that the presence of a date label of any type does influence behaviour, making people less likely to discard food before the date and more likely to discard it after the date.

[26] *Household food and drink waste: A product focus. WRAP, 2012*
https://wrap.org.uk/resources/report/household-food-drink-waste-product-focus
[27] *Consumer insight: date labels and storage guidance. WRAP, 2011.*
https://wrap.org.uk/resources/report/consumer-insight-date-labels-and-storage-guidance
[28] *Consumer behaviour, date labels and food waste. WRAP, 2019. Unpublished.*

As well as the impact of date labels on disposal decisions, dates can also help people manage the stock of items in the home. Where people have multiple packs of a given item, they could identify and use the oldest items first. Similarly, dates can also prompt people to use up a range of items in an appropriate order to minimise food waste: short-shelf-life fresh produce (e.g., berries) soon after a shop, leaving items with a longer shelf life until later.

It is also conceivable that an opposing effect occurs in some households: in the days leading up to the date on-pack, the presence of the date could cause people to perceive that the quality of the product is deteriorating (or increasing in risk), and consequently some citizens may reduce their consumption of the items in question.

- In WRAP's "Helping Consumers Reduce Fruit and Vegetable Waste" survey in 2008[29] 33% of respondents claim to always read and follow dates in the home. However, this percentage could include the proportion of people who use dates to indicate when to *throw away* food as well as those who use dates to help manage stocks and/or plan meals.

The authors of this report are unaware of any studies that have determined whether consumption is increased or decreased due to the presence of a date label.

The following sections provide further information on citizen understanding, interpretation and use of date labels.

2.1.1 Citizen understanding of date labels

It is important that citizens understand the difference between Use By and Best Before dates. If people do not understand the difference, they may believe that food marked with a Best Before date is unsafe after the date and dispose of it unnecessarily.

The most recent detailed, published survey that WRAP has undertaken on UK citizens' understanding of date label definitions was in 2011[30]. Overall, the survey showed a high level of understanding among citizens, specifically:

- Most UK citizens (between 70% and 85%) identified the correct definition of Best Before when given a list of options to choose from.
- However, a sizeable minority (between 14% and 27%) incorrectly associated the Best Before date with safety.
- When Display Until dates were displayed alongside Best Before dates, the proportion of respondents that chose the correct definition of Best Before reduced by up to 15 percentage points (from 85% to 70%).

There have been other studies that investigated citizens' understanding of date labels. However, the picture is mixed with some research suggesting high levels of understanding and some suggesting widespread confusion.

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[29] *Helping Consumers Reduce Fruit and Vegetable Waste: Final Report. WRAP, 2008 https://wrap.org.uk/resources/report/helping-consumers-reduce-fruit-and-vegetable-waste*

[30] *Consumer insight: date labels and storage guidance. WRAP, 2011 – Page 76 Table 14. https://wrap.org.uk/resources/report/consumer-insight-date-labels-and-storage-guidance*

- A study by the Food Standards Agency in 2009[31] showed that there was low understanding of Best Before and Use By labels with high levels of confusion amongst respondents.
- A study in 2014[32] of Belgian citizens found that 70% indicated they knew the difference between Use By and Best Before, but that most interpret the date with some flexibility depending on the type of food product.
- Research by the TNS in 2014[33] found 66% of UK citizens correctly understood that the Best Before date is a mark of product quality. An important minority (21%) of UK citizens incorrectly believed Best Before dates to be a marker of product safety, but this was low in comparison to an average of 37% across other EU countries[34].
- A study in 2017[35] of EU citizens found that date label understanding was a key component in food waste behaviours.
- A survey by the Food Standards Agency in 2021[36] found that almost three-quarters (71%) of respondents identified the Use By date as the information which shows that food is no longer safe to eat. However, 11% of respondents identified the Best Before date as the date which shows food is no longer safe to eat.

An important factor in assessing citizens' understanding of date labels is whether the question asks respondents for a "dictionary definition" of the label or *what they would actually do* when presented with the date label. In theory, if citizens applied the correct definitions of Use By and Best Before dates, then all food that has passed a Use By date would be discarded and citizens would be willing to eat food that is past a Best Before date. However, even if citizens can correctly answer questions about the definition of different date label types, this does not necessarily mean that they follow the definitions in practice.

2.1.2 How citizens use date labels

Before assessing the influence of *different* date labels on food waste behaviours, it is necessary to understand the extent to which the presence of *any* date label, irrespective of its type, affects citizen behaviour.

Research does suggest that the mere presence of a date label influences citizen behaviour:

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[31] *Qualitative Research to Explore Peoples' Use of Food Labelling Information, Food Standards Agency, 2009.* https://nanopdf.com/download/qualitative-research-to-explore-peoples-use-of-food-labelling_pdf

[32] *Understanding and attitude regarding the shelf life labels and dates on pre-packed food products by Belgian consumers. Van Boxstael et al. (2014).* http://dx.doi.org/10.1016/j.foodcont.2013.08.043

[33] *Study on the Impact of Food Information on Consumers' Decision Making, TNS European Behaviour Studies Consortium, 2014 (Table 80 and 81, pages 149 and 150).* https://ec.europa.eu/food/sites/food/files/safety/docs/labelling_legislation_study_food-info-vs-cons-decision_2014.pdf

[34] *EU countries included in the averages: Finland, UK, Italy, Spain, Germany, Poland France, Romania.*

[35] *Impact pf consumers' understanding of date labelling on food waste behaviour. Toma et al. (2017).* https://link.springer.com/content/pdf/10.1007/s12351-017-0352-3.pdf

[36] *Food and You 2: Wave 1 Key Findings. Food Standards Agency, 2021.* https://www.food.gov.uk/sites/default/files/media/document/fy2-wave-1-report-_key-findings_1.pdf

- A study in the USA[37] asked participants to perform the "sniff test" on partially full bottles of milk and decide to discard or keep it. Milk samples either had a Sell By date or no date[38]. The study found that the presence of a date label is associated with a significantly higher rate of disposal for milk that is past the date label.
- Similar results were also found in a study in Italy that assessed sensitivity to Best Before dates on pasta sauce and orange juice[39].

Looking at differences in behaviour between different types of date label:

- Another study in the USA[40] found a date label that is most suggestive of a food safety concern (Use By) led to higher levels of food waste than date labels related to food quality (Best Before[41]) which led to less food waste.
- Research by the TNS in 2014[42] found that treating the Best Before date as a safety limit is one of the strongest factors that drive consumers to throw away food that is still safe to eat.
- A survey by the EU REFRESH project in 2019[43] found that when participants were shown Best Before dates on yogurt and orange juice, most (70% for yogurt and 82% for orange juice) responded in the intended way to the Best Before date. However, for yogurt, 30% were more cautious, eating only up until the end of the Best Before date, essentially treating it as a Use By date. The same survey found that this effect (treating the Best Before date like a Use By date), was present for the fresh produce items tested but less pronounced (12% for pre-packaged carrots and 9% for bagged oranges).
- The same EU REFRESH survey referenced above found that participants' responses to *different* types of date label were similar, suggesting either widespread confusion or that dates are unimportant in consumers' decision-making processes. Most participants responded in the same way to Best Before as Use By dates for yogurt and orange juice, and in the same way for Display Until as Best Before dates for pre-packaged carrots and bagged oranges.

An important factor that cannot be omitted is the influence of product type on interaction with date labels. There is widespread evidence that the product type (in addition to the date label type) is a key component in citizen decision-making around date labels.

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[37] *Discard intentions are lower for milk presented in containers without date labels. Roe et al. (2018. https://doi.org/10.1016/j.foodqual.2017.12.016*

[38] *There were four "with date" samples in total; one sample was before the date and three samples were past the date label at 7-, 12-, and 22-days past-date.*

[39] *A behavioural study on food choices and eating habits. Elsen et al. (2015). https://ec.europa.eu/food/sites/food/files/safety/docs/fw_eu-actions_bexpo-milan_final-report.pdf*

[40] *Food waste: The role of date labels, package size and product category. Food Quality and Preference. Wilson et al. (2017). https://doi.org/10.1016/j.foodqual.2016.08.004*

[41] *Date labels in the USA are worded differently to the UK. Date labels that relate to product quality in the USA are: Best By, Fresh By, and Sell by, whereas in the UK and the EU a Best Before date is a marker of product quality.*

[42] *Study on the Impact of Food Information on Consumers' Decision Making, TNS European Behaviour Studies Consortium, 2014 (Table 80 and 81, pages 149 and 150). https://ec.europa.eu/food/sites/food/files/safety/docs/labelling_legislation_study_food-info-vs-cons-decision_2014.pdf*

[43] *The effects of on-pack storage and consumption guidance on consumer food waste behaviours. REFRESH Deliverable 1.6. 2019. https://eu-refresh.org/effects-pack-storage-and-consumption-guidance-consumer-food-waste-behaviours.html*

2.1.3 How citizen use of date labels varies by product type

Citizens' use of dates is influenced by a combination of factors, not just their understanding of what is meant by the date label (e.g. Best Before versus Use By). One such factor is product type. Previous WRAP research[44] suggests that date labels are an important factor in food disposal decisions for products with a greater perceived safety risk (e.g. dairy, fish, meat) and that citizens refer to date labels more often on these products. In comparison, date labels are of less importance for products with a lower perceived safety risk, such as bakery and fresh produce.

A survey conducted by WRAP in 2011 suggests that the date label is important in 80% of disposal decisions around yogurts and eggs, compared to just 11% of disposal decisions of fresh fruit[44]. The same survey found that product type is often more important than label type as there is large variation between products that have the same type of date label. For example:

- Although chicken and cheddar cheese were both shown with a Use By date, there was a large difference in the proportion of people who said they would stick to that date – 51% for chicken and 21% for cheddar cheese.
- Even though fresh vegetables and fresh fruit carry a Best Before date (rather than a Use By date), only 11% of citizens rate the date label as important for fresh fruit compared to 28% for fresh vegetables.

Similarly, the same survey also found that there was little variation between products that were shown with Use By versus Best Before dates, particularly for cheese and yogurt.

- The proportion of respondents that would eat cheese *the day after the date on the label* was very similar between those that saw Use By (10%) and those that saw Best Before (11%) dates.
- The proportion of respondents that would eat yogurt *the day after the date on the label* was the same for those that saw Use By and those that saw Best Before (18%) dates.
- The proportion of respondents that would eat cheese *up to the date on the label* was very similar between those that saw Use By (21%) and those that saw Best Before (16%) dates.
- The proportion of respondents that would eat yogurt *up to the date on the label* was also similar between those that saw Use By (37%) and those that saw Best Before (27%) dates.

2.1.4 Using date labels versus using own judgement

The literature suggests that most citizens use a combination of date labels and their own judgement when deciding to discard food. The relative importance of each is different for different people, in different contexts and for different products. Citizens tend to use their judgement more often for products with a lower perceived safety risk, such as fresh fruit and vegetables. For example, previous WRAP research[44] shows that for

[44] *Consumer insight: date labels and storage guidance. WRAP. 2011.* https://wrap.org.uk/sites/default/files/2020-12/Consumer-insight-date-labels-and-storage-guidance.pdf

potatoes, 70% of citizens claim to rely 'entirely' or 'mostly' on their own judgement when making decisions to eat or throw away. In contrast, just 7% of citizens claimed to rely 'entirely' or 'mostly' on their own judgement for chicken, 15% for yogurt and 17% for milk.

2.2 Packaging and Food Waste

Plastic food packaging can be perceived in both positive and negative lights. On the one hand it could be criticised due to its environmental impact as a fossil fuel-based material that litters marine and terrestrial environments, yet on the other hand it can play an important role in protecting food and displaying information to citizens. Understanding the relative benefits and trade-offs between plastic packaging and food waste is crucial to be able to make informed decisions about selling food, in particular fresh produce, loose rather than packaged.

The academic literature has demonstrated through specific case studies the influence of food packaging on food waste:

- A study of 61 Swedish households that recorded a seven-day food waste diary found that about 20 - 25% of the households' food waste could be related to packaging[45]. Specific aspects of the packaging that led to food waste were packaging that was difficult to empty, items that were beyond a Best Before date, and packaging that was too big. The research, however, does not distinguish whether "packaging that was too big" means that the participants felt that the pack size was too large given the time available to eat the product, or the actual size/amount of packaging was excessive.
- Another study in Sweden of 37 households, found that pack size, date labels, and other packaging aspects (e.g. difficult to empty) were the most important aspects of food packaging linked to food waste[46]. Whilst the study found that those aspects played a significant role in food waste decisions, their relative, and combined, influence varied by product type. The proportion of waste (by weight) linked to packaging was up to 68% for bread, 89% for dairy, and 73% for meat and fish. In contrast, packaging was linked to just 36% of fruit and vegetable waste. It should be noted that the research does not investigate any impact of the packaging itself on food disposal decisions.
- A study that evaluated the GHGs associated with food packaging and food waste suggested that if packaging could, hypothetically, reduce food waste by just 10%, this would lead to a greater reduction in GHGs than simply removing plastic packaging from the product. The study highlights that the GHGs associated with producing the plastic packaging are far less than the GHGs that would be associated with a 10% food waste reduction[47].

To understand the environmental impact of food packaging, Life Cycle Assessments (LCAs) are often undertaken, however, food waste is rarely acknowledged or included in

[45] *Reasons for household food waste with special attention to packaging. Williams et al. (2012). Journal of Cleaner Production.* https://doi.org/10.1016/j.jclepro.2011.11.044

[46] *Avoiding food becoming waste in households – The role of packaging in consumers' practices across different food categories. Williams et al. (2020). Journal of Cleaner Production.* https://doi.org/10.1016/j.jclepro.2020.121775

[47] *Mapping the Influence of Food Waste in Food Packaging Environmental Performance Assessments. Heller et al. (2018). Journal of Industrial Ecology.* https://doi.org/10.1111/jiec.12743

the assessment[48]. This means that a packaging format that causes high food waste, but otherwise has a lower environmental impact, can appear to be a better choice than a packaging format that has high environmental impact, but reduces food waste[49].

The most comprehensive overview of food packaging LCAs that include food waste is by Heller *et al.* (2019)[50]. The authors model the packaging of multiple food items including meat, dairy, salad leaves and some vegetables. The study evaluates all GHGs associated with food packaging including food production and processing, primary and tertiary packaging production, distribution, retail, transport to home, home refrigeration, packaging waste disposal and wasted food and associated inedible parts. Their results demonstrate that the ratio of GHGs associated with food production relative to packaging production is different for different products.

- The ratio is highest for carbon-intensive food such as cereals, meat, seafood, and dairy. For these products there is greater opportunity to reduce GHGs by using packaging that is specifically designed to reduce food waste.
- The ratio is lowest for less carbon-intensive foods such as potatoes, spinach, and ready-to-eat lettuce. For these products there may be greater scope to remove packaging, but *only* if there is no subsequent increase in household food waste.

The relationship between food waste and food packaging is complex. An essential part of understanding how packaging influences food waste decisions is understanding citizens' attitudes, knowledge, and behaviours.

2.2.1 Citizen attitudes towards food packaging.

In recent years, there has been a marked shift in attitudes towards food packaging and most citizens view it as having a negative impact on the environment[51]. However, there are many packaging functions that have been specifically designed to reduce household food waste[52]. These include prolonging shelf-life, availability of different pack sizes for different sized households, communicating correct storage, temperature and freezing guidance, and recommended portion sizes.

Whilst current citizen attitudes towards food packaging are generally negative, WRAP research conducted in 2013[53], found that attitudes to food packaging shifted according to the context and mind-set of citizens. When shopping in-store, packaging was a low priority for citizens, with product quality and freshness the most important factors. When asked unprompted about wider concerns about food, 'the price of food' (64%) was

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[48] Managing the incorporation of consumer food waste into the packaging development process: a cross case analysis of the UK packaged food sector. De Gama, L. (2019). University of Portsmouth. PhD Thesis.

[49] The influence of packaging attributes on consumer behaviour in food-packaging life cycle assessment studies - a neglected topic. Wikström et al. (2014). Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2013.10.042

[50] Mapping the Influence of Food Waste in Food Packaging Environmental Performance Assessments. Heller et al. (2018). Journal of Industrial Ecology. https://doi.org/10.1111/jiec.12743

[51] UK survey 2019 on citizens' attitudes and behaviours relating to food waste, packaging, and plastic packaging. INCPEN & WRAP. https://wrap.org.uk/sites/default/files/2020-08/WRAP-citizen-attitudes-survey-food-waste-and-packaging.pdf

[52] The importance of packaging functions for food waste of different products in households. Wikström et al. (2019). https://doi.org/10.3390/su11092641

[53] Consumer attitudes to food waste and food packaging. WRAP. 2013. https://wrap.org.uk/sites/default/files/2020-12/Consumer-attitudes-to-food-waste-and-packaging.pdf

the most frequent response, followed by 'how long fresh food lasts for' (48%), and just 16% cited 'how it is packaged'. However, when set within a framework of environmental concern, citizen attitudes to packaging were substantially more negative. Around four in five (81%) agreed that packaging is a major environmental problem and 57% agreed that it is wasteful and unnecessary. The same survey also found that the main concerns about packaging were linked to how easy, or indeed how difficult, it is to recycle the packaging at home.

INCPEN and WRAP conducted a follow-up survey to understand if citizen attitudes to packaging had changed[51]. The survey found that 'the price of food' (54%) and 'how long fresh food lasts for' (32%) remain as top priorities for UK citizens, yet the number of citizens that say they are concerned about food packaging has almost doubled from 16% in 2013 to 28% in 2019. When participants were unprompted, the main concerns about food packaging were the amount/quantity of food packaging, the environmental impact, and the recyclability of food packaging. However, when presented with a range of options that included reference to environmental factors, the most prominent concerns were the 'impact on oceans/marine life' (66%), food packaging that 'goes to landfill' (61%) and food packaging that is 'difficult/not possible to recycle' (58%). The 2019 survey also found that more than half of UK citizens (53%) said they had become more concerned about food packaging over the previous year. The results suggest a marked shift in concern towards food packaging largely driven by the environmental impact of it.

2.2.2 Understanding the role of packaging in reducing food waste

For fresh produce items, the relationship between packaging and shelf-life extension is not always apparent. An evidence review by WRAP in 2018 shows that there is limited evidence to suggest that plastic packaging significantly extends the shelf life of fresh produce items[54]. Whilst the results suggested that polyethylene (PE) bags can help to retain moisture and freshness, this did not translate to a significant extension in shelf-life. Only two of the 17 fruit and vegetables tested (lemons and peppers) showed a significant improvement (of more than three days) in storage-life when bagged in the fridge, versus un-bagged in the fridge. It should also be noted that the fresh produce items tested were stored in a PE bag, of the type usually provided in the supermarket, as opposed to being stored in the original packaging.

There are, of course, specific situations where packaging can extend shelf-life and can be of benefit in reducing food waste, e.g., modified atmosphere packaging that can substantially prolong the shelf-life of carbon-intensive food (e.g. meat, dairy, fish). Whereas unnecessary, non-recyclable packaging that does not significantly extend the shelf life of a product may have a limited effect on reducing household food waste. However, there is a distinct lack of research in this area.

As well as a lack of empirical evidence on the role of plastic packaging in extending shelf-life, there is also limited research about how citizens perceive the role of food packaging in reducing food waste.

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[54] *Evidence Review: Plastic Packaging and Fresh Produce, WRAP, 2018.* *https://archive.wrap.org.uk/sites/files/wrap/Evidence%20Review%20Plastic%20Packaging%20and%20Fresh%20Produce%20171218.pdf*

A review paper by Brennan et al. (2021)[55] found a series of evidence gaps in the academic and grey literature on food packaging and food waste. These include a lack of:

- Research that examines citizens' perceptions of food packaging.
- Research that focuses on actual behaviour/lived experience of citizens – rather than studies that focus on attitudes and awareness of food packaging.
- Research on the role that citizens' perceptions of food packaging can play in reducing food waste.
- Impacts of packaging design on citizen behaviours.

Only a handful of studies have examined citizen perceptions of food packaging and food waste, one of which is the consumer survey by INCPEN and WRAP (2019). The research found that whilst there has been an increase in concern about food waste and food packaging, when citizens are asked about the relative impact of both issues, only one in 10 (9%) correctly acknowledge that food waste is a bigger climate change issue than packaging waste. In contrast, around four in 10 citizens (38%) believe the opposite. These results are unsurprising given that very few citizens understand the scale and impact of food waste on the climate. In WRAP's 2019 Food Waste Trends Survey[56] 82% of citizens 'strongly' or 'tend to' agree that 'food waste is an important national issue' yet only 39% make a strong link between throwing away uneaten food and climate change.

There is currently no evidence in the academic or grey literature to suggest that packaging alone (irrespective of the date label or its other functions, such as if it extends shelf life) changes food disposal behaviours. Since evidence in this area is lacking, it is not possible to know *how* the packaging might change behaviour, and for who in what circumstances. Questions that remain unanswered in this area include:

- Do citizens keep food that is in packaging for longer than they would keep food that is bought loose, simply because it is in packaging?
- Is the reverse true? Do citizens keep food that is unpackaged for longer than food that is bought packaged simply because it is unpackaged?
- Does packaging automatically signify freshness as it can protect the product from damage, prevent contamination and stop it from drying out?
- Alternatively, does packaging automatically signify *lack of* freshness as some food may "sweat" and go off quicker when in packaging?

2.3 Summary and evidence gaps

The evidence presents a mixed picture on citizen understanding and behaviours around dates and packaging. Whilst there remains a general consensus that uncertainty and misunderstanding around date labels exists, there remains little evidence about how citizens use date labels in practice. The studies that do exist tend to be focussed on evidence derived from food waste diaries or traditional surveys – both of which rely on explicit, or claimed, responses.

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[55] *The role of packaging in fighting food waste: A systematised review of consumer perceptions of packaging. Brennan et al. (2021)* https://doi.org/10.1016/j.jclepro.2020.125276

[56] *Food Waste Trends Survey 2019: Citizen behaviours, attitudes and awareness around food waste, WRAP, 2019* https://wrap.org.uk/sites/default/files/2020-08/WRAP-Food_Waste_Trends_Survey_Report_%202019_0.pdf

At present there is very little research into citizen behaviours around food packaging and how this relates to food waste. Despite widespread recognition of the environmental and pollution aspects of food packaging, many citizens do not make a link between food waste and packaging, and many incorrectly believe that food packaging has a greater impact on climate change than food waste.

A fundamental problem seems to be that food waste behaviours are complex and interconnected, driven by social, emotional, physical and psychological factors, many of which may not even be clear to survey respondents. This means that evidence gathered via self-reporting techniques assumes the respondents can accurately recall specific aspects of their food/packaging behaviours and be aware of the reasons for those behaviours. This means that findings based on self-reporting may not necessarily paint an accurate picture of citizen behaviours.

An alternative approach is to use research techniques that, rather than relying on direct questioning and explicit responses, directly observe citizens in real-time. However, this technique involves substantial financial input creating a barrier to many researchers and research organisations. Because of these constraints, observational-type research tends to use sample sizes that are too small to infer reliable conclusions at the population level, which is essential to design and implement effective food waste interventions.

To overcome these barriers, another approach is to use indirect methods to gather implicit, as well as explicit, responses. One such methodology is the more cost-effective approach of implicit testing, which measures unconscious responses such as emotion. Implicit testing can be used to test the explicit response by using reaction time as a proxy for emotional certainty. The faster the reaction time, the more emotionally certain a respondent is likely to be.

The following chapter presents in more detail, the methodological approaches undertaken in this research.

3.0 Methodology and research design

This section describes how the research was undertaken, the design of the questionnaire and, in more detail, the approach taken in the Implicit Association Test (IAT) as well as guidance on how to interpret the IAT charts. The final section considers methodological limitations.

3.1 Approach and survey design

The survey was undertaken online from 26 January – 2 February 2021, using Yonder's proprietary panel of respondents, which is used exclusively for consumer research. A total of 4,559 adults aged 18+ in the UK were interviewed and the survey took 11 minutes to complete, on average.

3.1.1 The sample

To be eligible to complete the survey, panellists had to confirm that they ate at least four of the eight products explored in the research (i.e. fresh dairy milk; yogurts; cheddar cheese; fresh potatoes; apples; fresh broccoli; cucumber; fresh bananas). This was to ensure that the survey elicited meaningful information about the products in the research, and also to preserve the integrity of the implicit testing. Those who said they ate three or fewer of the key products were screened out of the research.

To support the research aim of understanding the behavioural response to unpackaged versus packaged products, and packaged products with no date label versus packaged products with a date label, the total sample was split into three independent samples for the main IAT element of the survey:

- Test-sample A (1,513) were shown the unpackaged products test.
- Test-sample B (1, 514) were shown the packaged products - no date label test.
- Test-sample C (1,532) were shown the packaged products - with date label test.

Henceforth, the three tests are referred to as: 'Unpackaged', 'Packaged' and 'Packaged with date'.

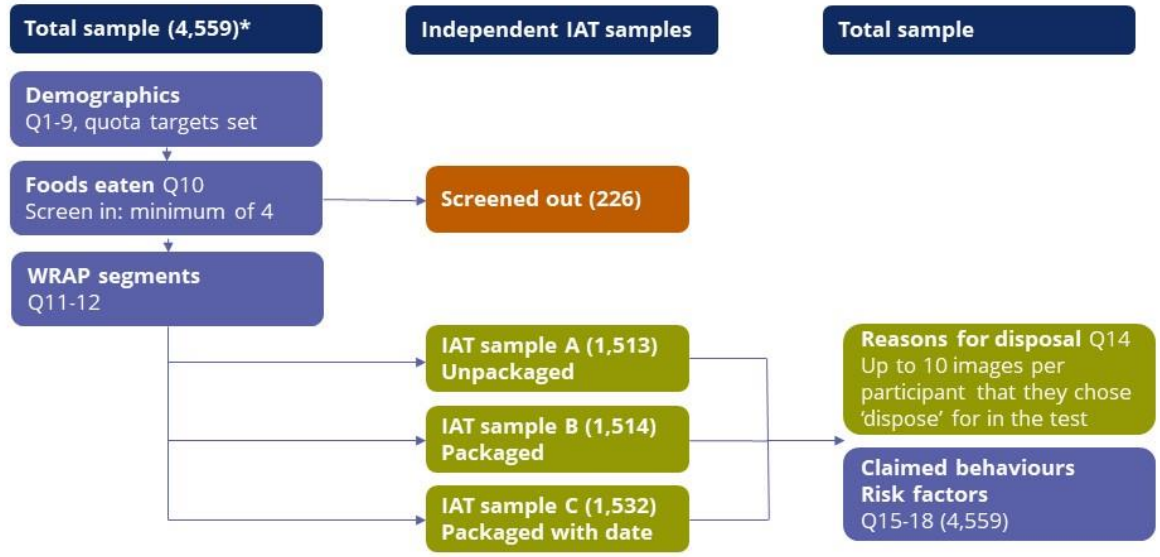
Quota targets were used to ensure that the profile of the survey sample matched the known profile of the UK population. The quotas were set on the following demographic variables: age, gender, UK nation, English region and social economic grade. Weighting was used post-hoc to correct for any minor shortfalls in the quota targets using the Random Iteration Method (RIM). The resultant weighting efficiency of the sample was 98.3%[57].

To control for as much variation between the three tests as possible, quota targets were also used in the allocation of participants to one of the three tests and minor post-survey weighting was applied. This ensured that the three IAT samples had an identical

[57] *Applying weights is the accepted way to correct for minor imbalances in the profile of a sample, but it does affect the statistical reliability of the survey estimates. We can measure how much they are affected by examining the weighting efficiency: 100% efficiency describes a sample with no weighting. Typically, for a sample which does not have any sample boosts or disproportionate sampling, we would expect the weighting efficiency to be at least 80%. A result of 98.3%, as per this survey, indicates very little weighting effect and confirms the quality of the sampling approach and adherence to the quota targets.*

demographic profile according to age, gender, nation/region and social economic grade. It means that any observable difference between the three tests would not be the result of variations in the demographic variables between the test samples, no matter how small the variation. Respondents were additionally classified into WRAP's food waste segmentation model. The way in which the sample was routed through the survey, including the division into the three test samples, is illustrated in Figure 1.

Figure 1. Survey structure and the IAT samples.



**Excludes 226 respondents that were screened out at Q10.Their responses for Q1-10 were excluded from the analysis.*

3.1.2 The structure of the survey

Further detail on the structure of the survey shown in Figure 1 is as follows:

Initial questions focused on socio-demographic factors that either formed the basis of the quota targets (i.e. age, gender, nation/region and social economic grade) or other key variables of analytical interest (i.e. work status, income and children in the home).

Respondents were then asked a question to establish which of the eight food items they eat. This acted as both a screening question (i.e. only those who said they eat four or more went on to complete the survey) and also a routing question (i.e. to ensure that a respondent was only shown images of foods that they eat). In other words, if a respondent said they didn't eat broccoli, they were not shown broccoli in the test.

Respondents were then shown the implicit test. This comprised the following:

- An orientation and information screen to set out what the test involved and the instructions for completing the test.
- A 'warm up' exercise to introduce respondents to the test (i.e. a series of screens where they were required to make a binary choice using two keys on their keyboard). This exercise also acted as a means of calibrating response times and ensuring that

all respondents were, quite literally, "up to speed" for the main test. The warm-up was unrelated to the main test, involving attitudes towards several well-known consumer brands.

- The main test was then undertaken, and respondents were shown a number of screens (25 for Test A 'Unpackaged', 32 for Test B 'Packaged' and 36 for Test C 'Packaged with date').
- Each screen showed an image of a food type at a different stage of deterioration and – in the case of the date label test – an associated date label. Respondents were asked, for each screen, whether they would either: (a) use the food (where use was defined as "eat it as it is, cook it, freeze it to use another time"); or (b) dispose of it (defined as "put in the general rubbish, food waste caddy, down the sink, compost, feed to animals, etc.")
- The sequence in which the screens appeared was randomised, meaning that a respondent would see both the products and states of deterioration in random order. For example, one respondent may have seen Banana 5, Apple 1, Milk 2 and so on, whereas another may have seen Milk 1, Banana 3, Apple 2 and so on.

Immediately following the implicit test, participants were asked for the reason that underpinned their choice. This comprised the following:

- Each respondent was shown up to 10 images they had chosen to 'Dispose' of and were asked to select a single, main reason for their choice from a prompted list. While respondents may have chosen to dispose of more than 10 products, this was decided as the limit that a respondent should see (to protect against respondent fatigue, given that they were required to answer the same question for multiple products).
- While we know from other research that real-world decisions about disposal are multi-faceted (e.g. combinations of look, smell, open life etc.), by forcing a selection here the survey aimed to avoid participants choosing all of the prompted answers and to highlight the most salient reason. That included the product being past its Best Before or Use By date in the 'Packaged with date' test.
- The full list of reasons shown to respondents has been collapsed into thematic headings in the charts showing the results in Section 5. The detailed list under each theme is as follows:

Table 2. The list of reasons for disposal with grouping into themes

Theme	Prompts included in the survey question	
Risk	Wouldn't want to risk it / take the chance	Unsafe / risk of food poisoning
Lack of confidence	Not confident in judging whether it's still OK to eat	Not confident / sure how to use it once it's reached this point
Disgust	It would taste bad / disgusting	Don't want to touch it / gross
Preference	Lost its freshness / goodness	No longer appealing
Past date	It's gone past the date on the label (shown in the 'Packaged with date' test only)	

The survey then focused on some final contextual questions to help understand the test results. This included questions about the extent to which – for each of the eight products – respondents feel they rely on date labels as opposed to their own

judgement; whether they had actually eaten any of the eight products past the specified date in the past two weeks; and finally, a question to establish the "risk profile" of respondents (e.g. previous experience of food poisoning, underlying health conditions, etc.).

3.2 Implicit Association Test

The following sections provide some contextual information about Implicit Association Tests; guidance on interpreting the IAT charts that are presented in this report; the approach taken when selecting images to use in the tests and the analytical approach undertaken.

3.2.1 Contextual information about Implicit Association Tests

Implicit testing is an advanced research tool that is used to measure emotional resonance and, by extension, propensity to change behaviour. Traditional survey questions (involving an explicit response) gather rational reactions that can, on occasion, mislead. This happens in situations where people are not able perfectly to observe or understand their own behaviour (e.g. where they are subject to influences that they either do not consciously perceive or simply underestimate)[58].

Implicit Testing is well suited to testing stated behavioural choices since it tests unconscious responses (including emotion or 'affect') which contrasts with conventional approaches that rely on conscious cognition and stated response (i.e. Kahneman's system 1 and 2 thinking, respectively).

The test presents participants with one or more target attributes (e.g. engaging; motivating, etc.) and captures the speed of response – in milliseconds – as a way of understanding levels of certainty and obtaining a more reliable assessment. The premise is that the faster people answer a question, the more emotional certainty they have in the answer they have given.

An implicit test does not undermine the stated explicit response, which remains a central part of the output. Rather, implicit testing is a way to augment the process. For example, it may simply provide high confidence in the explicit answers given or, conversely, it may suggest that the explicit answers are subject to more uncertainty than might appear at face value[58]. Put another way, the premise of implicit testing is to get closer to what happens in 'real life' than what may be achieved in terms of claimed behaviour in traditional survey.

3.2.2 Guidance on interpreting IAT charts

This report presents findings for the explicit results on their own (i.e. the percentage of respondents that selected 'Dispose' in the IAT) and as an index that combines the explicit (extent) and implicit (time) results on a two-axis grid, or quadrant graph.

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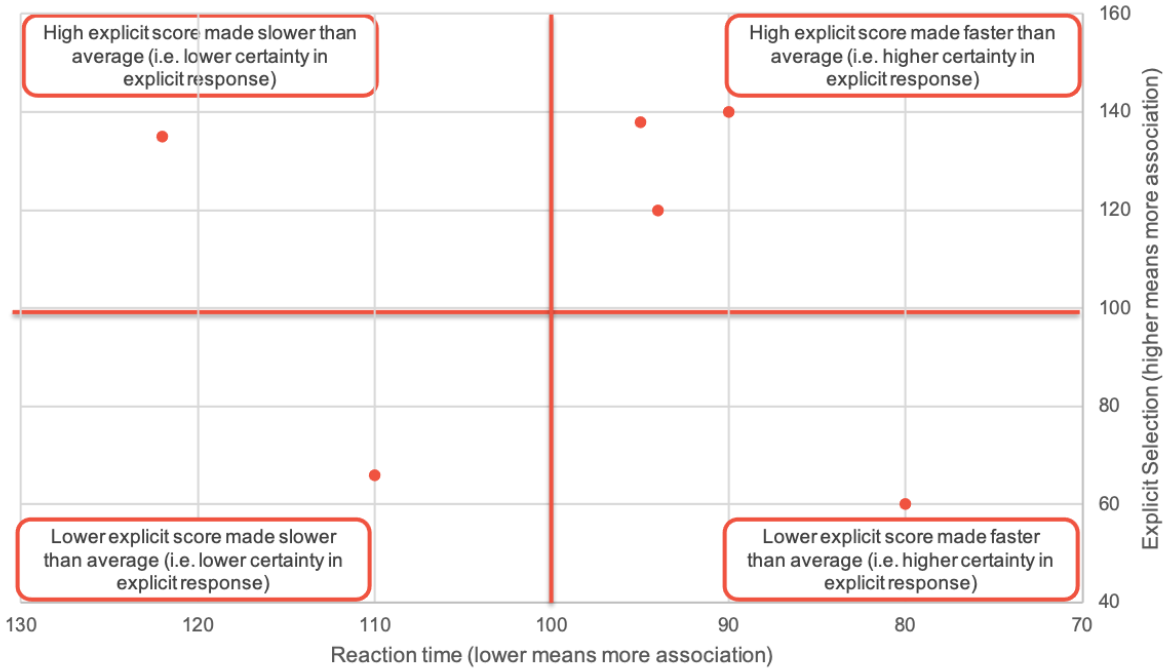
[58] *For example,* Greenwald et al (2009) *Understanding and Using the Implicit Association Test: III. Meta-Analysis of Predictive Validity,* Journal of Personality and Social Psychology, 2009, Vol. 97, No. 1, 17– 41 https://faculty.washington.edu/agg/pdf/GPU&B.meta-analysis.JPSP.2009.pdf .

- The explicit results (extent of dispose) are shown on the *y*-axis as an index score based around 100.
- The implicit (time reaction) results are shown on the *x*-axis as an index score around 100, with faster decisions assigned a value lower than 100; slower decisions a value greater than 100 and response times in line with the average assigned a score of 100.

The index baseline of 100 is calculated from the results for all the products included in the test. It is not unique to each product. It is relevant to compare, for example, the IAT results for cucumbers with the results for potatoes. A hypothetical example of the quadrant graph is shown below in Figure 2. On the graph:

- 100 on the *x*-axis represents the same value for all the products. It represents the average time taken to select 'Dispose' for every product at every stage of deterioration.
- 100 on the *y*-axis represents the same value for all the products. It represents the average proportion of respondents selecting 'Dispose' for every product at every stage of deterioration.

Figure 2: Hypothetical example of the IAT quadrants presented throughout this report.



Since the scores are indexed against every response time (i.e. for every respondent and every product at every stage of deterioration) this means that if a respondent were to be "naturally slower" to respond to the IAT images than other respondents, it would be taken into consideration when the index scores are produced. If, for example, Respondent A takes 15 seconds on average to answer, but Respondent B takes 3 seconds on average to answer, then if Respondent A took 15 seconds to answer, this would be seen as "normal" for them (rather than slow in comparison to other respondents) and given an index score of 100.

For the sake of clarity and accessibility, we do not display on the quadrant graphs data points associated with those who would use the products, all of which have their own, separate reaction time-extent index scores.

To guide the interpretation of the data, it is helpful to identify four quadrants on the graph, as follows:

- All data points in the top right quadrant represent an item of food that most respondents have said they would dispose of and, moreover, have made this decision rapidly (i.e. according to the premise of implicit testing, they are emotionally certain in their answer).
- All data points in the top left quadrant likewise indicate that most respondents say they would dispose of these items of food. However, these decisions were reached more slowly than average, indicating a degree of uncertainty in the stated answer.
- The same is true of the data points in the lower quadrants (left and right). Here, fewer respondents state they would dispose of the food items in question – some of whom do so rapidly in the right-hand lower quadrant (with more certainty); others in the left-hand lower quadrant (with less certainty).

3.2.3 Images used in the IAT.

What participants saw

Six of the products (apples, bananas, broccoli, cucumber, potatoes and cheese) were shown in all three tests. Four or five stages of visual deterioration were shown for each, depending on the product. To separate the impact of the date label, the same images were used for the 'Packaged with date' and the 'Packaged' tests and the only difference between the images was the presence of the date label on the 'Packaged with date' test. In a small number of instances, there was a visible difference in the visual deterioration between the packaged and unpackaged images, presented at an equivalent age/stage of deterioration: this limitation of the research is discussed further in section 3.3.4.

As the survey ran across several days, the date labels were adjusted each day so that respondents on each survey day saw a date label that corresponded to the same number of days past the Best Before.

Images of milk and yogurt were shown in the 'Packaged' and 'Packaged with date' tests only. Milk was shown in a glass bottle rather than a carton to make it easier to see the visual quality of the milk inside. Similarly, yogurt was shown in an opened pot with the lid partially folded back to show the contents. There were two stages of freshness/deterioration for milk and four different stages for yogurt. For the two milk items and the first two stages of deterioration of yogurt an identical item was shown without a date in the 'Packaged' test and with varying post-Use By dates in the 'Packaged with date' test, so as to separate the impact of the date label by showing the same image, with and without.

The above permutations of images resulted in the following number of images being shown in each test. Participants saw 26 in the 'Unpackaged' test, 32 in the 'Packaged' test and 37 in the 'Packaged with date' test (Table 3). Each image was shown as a single screen that asked for a binary 'Use'/'Dispose' choice. The order of seeing images was randomised.

The results section for each product in Chapter 5.0 begins with all the images shown in the IAT for that product.

Table 3. Number of product images shown in each IAT.

Product	Unpackaged	Packaged	Packaged with date
Apples	4	4	4
Bananas	5	5	5
Broccoli	4	4	4
Cucumber	4	4	4
Potatoes	5	5	5
Cheese	4	4	4
Milk	-	2	4
Yogurt	-	4	7
Total	**26**	**32**	**37**

How stages of deterioration and dates were selected, and images prepared

Images chosen for each product had to show stages of deterioration that were visually distinct from one another. If the images had only slight variations in visual deterioration, then respondents may pause to reflect on whether they had already seen and answered about the images in the test. This could skew response times and may lead to misinterpretation of a seemingly slow reaction time.

Since the product images had to be visually distinct, this impacted the choice of dates that were used in the 'Packaged with date' test. The majority of dates that were used in the test represent the time taken for the product to deteriorate, rather than a series of hypothetical dates that could test respondent sensitivity to different dates around Best Before. Due to budget constraints, exploration of hypothetical date labels around the Use By date were only explored for Milk and Yogurt. A follow-up piece of research was later commissioned to explore difference in disposal decisions for Use By versus Best Before dates on Milk and Yogurt, using a similar methodology to an IAT. This will be published later in 2022.

It should be noted that the dates for each image were derived from a small-scale in-house experiment where each of the products were stored according to the on-pack storage guidance. Images were taken daily of each product and the number of days taken to reach specific deterioration stages noted and calculated as the number of days before or after the Best Before/Use By date. The number of days past/before the date was then used to calculate the date that was shown on the 'Packaged with date' test.

Since the dates used in the IAT test were informed from a small-scale in-house experiment rather than laboratory methodologies and conditions, the dates used in the IAT were compared to shelf-life experiments that WRAP commissioned in early 2021, after the IAT survey was completed. This exercise demonstrated that the number of days before/beyond the Best Before/Use By date used in the 'Packaged with date' test was broadly comparable to the shelf-life experiments. Therefore, the dates used in the IAT test in this research are considered to reflect realistic timescales of deterioration for each product. In the ideal situation, the shelf-life experiments in laboratory conditions would have been undertaken *before* the IAT survey, to ensure that images and dates were completely consistent and more accurate than those determined from the in-house experiment. However, this was not possible because, due to UK-wide Coronavirus lockdowns, the shelf-life experiments were commissioned *after* the IAT research.

3.2.4 Analysis of the IAT results

Results were compared between the different IATs to understand the relative influence of date labels and packaging on decisions to discard. Results for the explicit part of the IAT and the explicit questions were also compared, and differences tested for statistical significance.

The IAT results were converted into index scores, as explained above. Statistical tests were performed to assess whether an apparent difference in the survey data is statistically significant or not[59]. These tests are based on statistical T-tests. They have been undertaken to the 95% confidence level (i.e. 95 times out of 100 the observed difference will be real versus five times out of 100 it will have happened by chance).

Because a sample of households has completed the survey (rather than a census), the results are subject to statistical margins of error. The margin of error is dependent on two things:

- Where the survey result falls between 0-100%: the "minimum" margin of error applies to results that are close to 10% or 90%; and the "maximum" margin of error applies to results that are close to 50%.
- The unit of analysis – for example, if it is based on the overall sample of 4,559 as a whole (i.e. where a question was asked of the whole sample); a comparison between the three independent tests (i.e. 1,513 vs 1,514 vs 1,532); or comparisons across different sub-groups (e.g. those who are reliant on date labels).

For the overall sample of 4,559, the margin of error is between ±0.9 percentage points (minimum) to ±1.5 percentage points (maximum). In other words, if the survey produces a result of 50% then the "real" result, if everyone were interviewed, would be in the range of 48.5% - 51.5%.

[59] *Statistical tests are only valid when the survey method has used random probability sampling. While the market research industry routinely applies the same logic to non-probability samples, this must be done with appropriate caveats. For example, if the data reported throughout this report were generated from a random probability sample, then the confidence intervals discussed in the report would apply. However, as the data were generated from a quota sample, confidence intervals are – strictly speaking – not possible to calculate.*

When comparing results across the three independent test samples, the margin of error is between ±2.1 percentage points (minimum) to ±3.6 percentage points (maximum). In other words, for an observable difference between the tests to be considered statistically significant, the difference must be at least 2.1 percentage points when the results are close to 10% or 90%, increasing up to 3.6 percentage points for results close to 50%. For example, if the 'Unpackaged' test produces a result of 50% and the 'Packaged' test produces a result of 53%, then this is within the margin of error and would not be statistically significant. The result in the second test would need to be 54% or greater in order to be confirmed statistically (i.e. not due to chance).

3.3 General limitations of the research project.

The research design for this project is strong, involving large sample sizes; strong adherence to quota targets and weighting efficiency; and matched sampling across the three test samples to maintain the integrity of the three tests. Nonetheless, all research projects are subject to limitations, and here we outline key issues to consider in relation to this study.

3.3.1 Survey method

An online survey method was used for this research. All survey methods have their own idiosyncrasies and biases, and all rely on agreement to take part (resulting in a degree of self-selection). This is true of online surveys in that respondents have agreed to be part of a research panel and be sent surveys to complete (which may make the pool of respondents different in some way to the wider population). They also all have – by default – online access, thus eliminating those who are digitally excluded.

The samples that are derived through online surveys can be designed – through quotas and weighting - to match the profile of the population of interest (in this case, the UK population). However, it is not technically accurate to refer to them as "representative samples", because they have not used random probability sampling where everyone in the population has an equal chance of taking part. Similar critiques are true of telephone surveys and face-to-face survey methods that use quota sampling.

3.3.2 Survey sequencing

The questions that appeared at the end of the survey (i.e. those designed to capture contextual information to help guide the interpretation of the implicit tests) were likely subject to a degree of priming bias. For example, participants who were shown the implicit test involving packaged products with a date label may – by virtue of having repeatedly seen date labels in the test – have been primed to subsequently report a higher reliance on date labels. Priming bias is an inevitable feature of any survey where some things are asked before others. In this instance, the risk of priming bias to the supporting contextual questions was considered more acceptable than asking the contextual questions earlier and thereby risking a priming bias within the implicit test.

3.3.3 The use of implicit testing

Research tests, even those that include implicit testing, cannot predict with perfect accuracy how citizens will actually behave in the real world. For example, the tests could not make allowance for the likely multiple influences on disposal choices in real-world settings (e.g. time pressures, influence of others, family dynamics, state of mind at the time, etc.). Even in the real world, individuals might not make the same choice with perfect consistency (i.e. they may choose to dispose of a food item one day under a specific set of circumstances, but then make a different choice on another day under a different set of circumstances).

3.3.4 The use of images of product deterioration

Another limitation of this research is that the test was limited to a visual inspection on screen and as such could not replicate real-life encounters with products, including other important sensory factors such as smell and touch.

The packaging of the food shown might not necessarily reflect how each participant would actually purchase and store it in real life. For example, some respondents in the packaged tests may only ever purchase broccoli unpackaged, and vice versa with the unpackaged test (e.g. cheese, which is rarely purchased unpackaged).

Likewise, there may have been a disconnect between respondents' everyday experience and the exact type of food, or the exact type of packaging shown. For example, a red apple was chosen to represent apples (even though it is conceivable that some citizens may only eat green apples). Likewise, the image of milk was shown in a glass bottle (even though some citizens may only purchase milk in plastic bottles).

While every effort was made to reduce any influence arising from differences in visibility between the packaged and unpackaged images, it is possible that some of the signs of deterioration were less visible in some of the packaged images or that dark areas within the packaging could have been viewed as deterioration.

In addition, the images in the 'Unpackaged' and 'Packaged' tests did not always show products of identical quality at the same stage of deterioration. The selection was driven by showing products of an equal age in relation to a normal Best Before date, and the deterioration may have looked different when the products were packaged compared to unpackaged (e.g. some products can appear "sweaty" when packaged, whereas unpackaged products may be more prone to moisture loss and drying).

It had to be assumed in the test that citizens would keep packaged products in the packaging when they stored them. We could not account for what would happen in the real-world when citizens would remove items from the packaging for storage, or for closer inspection, before deciding whether to use them.

Some of the Best Before dates were in the distant past (several weeks, or months in the case of cheese). This is because the selection of dates was driven by the time taken for items to reach certain stages of deterioration, rather than for investigating the dates themselves. This means that insights about citizens' sensitivity to date labels just before,

on and just after the date label are limited in this research. The same method could be applied to a more granular set of dates to explore that aspect further.

4.0 Results: Claimed behaviours

The results from this research are split across this chapter and Chapter 5.0. This chapter details the results from the survey questions that focussed on participants' claimed behaviours whereas Chapter 5.0 presents the results from the Implicit Association Test (IAT) and the participants' reasons for choosing 'Dispose' in the IAT. Questions about claimed behaviours were asked both before and after the IAT in the survey. The results for these questions are presented before the IAT results in Chapter 5.0 to provide context to those findings.

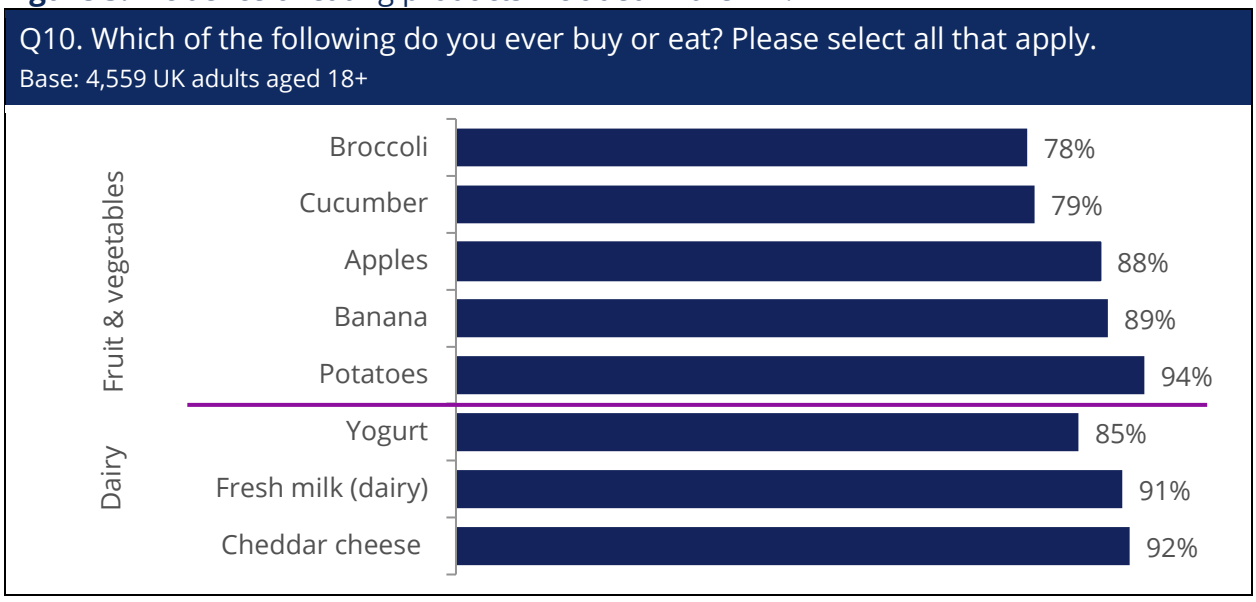
Before being directed to the IAT, respondents were asked which products they buy or eat, to ensure they were only shown images relevant to them. This question was also used to screen out participants who said they eat fewer than four products. The results in this section include only the post-screen sample that proceeded to the three IATs and the rest of the survey (Figure 1 in Chapter 3.0 provides more information about the sample). The results for this question are shown in section 4.1.

Following the IAT, questions were asked to capture explicit responses about certain behaviours relating to Use By and Best Before dates (section 4.2), and to eating past the date shown on the product (section 4.3). These responses provide additional context for the IAT results, showing what citizens say they generally do when they are prompted directly to think about it, rather than when they react instinctively to the IAT images.

4.1 Incidence rates of eating products included in the research.

Incidence of eating the different products in the tests was lowest for broccoli and cucumber, though it was still a large majority, at almost four in five respondents (Figure 2). More participants eat the other products, rising from 85% for yogurt to 94% for potatoes.

Figure 3: Incidence of eating products included in the IAT.

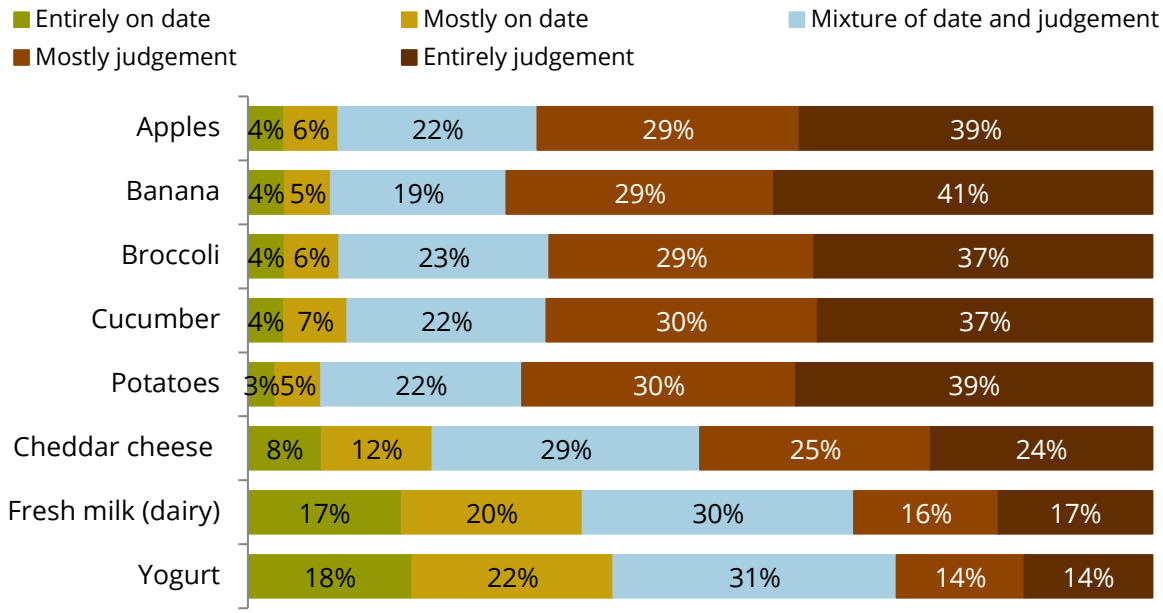


4.2 Reliance on dates versus own judgement

A key question in the survey investigated the degree to which people use their own judgement or date labels, or a mixture of both, to make decisions about when to eat or throw away food. Reported reliance on product dates to inform disposal decisions is far greater for dairy products than for fresh produce (Figure 4). NB: This question asked about dates in general terms as it included a mix of products that usually have Use By and Best Before dates.

Figure 4: Stated reliance on date labels versus judgement in disposal decisions.

Q15. Please indicate on the scale below how you make decisions about when to eat or throw away the following foods.
Base: 4,559 UK adults aged 18+



Yogurt and fresh milk

- Reliance on dates is highest for yogurt: 40% rely entirely/mostly on dates. The proportion that rely on dates rises to 71% when we add in those who rely on a mix of dates and their own judgement.
- Date reliance is only slightly less for milk: 37% rely on dates entirely/mostly; 67% when we add in those who rely on a mix of dates and their own judgement.

Since these products normally show a Use By date it is interesting that only a minority of participants said they rely entirely or mostly on dates. A further sizeable minority said they rely on their own judgement (rather than dates) either mostly or entirely (33% for milk and 28% for yogurt). Insights from other research suggest that judgement could include aspects such as whether the product is open or still sealed, how long it has been open, and important sensory features such as appearance and smell.

Cheese

Cheese appears to be in a category of its own, where date reliance sits somewhere between the fresh dairy items and fresh produce:

- 20% rely entirely or mostly on dates, which rises to 49% that rely on dates when those that used a mixture of their own judgement and dates are included.

Fresh produce

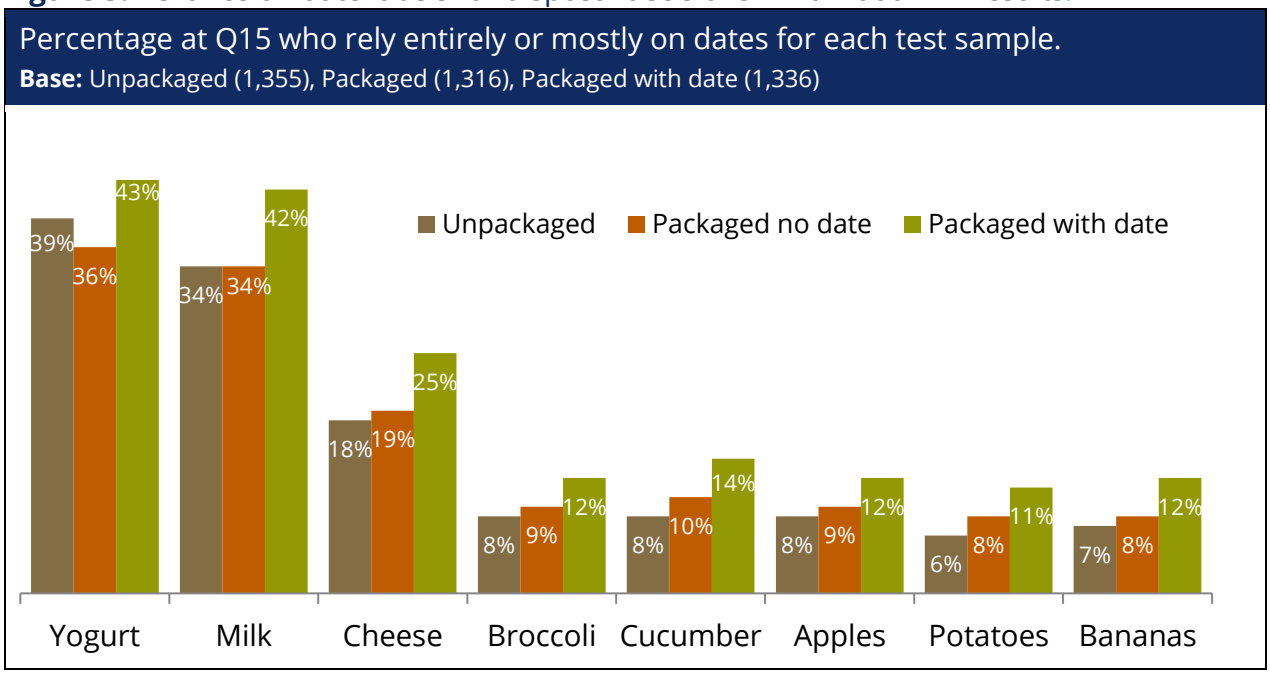
The pattern for fruit and vegetables is reversed, with a majority stating that they use their own judgement, rather than dates, to decide when to eat or throw products away.

- The proportion who use entirely or mostly their own judgement is similar across the five products, from 66% for broccoli to 70% for bananas (67% for cucumber, 68% for apples, and 69% for potatoes).
- In contrast, between only 8% and 11% (depending on product) say they rely mostly or entirely on dates (8% potatoes, 9% bananas, 10% apples and broccoli, and 11% cucumber).
- Around a further one in five (19% to 23% depending on product) use dates alongside their own judgement.

Previous WRAP research has shown that responses to questions concerning date labels may be influenced by how the questions are asked[60]. In this current survey there appears to have been a priming effect from the test itself, when comparing between the three IATs.

Stated reliance (entirely or mostly) on date labels was greater in the test that showed products carrying a date label compared to the tests that didn't show date labels (Figure 5). The difference between the proportion in the 'Packaged with date' test and the other two tests ('Unpackaged' and 'Packaged') was statistically significant for all products. The differences remained statistically significant when those saying 'a mix of date and judgement' were added to those relying on dates.

Figure 5: Reliance on date labels for disposal decisions – individual IAT results.



[60] *Consumer insight: date labels and storage guidance. WRAP, 2011.* https://wrap.org.uk/sites/default/files/2020-12/Consumer-insight-date-labels-and-storage-guidance.pdf

This finding is interesting in itself. It suggests that some participants who saw a date on products in the IAT were primed by that experience to then feel that they rely on dates more generally when they answered the later survey question, and more than they would have done if they had not seen dates. If such a priming effect from seeing dates exists in real-world settings it is possible that date labels could influence disposal decisions both directly through the information on the label and indirectly by sending signals to rely on the date rather than personal judgement (e.g. for Best Before dates). This is a tentative insight and would need to be investigated further.

4.3 Reported incidence of eating products beyond the date label.

Participants were also asked if, in the past two weeks, they had eaten any of the food items in the survey when they were past the date on pack. By asking about the past two weeks the question is intended to provide insight on what participants might regularly do, but we cannot be sure they always do this. As such, it offers a broad indicator of willingness to eat past date, with a caveat that the results might vary if the question is asked in a different context or at a different time.

To assess the incidence of eating past the product date, the question was split into two: for products that have a Best Before date (fruit, vegetables and cheese); and products that have a Use By date (yogurt and fresh milk). Results for the two questions are shown in Figure 6 and Figure 7.

Figure 6: Fruit, vegetables and cheese - incidence of eating past the Best Before date.

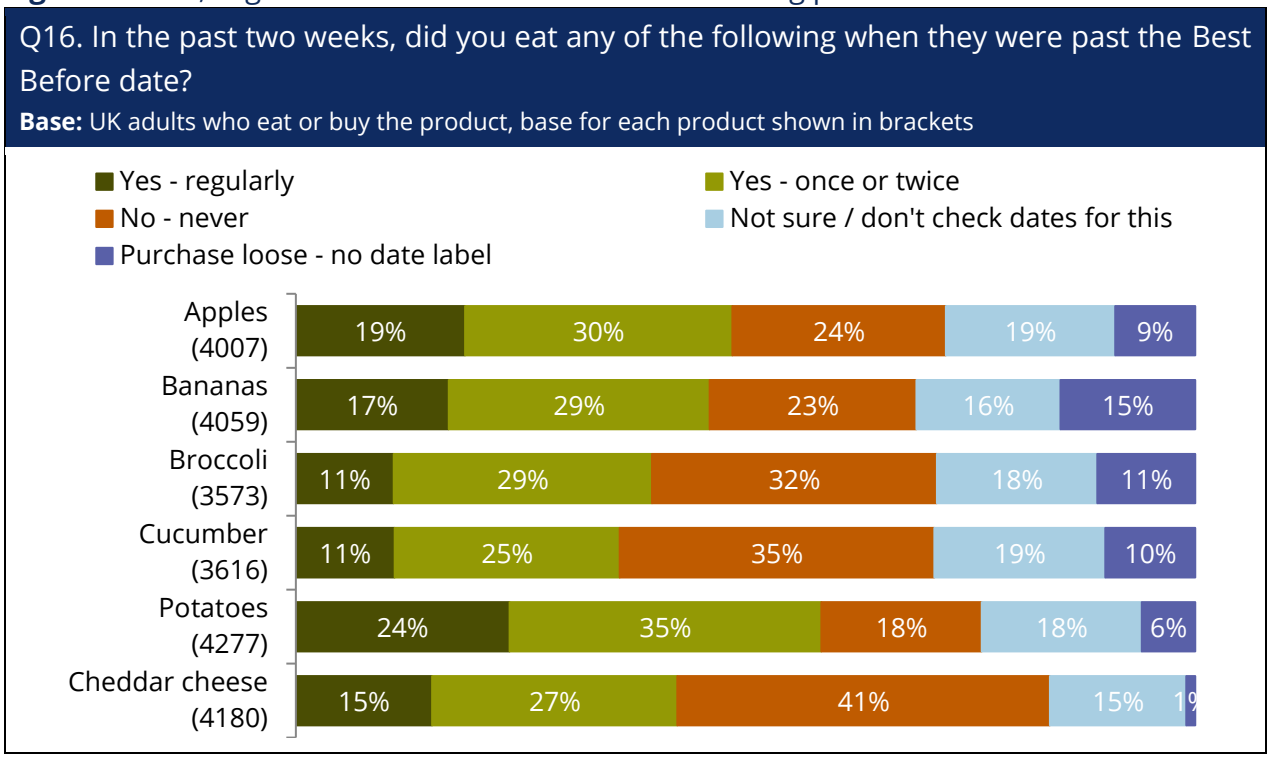
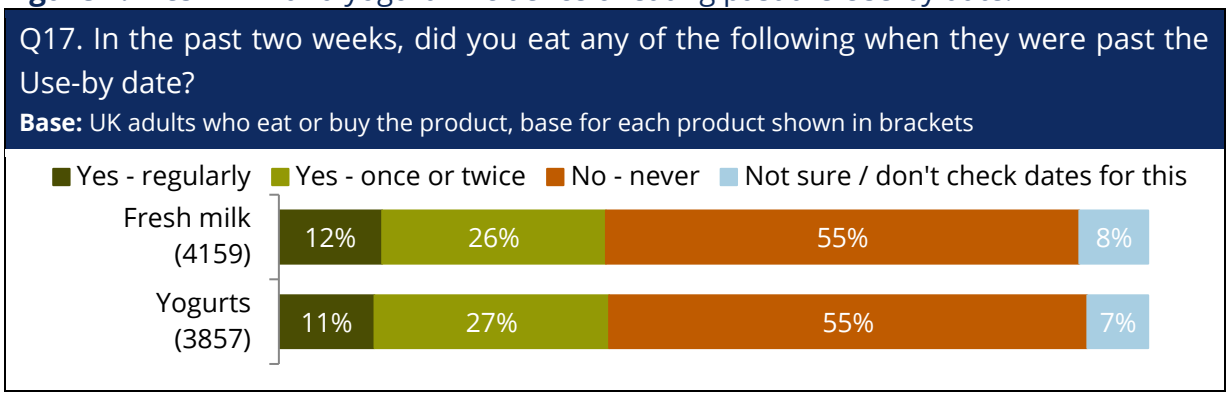


Figure 7: Fresh milk and yogurt - incidence of eating past the Use-by date.



For products with Best Before dates

- Potatoes were the item most frequently eaten past the date: 59% of participants say they ate potatoes beyond the date in the past two weeks (either regularly or a few times) whilst only 18% say they never did this, the lowest proportion of any of the products.
- Next most frequently eaten items past date were apples and bananas: 49% ate apples and 46% ate bananas past the date. Just under 1 in 4 participants never ate these items after the date (24% apples, 23% bananas).
- Broccoli and cucumber were eaten past date by fewer participants than for the other fresh produce items: 40% ate broccoli and 37% cucumber. Around 1 in 3 never ate these items past date (32% broccoli, 35% cucumber).
- Cheese, again, was different. A much higher proportion (41%) never ate past the date whilst 42% did eat past date.

A notable difference between cheese and the fresh produce items was the percentage of participants who said, *"I purchase this loose so there was no date label".* It was only 1% for cheese, 6% for potatoes, 9% for apples and 10% or more than for the other items (11% broccoli, 10% cucumber, 15% bananas). This is useful context for the test results reported in Chapter 5.0, where respondents saw only unpackaged items in the 'Unpackaged' IAT. It suggests that most participants in that IAT did not have recent experience of buying the products unpackaged, so they were possibly responding to a hypothetical scenario[61]. We cannot tell if this is their normal behaviour because a question was not asked about the frequency of buying packaged versus unpackaged products.

For products which have Use by dates

The pattern of incidence for fresh milk and yogurt was similar for the two items:

- More than 1 in 2 participants (55%) never ate past the date. This was the highest percentage for any of the products and it was the most common behaviour for both items.

[61] *The responses about purchasing products loose could have been influenced by the Covid-19 lockdowns when more people were purchasing items in packaging and shopping online where there are fewer opportunities to purchase fresh produce items unpackaged.*

- Even so, 38% said they used milk past its date and 38% ate out-of-date yogurt, which means that a sizeable minority had apparently ignored the Use By direction[62].

Across all eight products there is a small proportion of participants who appear to be relatively carefree about checking dates. In response to this question, they stated either that they were not sure if they had eaten past the date or, more definitely, that they do not check dates for a given item. This group was between 16% and 19% for the fruit and vegetable items, 15% for cheese, but smaller for milk (8%) and yogurt (5%).

In the following chapter the results from the IAT and the reasons for choosing 'Dispose' – including reference to the date on pack - are presented for each product (sections 5.1 - 5.8). At the end of each section for each individual product there is also a comparison between the above results for the explicitly stated behaviour of eating past the date and the percentage that chose 'Use' in the IAT for products that were past the date, as a proxy indicator of 'willingness to eat' past the date. The comparison provides evidence to feed into a discussion about removing Best Before and extending Use By dates.

[62] *The 38% of respondents that did consume milk past the Use By date is similar to the recent findings reported by the Foods Standard Agency in 2021 where 28% had consumed milk past the Use By date in the past month. Figure 18. https://www.food.gov.uk/sites/default/files/media/document/fy2-wave-1-report-_key-findings_1.pdf*

5.0 Results: IAT and reasons for waste

This section outlines the results of the IAT and the stated 'reasons for disposal' question, which was asked immediately after the IAT. Results are shown for each product separately, looking first at results for the explicit choices (i.e. the binary choice between 'Use' and 'Dispose') and then the IAT index results, which take into account the speed of response. Reasons given for disposal, and a comparison between stated behaviour of eating past the date and the explicit IAT results, are also presented. Key themes are drawn out in the discussion in Chapter 6.0.

5.1 Apples

Table 4 shows the images that were used in each of the IATs for apples. The number of days before or after the Best Before date that was shown on screen for the 'Packaged with date' test is also included.

Table 4: Images used for apples in each of the IATs. The images are shown in order of deterioration where Apple 1 is the least, and Apple 4 is the most deteriorated.

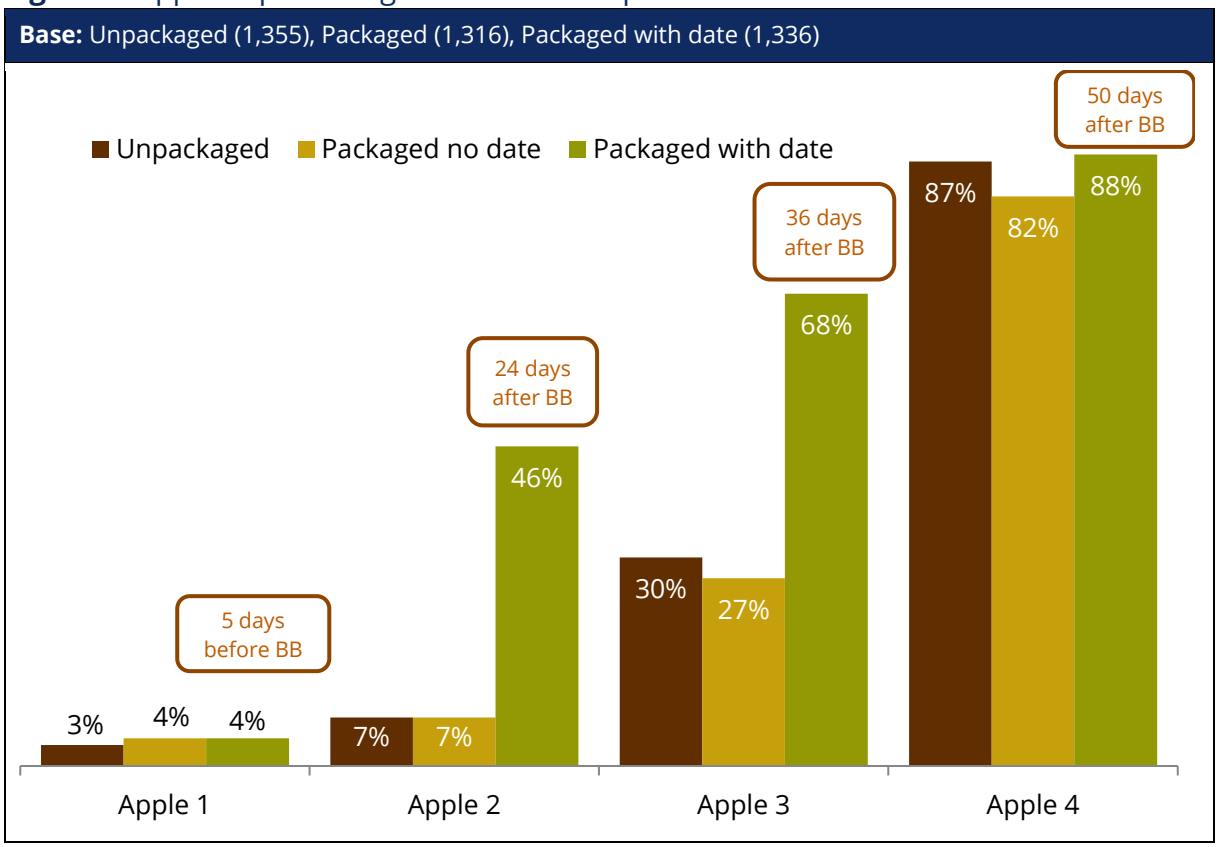
	Unpackaged	Packaged	Packaged with date
Apple 1			 5 days before BB date
Apple 2			 24 days after BB date
Apple 3			 36 days after BB date
Apple 4			 50 days after BB date

5.1.1 Explicit responses

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 8 shows the percentage of participants that chose to dispose of the apples shown in Table 4.

Very few participants – less than 5% in all three tests - selected 'Dispose' for the apple image that represented an in-date product (Apple 1), including in the 'Packaged with date' test (Figure 8).

Figure 8: Apples – percentage who chose 'Dispose' in the IAT.



The trend across the subsequent product stages (which all represented products beyond the Best Before date) was similar in the 'Unpackaged' and 'Packaged' tests. Only 7% in both tests selected 'Dispose' for Apple 2, increasing to 30% and 27% respectively for Apple 3 - which depicted apples that were a considerable 36 days past the Best Before date. At Apple 4, more than 4 in 5 in all three tests selected dispose.

The presence of a date elicited a much stronger 'Dispose' response for Apple 2 and Apple 3 in the 'Packaged with date' test. For Apple 2, 46% selected dispose at that stage compared to just 7% in the other two tests; and for Apple 3 (which was 50 days past the Best Before date) 68% selected dispose compared to 30% and 27% in the other two tests. For Apple 4, having a date appears to have made only a small difference.

The results above suggest that the presence of a date has the greatest relative impact in disposal choices at the stages of deterioration represented by Apple 2 and Apple 3. Both these stages are many weeks past the Best Before date.

5.1.2 Implicit responses

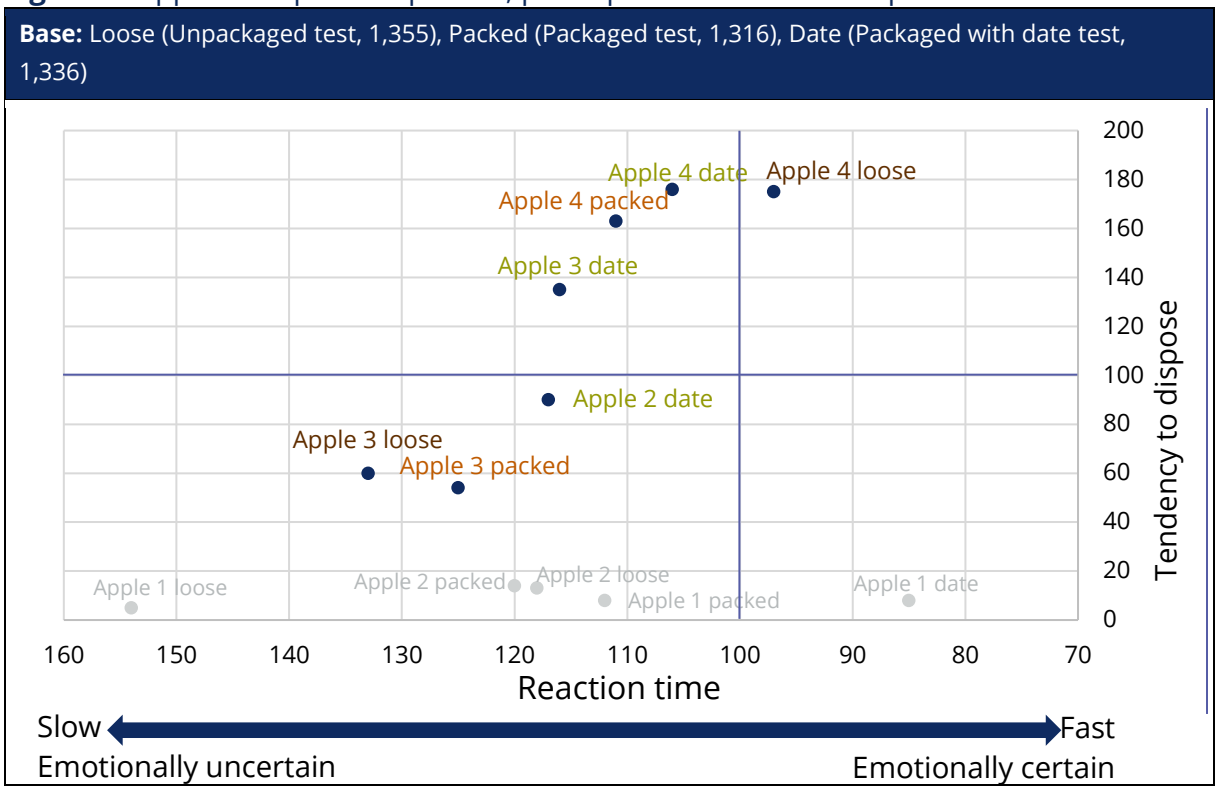
The implicit responses provide insight into how certain participants were when they decided to dispose (Figure 9). The shorter the amount of time that participants spent

choosing to dispose, the more emotionally certain we can assume they were, and the more automatic or instinctive their choice.

In the chart below, the vertical axis shows an index based on the percentage of participants that chose 'Dispose'. The horizontal axis is an index of how quickly those who chose 'Dispose' did so. Section 3.2 in Chapter 3.0 provides further guidance on how to read these IAT charts.

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 9 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

Figure 9: Apples – implicit responses, participants who would dispose.



The results indicate that participants had some degree of uncertainty for all conditions of the apples shown in all three tests - with two exceptions where the index suggests a more automatic choice [63]. These exceptions were Apple 1 in the 'Packaged with date' test; and Apple 4 in the 'Unpackaged' test. The results are described by life-stage of the product, from the stage when few would dispose (Apple 1) to when most participants would dispose (Apple 4).

Apple 1

- Very few (<100) in any test opted for 'Dispose' so those implicit results are not described (but are shown in grey in Figure 9).

[63] *To allow for the possibility that some participants would only be prepared to eat a specific variety of a product the following instruction was included before participants started the test: "Do not worry if they do not look exactly like the products you have. For example, if you see an image of a red apple but only buy green apples, imagine that it is a green apple."*

Apple 2

- There was little difference in the reaction time index between the three tests, but far more participants in the 'Packaged with date' test chose 'Dispose' (46%).

Apple 3

- A similar proportion of participants in the 'Unpackaged' and 'Packaged' tests would dispose at this stage (30% and 27%). Those in the 'Unpackaged' test were more uncertain.
- Those choosing 'Dispose' in the 'Packaged with date' test were less uncertain, though still hesitant, and more of them would dispose than in the other two tests (68% of participants).

Apple 4

- A majority opted for 'Dispose' at this stage in all three tests, slightly fewer in the 'Packaged' test than the other two tests.
- The index for those who saw unpackaged apples indicated certainty (i.e. an instinctive reaction); those in the two packaged tests were moderately uncertain, slightly more so in the 'Packaged' test with no date.
- The advanced state of deterioration of Apple 4 was very visible in the unpackaged image and this may have contributed to the differences in reaction speed between tests at this stage.
- Comparing indices for the two packaged tests, the presence of a date appears to have added certainty to the impulse to dispose, in addition to the state of deterioration.

Comparing across the three tests, the results for Apple 3 are notable. This is the stage at which a majority who saw dates (7 in 10) would dispose, which was the reverse of the other two tests without dates, where some 7 in 10 were still willing to eat the product. Those who saw dates were also less uncertain about disposing than in the other two tests at this stage. We could hypothesise that the presence of a date switches on a signal to dispose where otherwise citizens might take more time, giving the benefit of the doubt to a product of the same quality that does not have a date.

5.1.3 Reasons for waste

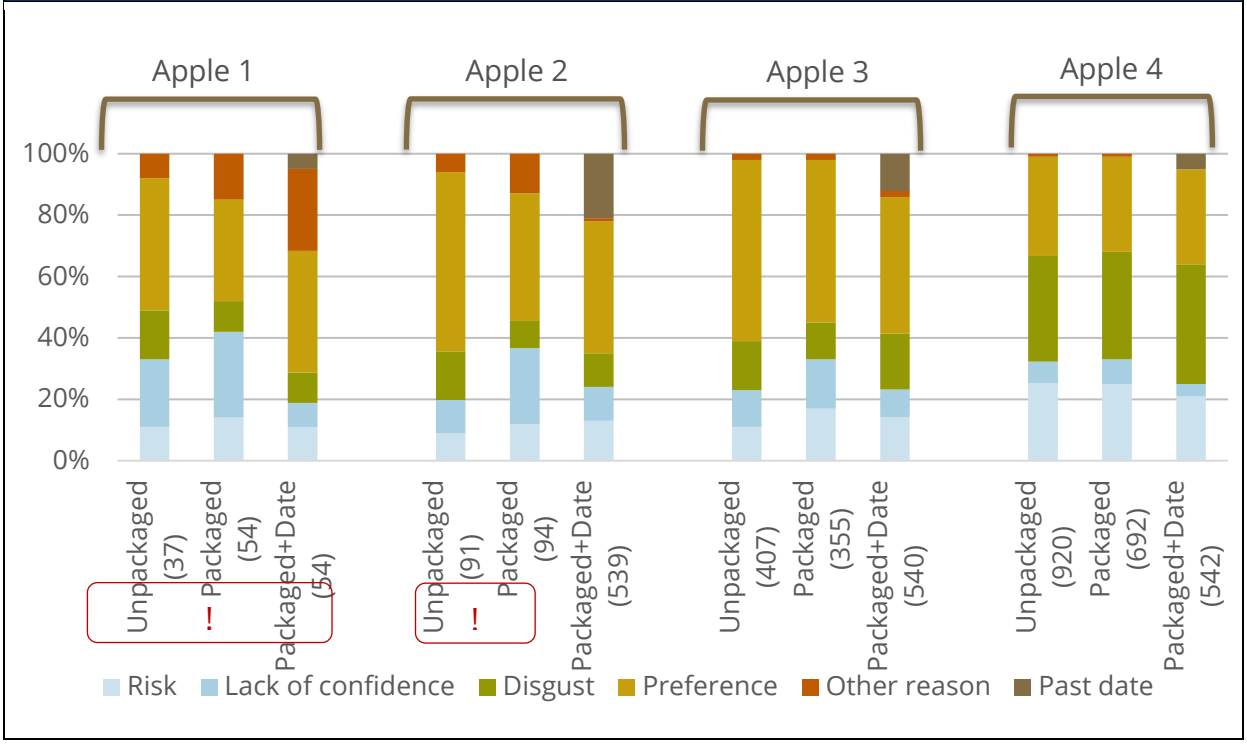
Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'. Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 10.

Figure 10: Apples - Reasons given for disposal by those saying 'Dispose' at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



The results in Figure 10 need to be considered in the context of the trend in the percentage who chose 'Dispose' in the IAT (section 5.3.1). Very few chose to dispose of Apple 1 or Apple 2 in the two undated tests, which means that the breakdown of reasons at those early stages needs to be viewed with caution. The results are more reliable for Apple 2 in the 'Packaged with date' test because of its larger sample (n = 539).

Looking at the trend in reasons across stages of deterioration:

- Personal preference is the most selected group of reasons for Apple 2 and Apple 3 in all three tests (59% in 'Unpackaged', 53% in 'Packaged' and 44% in 'Packaged with date' for Apple 3). This theme includes perceptions of lost freshness and feeling that the product is no longer appealing.
- By the stage shown in Apple 4, disgust overtakes personal preference as the most cited reason in all three tests.
- Disgust and personal preference together are cited by two-thirds or more of participants at the Apple 4 stage (66%, 66% and 70%).
- The proportion of participants who cite risk also increases between Apple 3 and Apple 4 in each test.

- Lack of confidence (e.g. in not being able to judge risk) appears to be more influential at earlier than later stages of deterioration, though it is always cited less than personal preference at each stage.
- In line with the implicit responses given in the IAT test, the proportion citing lack of confidence drops for Apple 4 in all three tests – participants are evidently certain by this stage that the product is risky or not good to eat.

Considering differences in the pattern of reasons between the 'Unpackaged' and 'Packaged' test without date labels:

- Whether the product is unpackaged or packaged appears to be irrelevant once apples have reached stage 4, where there is little difference in the breakdown of responses between the 'Unpackaged' and 'Packaged' test without a date.
- The presence of packaging appears to make a difference for Apple 3 – the first stage at which more than a few in the 'Unpackaged' and 'Packaged' tests would dispose (30% and 27% respectively). At this stage, a combination of risk and a lack of confidence in the product is cited as a reason to dispose by more of those in the 'Packaged' test (33%) than 'Unpackaged' (23%).
- Conversely, more (59%) in the 'Unpackaged' test cite personal preference as the reason for disposing Apple 3 than in the 'Packaged' test (53%).

It is possible here that the presence of packaging in the images made it more difficult to assess properly the quality of the product and that those most sensitive to risk opted instinctively for dispose. The IAT results indicate that decisions made for Apple 3 were quicker (i.e. more certain) at this stage in the 'Packaged' test than 'Unpackaged'. Whether this outcome would be replicated in a real-world situation where citizens can handle and examine the packaged product more closely would need to be assessed further.

Turning to the 'Packaged with date' test:

- 'Past date' is given as the main reason by one in five (21%) for Apple 2, falling to 12% for Apple 3 and 5% for Apple 4.
- The importance of a date label as a disposal trigger for Apple 2 aligns with the explicit IAT results, which showed that almost half in the 'Packaged with date' test would dispose of Apple 2, compared to only 7% in the other two tests.
- Personal preference is the most important reason given for Apple 2 (by 43%) in the 'Packaged with date' test.
- For Apple 3, 'past date' appears to capture some of the sentiment that would otherwise be about personal preference. Personal preference is cited by 44% of those who would dispose at this stage in the 'Packaged with date' test, 53% in the 'Packaged' test and 59% in the 'Unpackaged' test.

The responses for Apple 2 might suggest that, in addition to those citizens who will simply never eat past the date on principle, there are others who may be sensitised to thinking a product is 'just too old' by seeing a certain date. By the stage represented by Apple 4 we could hypothesise that it is obvious that both the quality and the age of the product are unacceptable to citizens (in all three tests) so that the actual date itself is

less relevant. This test could not assess the marginal date at which such a sensitising effect, if it exists, would occur.

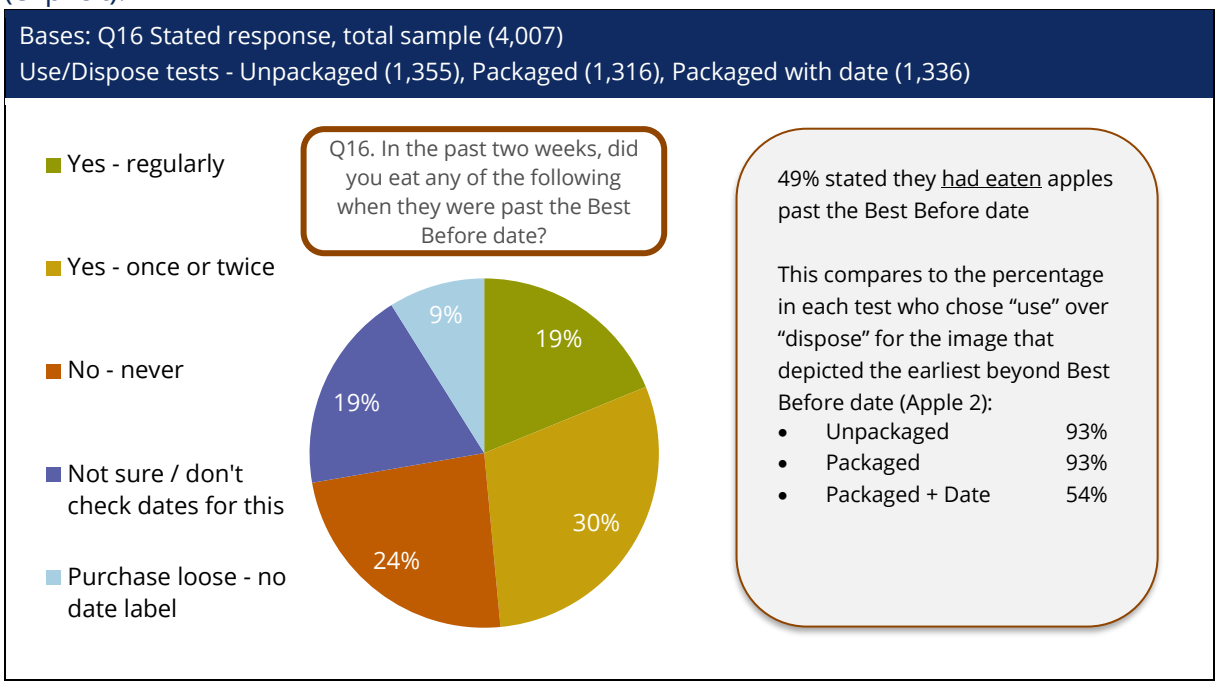
5.1.4 Difference between claimed willingness to eat past date and IAT explicit response.

If we view 'Use' in the IAT as a proxy for 'willingness to eat' then:

- In the 'Packaged with date' test we can see that the proportion who are willing to eat past the date (54%) broadly aligns with the proportion who stated they *had* eaten past the Best Before date in the past two weeks (49% in the whole sample; 51% in the 'Packaged with date' test) (Figure 11).
- By contrast, in the two tests without product dates, many more said they would use apples at the same stage of deterioration than might be expected based on stated behaviour in the past two weeks (93% willing to use Apple 2 compared to 49% who had eaten apples past the date).

This comparison further supports a hypothesis that the presence of a date label (and when the product is well past the Best Before) acts as a signal to dispose of apples that would otherwise be eaten if they did not have a date. The specific number of days past the Best Before date when such an effect would kick-in cannot be determined from the research.

Figure 11: Apples - willingness to eat past date: stated response versus test response (explicit).



5.1.5 Assumptions and considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for apples are:

- **It is possible that there is an unquantifiable bias from the variety of apple shown in the images.** For example, whether participants might be more sensitive to signs of deterioration on an apple of a variety that they do not like and would not buy. Such a possibility was recognised in the test design, which included an acknowledgement in the up-front instructions that not everyone eats the kind of apple shown: *"Do not worry if they do not look exactly like the products you have. For example, if you see an image of a red apple but only buy green apples, imagine that it is a green apple."*
- **Whether participants were responding to the *specific* dates shown on the product or an implicit *relative* scale derived from the dates included in the test.** The earliest image of a post-Best Before date apple was 24 days past the date, when nearly half of participants chose 'Dispose' in the 'Packaged with date' IAT, whilst only 4% would dispose at the previous date, which was 5 days before the Best Before date. Because this was the earliest post-Best Before date that participants saw, we cannot be certain if they were responding to the *specific* date or a *relative* sense of the date that was unconsciously benchmarked against the other dates they saw, for apples, and the other products. The images were shown at random and quickly, so there may have been an unconscious sorting process of dates going on. It is possible that the percentage who would dispose at this date might not be replicated in a test that included a set of more granular dates between the expiry of a Best Before and a few weeks past the date (or other products), because participants would be responding to a different 'post-Best Before' benchmark.
- **It is possible that there were differences in the visibility of signs of deterioration between the unpackaged and packaged apples for the later stages (stages 3 and 4).** This might have had a small influence on the speed of response in the IAT at stage 4 (e.g. if participants took more time to examine deterioration in the packaged images); and it may also be reflected in the very small difference observed in the explicit IAT result between the 'Unpackaged' and 'Packaged' apples at stages 3 and 4. A slightly larger percentage of participants chose to dispose in the 'Unpackaged' test at those stages (Figure 8). We do not believe this was an important source of bias for apples. The results for Apple 1 and 2 – where there was almost no difference in results between the 'Unpackaged' and 'Packaged' tests - similarly indicate there was negligible bias from the images used.

5.2 Bananas

Table 5 shows the images that were used in each of the IATs for bananas. The number of days before or after the Best Before date that was shown on screen for the 'Packaged with date' test is also included.

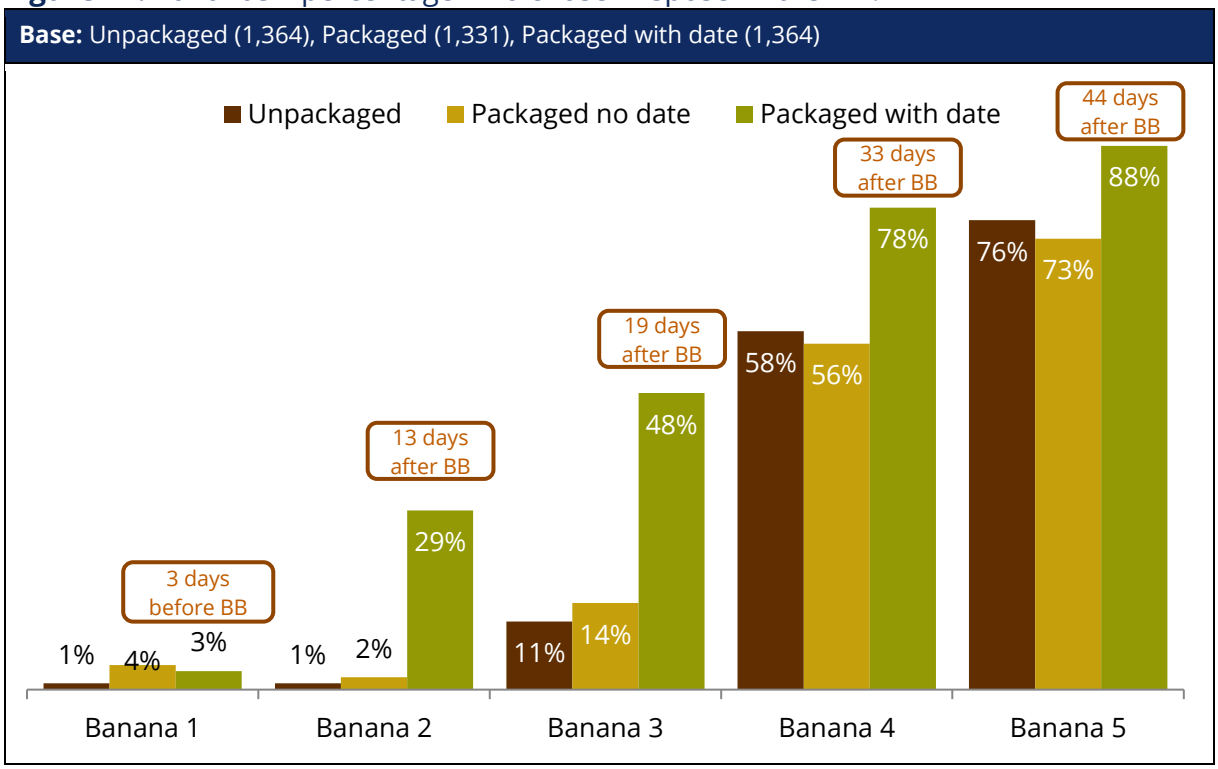
Table 5: Images used for bananas in each of the IATs. The images are shown in order of deterioration where Banana 1 is the least, and Banana 5 is the most deteriorated.

	Unpackaged	Packaged	Packaged with date
Banana 1			 3 days before BB date
Banana 2			 13 days after BB date
Banana 3			 19 days after BB date
Banana 4			 33 days after BB date
Banana 5			 44 days after BB date

5.2.1 *Explicit responses*

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 12 shows the percentage of participants that chose to dispose of the bananas shown in Table 5.

Figure 12: Bananas – percentage who chose 'Dispose' in the IAT.



Almost all participants chose 'Use' for Banana 1 (3 days before the Best Before date) and the same applied in the 'Unpackaged' and 'Packaged' tests for Banana 2 (equivalent to 13 days past the Best Before). Slightly more (4% compared to 1%) chose 'Dispose' in the 'Packaged' test than 'Unpackaged' for Banana 1, which was a statistically significant difference. There was no statistically significant difference between these two tests for Banana 2.

A larger percentage in both of those tests opted to dispose of Banana 3. It was slightly more in the 'Packaged' test (14%) than the 'Unpackaged' test (11%). The proportion moved to more than half in both tests for those who would dispose of Banana 4 and increased further for Banana 5 to nearly three-quarters of participants (76% and 73%).

The trend in the 'Packaged with date' test was very different. A sizeable minority (29%) opted to dispose of Banana 2, whereas very few participants in the other two tests would dispose. The label showed that the pack of bananas was the equivalent of 13 days past the Best Before date. It appears to be the presence of the date that is driving this difference between the tests, whereas it would appear that participants in the other tests made a decision based on the appearance of the bananas.

As shown in Figure 12, a gap between the tests in the percentage who would dispose was maintained for all the images that showed 'out of date' bananas, with many more in

the 'Packaged with date' test opting for dispose than in the two tests that did not show dates.

The trend shows very clearly that the presence of a date elicited an earlier and larger 'Dispose' response than when a date was not present. Whether the bananas were packaged or unpackaged appeared to make no or only a minor difference at every stage of deterioration.

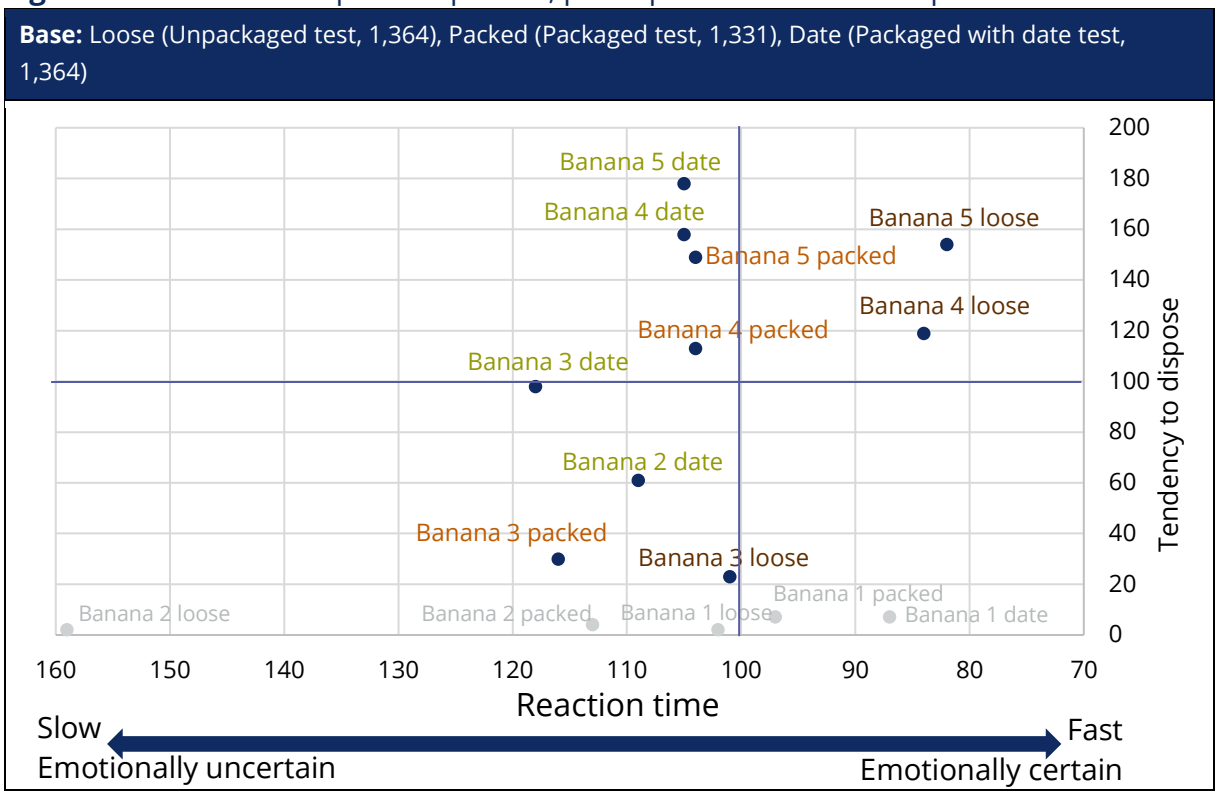
The results for Banana 2 and Banana 3 suggest that the presence of a date is activating those who are 'date sensitive' – those that say they rely wholly or partly on dates - to judge when to eat or throw away given products. The proportion who said they sometimes relied on dates for bananas was 28% in the sample combined across the three tests (Figure 4, page 48), but was 36% in the 'Packaged with date' test.

5.2.2 Implicit responses

The implicit responses offer insights on how emotionally certain (or instinctive) participants' choices were. The results indicate that participants in all three tests, and for most deterioration-stages of the bananas, were relatively uncertain. The exception was for unpackaged Banana 4 and 5, when decisions to dispose were fast, indicating automatic rather than deliberative responses by participants.

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 13 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

Figure 13: Bananas – implicit responses, participants who would dispose.



Banana 1

- Very few (<100) participants in any of the tests chose 'Dispose' for Banana 1 so those implicit results are not described (but are shown in Figure 13).

Banana 2

- This was the stage at which a sizeable minority in the 'Packaged with date' test chose 'Dispose' (29%).
- The index suggests there was some uncertainty by those who made that decision.
- Very few chose 'Dispose' in the other two tests (1% and 2%) so the results for response speed are not meaningful and have been coloured grey in Figure 13.

Banana 3

- Even more participants in the 'Packaged with date' test would dispose at this stage (48%), but those who said so were less certain than those who disposed of Banana 2 – i.e. there was more hesitancy about disposing at this stage.
- Once again, fewer participants opted for 'Dispose' in the other two tests: they were less uncertain than the larger proportion who disposed in the 'Packaged with date' test. Those who saw unpackaged bananas and would dispose were the least hesitant at this stage.

Banana 4

- There was a notable turnaround in the 'Unpackaged' test: a majority would now dispose, *and* that choice was certain.
- In the packaged tests, participants were slightly, and similarly, uncertain about disposing, and more participants did so in the 'Packaged with date' test.

Banana 5

- Three-quarters of participants who saw unpackaged bananas were very certain of their choice to dispose.
- Participants who saw packaged bananas were far less certain about Banana 4 and 5 than those who saw unpackaged bananas. We need to consider here whether the packaging in the images made it more difficult to assess the extent of browning of the bananas. There was little difference in reaction time between the packaged tests with and without Best Before dates.

For the life-stages of bananas when many participants would choose dispose (3, 4 and 5) there was little difference in the reaction times between the two packaged tests, which suggests that the date was adding no additional certainty, even though more of those who saw a date would dispose at each stage than if they had not seen a date. For each of those stages, fewer who saw unpackaged bananas would dispose, but they were more certain in that choice.

5.2.3 Reasons for waste

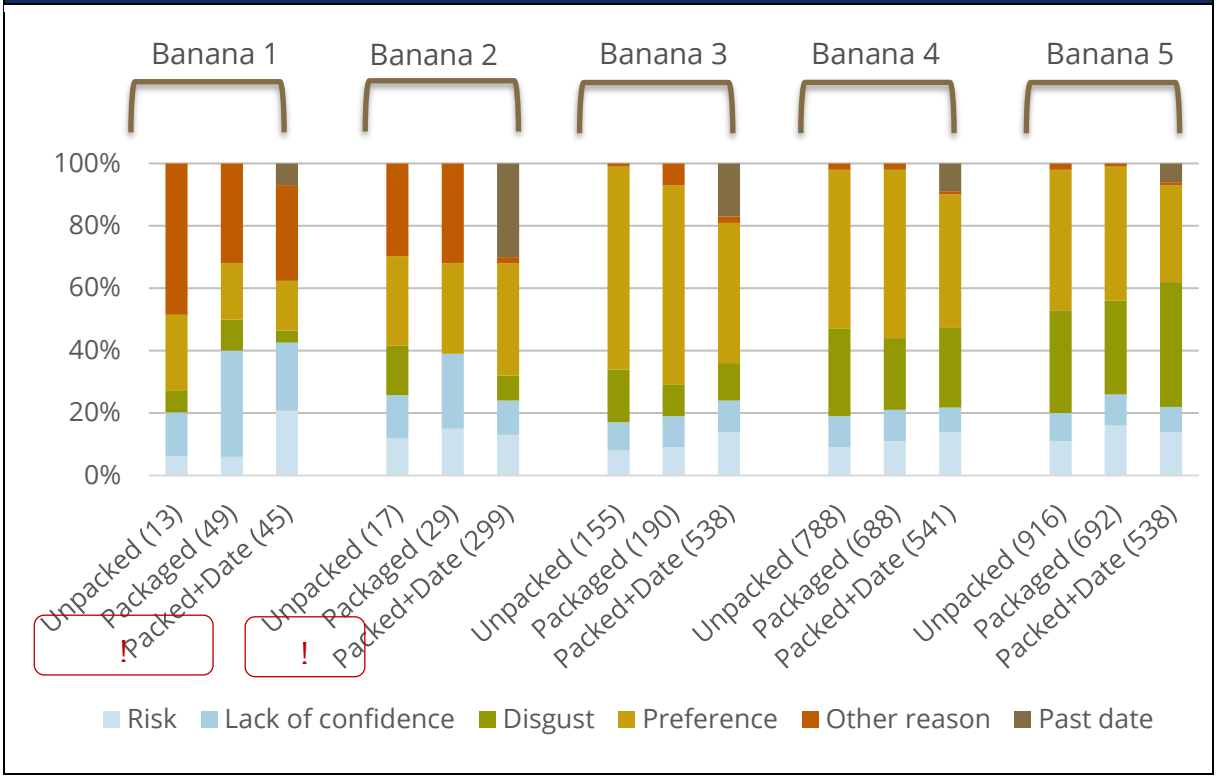
- Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'.

Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 14.
The explicit results suggest that the 'turning point' when decisions started shifting towards 'Dispose' was Banana 2 in the 'Packaged with date' test and Banana 3 in the other two tests.

Because so few selected 'Dispose' for Banana 1 and 2 in the 'Unpackaged' and 'Packaged' tests, the reasons given are only described for Banana 3 onwards for those tests (though results for all stages are shown in Figure 14 below). Results for Banana 2 are also considered for the 'Packaged with date' test, because a sizeable proportion (29%) selected 'Dispose' at that stage, unlike in the other two tests.

Figure 14: Bananas - Reasons given for disposal by those saying "dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.
Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.
! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



Looking at the trend in reasons across product life-stages:

- For Banana 2 (13 days past the Best Before) the date itself was a leading reason for selecting 'Dispose' in the 'Packaged with date' test (30%). The other main reason was personal preference, cited by a further 36% of participants.
- Preference was the dominant reason cited for Banana 3 in all three tests, though the proportion was greater where a Best Before date was not shown (65% in the

'Unpackaged' test and 64% in the 'Packaged' test; 43% in the 'Packaged with date' test). Preference included loss of freshness and loss of appeal.

- The date itself appears to have proxied for what might otherwise have been personal preference in the 'Packaged with date' test, with 17% of these participants citing it for Banana 3.
- Once the bananas were visibly brown all over, at stages 4 and 5, disgust became a more prominent reason for disposal, alongside personal preference in all three tests.
- Notably, whilst personal preference continued to be the leading reason in the 'Unpackaged' and 'Packaged' tests (45% and 43%), followed by disgust (33% and 30%), the order switched around in the test where a date label was shown (40% disgust: 31% preference).

Looking at the possible influence of packaging, a comparison between the 'Unpackaged' and 'Packaged' tests shows:

- Across stages 3 to 5 there was little difference between the two tests in the lead reason for choosing 'Dispose', which was personal preference about freshness and product appeal.
- However, disgust was cited by a notably higher percentage in the 'Unpackaged' test than the 'Packaged' test for Banana 3 (17% and 10% respectively) and Banana 4 (28% and 23%), and slightly higher for Banana 5 (33% and 30%).
- There are two possible reasons for this: either the presence of packaging conferred a greater sense of quality; or it was more difficult to see the decline in product appearance in the packaged images. As noted for apples, we cannot know if this result would be replicated in real-life situations where citizens could examine the product more closely or de-package a product to check.
- In any case, similar proportions in the two tests opted for 'Dispose' for Banana 3 and Banana 4. Therefore, it seems likely that for the greater proportion that cited disgust in the 'Unpackaged' test, their sense of disgust made little or no difference to their disposal choice.

Looking at reasons given in the 'Packaged with date' test, the presence of a date was associated with more participants choosing to dispose at every stage than in the other two tests:

- The date itself was less frequently cited as a reason for disposal as loss of quality became more apparent in the images of later stages of deterioration – falling from 30% of those disposing of Banana 2 to 17% for Banana 3, 9% for Banana 4 and 6% for Banana 5.
- We could hypothesise that for a banana where visible quality is still good (Banana 2) or 'on the turn' (Banana 3) some citizens are using the date label as a substitute for their own judgement about quality.
- As deterioration becomes more obvious the date itself is a less relevant indicator of quality and is overtaken by feelings such as disgust that are evoked directly by visual appearance or by historic calendar dates (4.7 to 6 weeks in this case). The faster response times for Banana 4 and 5 in the implicit results is suggestive of a more instinctive reaction to those images, which would fit with this hypothesis.

- Participants in both packaged tests were similarly fast in deciding to dispose at these later stages, but a greater proportion opted to dispose in the 'Packaged with date' test, and more gave disgust as a reason. This could suggest that the historic dates shown in the images triggered such emotions more than when participants did not see a date, which resulted in more participants opting for disposal.

5.2.4 Difference between claimed willingness to eat past date and IAT explicit response.

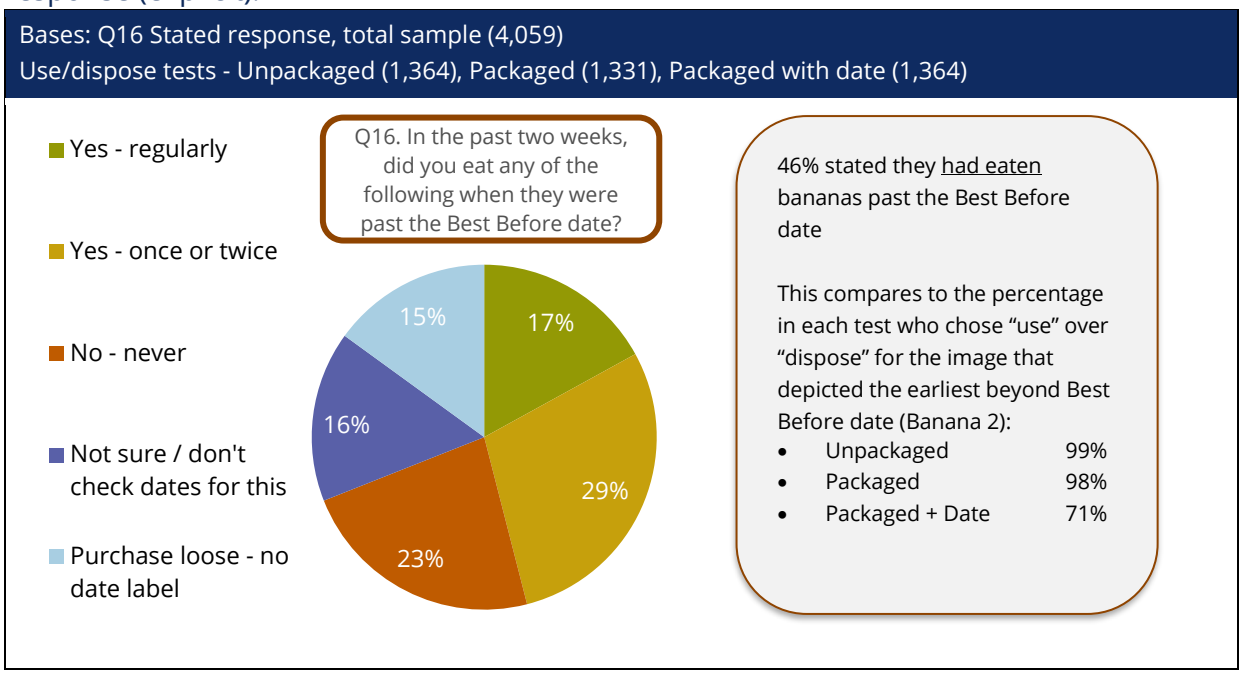
When participants were asked directly if they had eaten bananas past the Best Before date in the past two weeks, 46% said they had. There was little difference between the three tests in the proportion of participants who said this.

Banana 2 was the first stage depicting bananas that were beyond the Best Before date (+13 days). Figure 15 compares the percentage who were willing to eat (i.e. chose 'Use') Banana 2 with the proportion who said they had recently eaten bananas past the Best Before date:

- Many more participants in the 'Packaged with date' test (71%) would 'Use' Banana 2 (when the banana was mainly yellow) than those who stated they had eaten bananas past the Best Before date (46%).
- When the date was 19 days past the Best Before date (Banana 3), the proportion who would 'Use' it in the 'Packaged with date' test fell to 52%. This was when the image showed extensive brown spots on the banana.
- A much higher proportion of participants selected 'Use' for Banana 2 in the other two tests than would be indicated by their explicitly stated behaviour (99% in the 'Unpackaged' test and 98% in the 'Packaged' test). That proportion was more than double what would be expected on the basis of self-reported recent behaviour. It remained high, at 86% and 89% respectively, for Banana 3.

These results support the earlier hypothesis from the IAT findings: that many more citizens would be willing to eat bananas past the Best Before date if the product does not display a date. We could hypothesise from the results that many citizens would be willing to use bananas much later than a typical Best Before date would indicate. Whether the product was packaged or unpackaged appeared to make little difference at this crucial life-stage for bananas: the presence of a date was the important difference, which appeared to exaggerate the disposal cues from visible deterioration.

Figure 15: Bananas – difference between claimed willingness to eat past date and test response (explicit).



5.2.5 Assumptions and considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for bananas are:

- **Possible differences in the relative visibility of states of deterioration between unpackaged and packaged bananas at the later product life-stages.** This needs to be considered in relation to: the very small difference observed in the percentage who would dispose packaged or unpackaged bananas at stages 4 and 5; and the greater certainty about disposing bananas at those stages when participants saw unpackaged bananas.
- **Whether participants were responding to the *specific* dates shown on the product or an implicit *relative* scale derived from the dates included in the test.** The earliest image of a post-Best Before date banana was 13 days past the date, whilst the next earliest date was three days before the Best Before date, so there was no opportunity to capture responses to products that had just passed the Best Before date. Because this was the earliest post-Best Before date that participants saw, we cannot be certain if they were responding to the *specific* date or a *relative* sense of the date that was unconsciously benchmarked against the other dates they saw in the test, for bananas and the other products. The images were shown at random and quickly so there may have been an unconscious sorting process of dates going on. It is possible that the percentage who would dispose at this date might not be replicated in a test that included a set of more granular dates between the expiry of a Best Before and a few weeks past the date, or different products, because participants would be responding to a different 'past Best Before' benchmark.

5.3 Broccoli

Table 6 shows the images that were used in each of the IATs for broccoli. The number of days before or after the Best Before date that was shown on screen for the 'Packaged with date' test is also included.

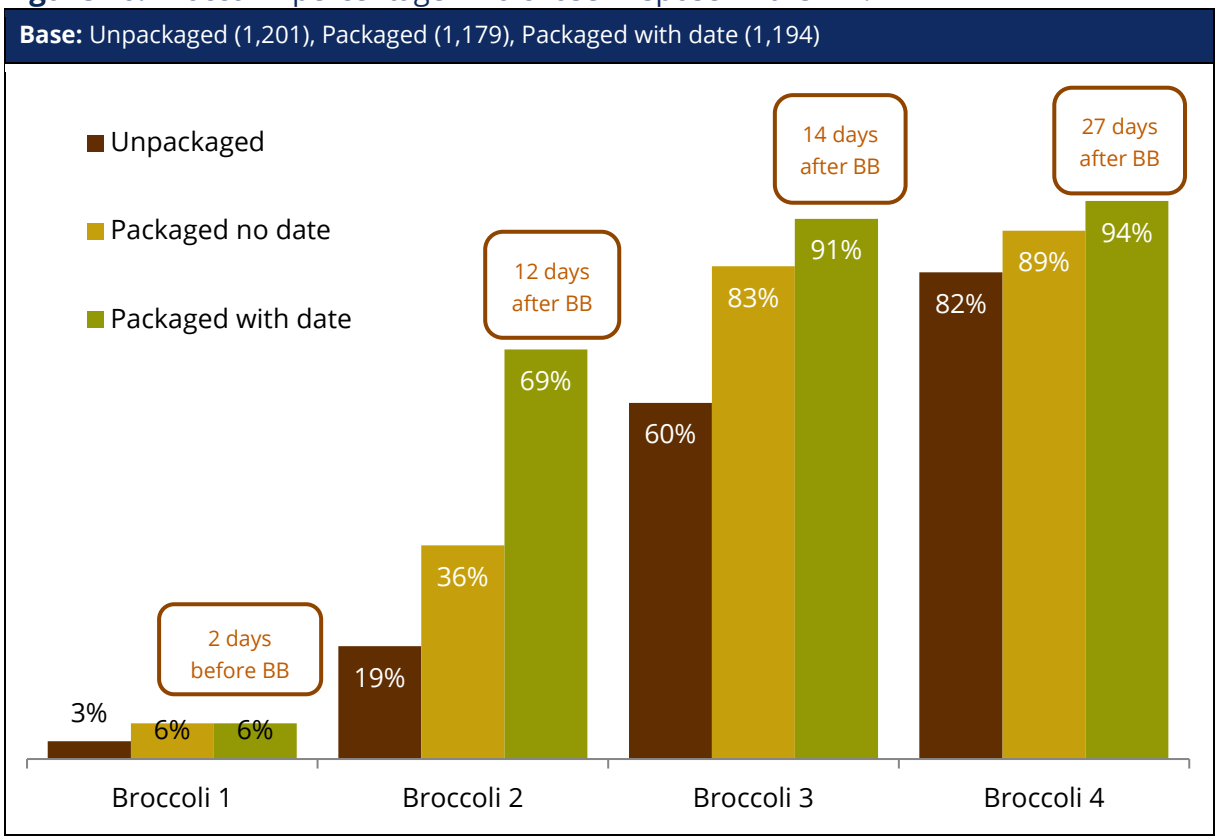
Table 6: Images used for broccoli in each of the IATs. The images are shown in order of deterioration where Broccoli 1 is the least, and Broccoli 4 is the most deteriorated.

	Unpackaged	Packaged	Packaged with date
Broccoli 1			 2 days before BB date
Broccoli 2			 12 days after BB date
Broccoli 3			 14 days after BB date
Broccoli 4			 27 days after BB date

5.3.1 *Explicit responses*

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 16 shows the percentage of participants that chose to dispose of the broccoli shown in Table 6.

Figure 16: Broccoli – percentage who chose 'Dispose' in the IAT.



Almost all participants in the three tests chose 'Use' for Broccoli 1, where the image showed broccoli that was two days before its Best Before date. There was, though, a small and statistically significant difference between the proportion who would dispose in the two packaged tests (6%) than those who saw unpackaged broccoli (3%).

There was a sizeable uplift in all three tests in the percentage that would dispose of Broccoli 2, which was 12 days after its Best Before date. The size of the uplift differed significantly between the three tests. It was smallest in the 'Unpackaged' test (19% would dispose), rising to 36% in the 'Packaged' test and 69% in the 'Packaged with date' test.

Broccoli 3 was the first stage at which a majority in all three tests opted for 'Dispose'. Participants who saw unpackaged broccoli were still least likely to choose 'Dispose' (60%) compared to those who saw packaged broccoli, where more than 4 in 5 in both tests would dispose.

The addition of a date to the pack appeared to further increase the likelihood of broccoli being thrown away at this stage: 91% chose 'Dispose' in the 'Packaged with date' test compared to 83% in the 'Packaged' test for Broccoli 3.

By the state of deterioration illustrated by Broccoli 4, more than 4 in 5 participants in all three tests would dispose. The hierarchy in the proportion who would dispose was sustained across the three tests – i.e. greatest in the 'Packaged with date' test (94%), followed by 'Packaged' (89%) and then the 'Unpackaged' test (82%). Notably, this meant that a sizeable minority (18%) in the 'Unpackaged' test indicated they would continue to use the broccoli.

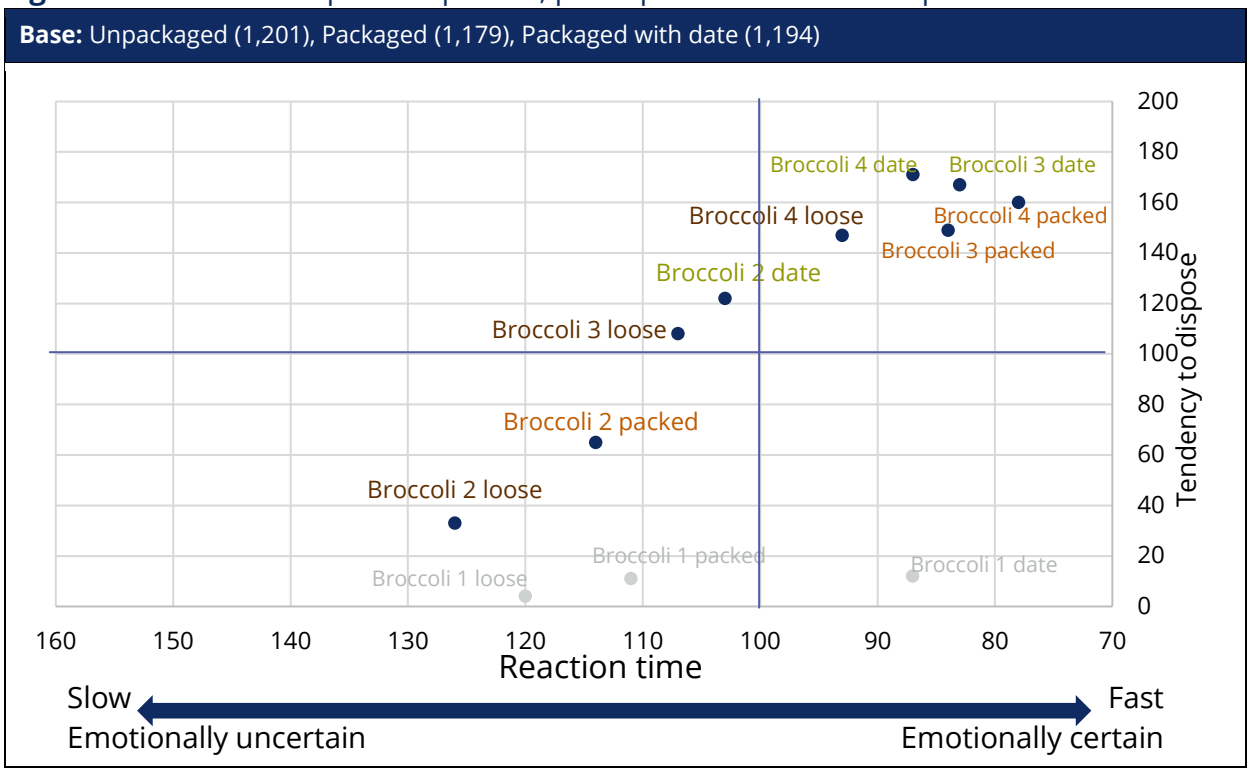
These results are different from apples and bananas in that they indicate the presence of packaging is, in itself, driving disposal decisions at every life-stage of the broccoli to some extent. The presence of a post-Best Before date appears to add to the effect, most importantly for broccoli in the quality state represented by Broccoli 2. As noted in previous sections, the specific number of days when this effect would kick-in was not explored in this research.

5.3.2 Implicit responses

The implicit results provide insight on how emotionally certain participants were when they selected 'Dispose' in response to each image. The faster the response the more instinctive it is assumed to be. Overall, the implicit scores indicate certainty about wanting to dispose of Broccoli 3 and 4 in both the packaged tests and Broccoli 4 in the 'Unpackaged' test. The images shown for these stages both had advanced signs of deterioration.

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 17 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

Figure 17: Broccoli – implicit responses, participants who would dispose.



Broccoli 1

- Very few (<100) participants in any of the tests chose 'Dispose' for Broccoli 1 so those implicit results are not described (but are shown in Figure 17).

Broccoli 2

- The same pattern of relative certainty was maintained across the three tests at this stage.
- Many more in the 'Packaged with date' test opted to dispose (69%) and they were more certain than the smaller proportions that opted for 'Dispose' in the other two tests.
- Those who chose 'Dispose' in the 'Unpackaged' test (19%) were the least certain by far in any test, at any product life-stage.

Broccoli 3

- There was a large shift towards certainty by those who chose 'Dispose' in all three tests, which most likely reflects the visual appearance of the broccoli at this stage, which was entirely brown except for the stalk.
- Those who saw unpackaged broccoli and would dispose were mildly uncertain, whilst those who saw packaged broccoli were very certain they wanted to dispose, and substantially more did so than in the 'Unpackaged' test (60% in 'Unpackaged', 83% in 'Packaged' and 91% in 'Packaged with date).
- There was little difference in degree of certainty between the 'Packaged' and 'Packaged with date' test, but more participants opted for 'Dispose' when they saw a date.

Broccoli 4

- There was little hesitancy by those who would dispose at this stage. There was greatest certainty by those would dispose in the 'Packaged' test, followed by those in the 'Packaged with date' test and, certain but less so, those in the 'Unpackaged test.

Comparing the implicit scores across the three tests:

- Those who saw unpackaged broccoli were least certain about disposal across all life-stages depicted. The scores suggest they were certain only once broccoli reached the stage of deterioration represented by Broccoli 4.
- Participants who saw packaged broccoli were certain about disposing at an earlier product life-stage than if they saw it unpackaged - at Broccoli 3.
- In the 'Packaged with date' test the 'turning' point from use to dispose was even earlier, at Broccoli 2, and the index suggests participants were close to being certain about choosing 'Dispose' at this point.

The implicit results support the explicit results, suggesting that when deterioration is visible on broccoli, the packaging itself exaggerates feelings that the broccoli is unusable, including reasons that are covered in the next section. The addition of a date label well past the Best Before, appears to accelerate and amplify that response, and the response is more automatic than when a date is not present (except for broccoli with an extremely old date).

5.3.3 Reasons for waste

- Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' of in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'.

Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 18.

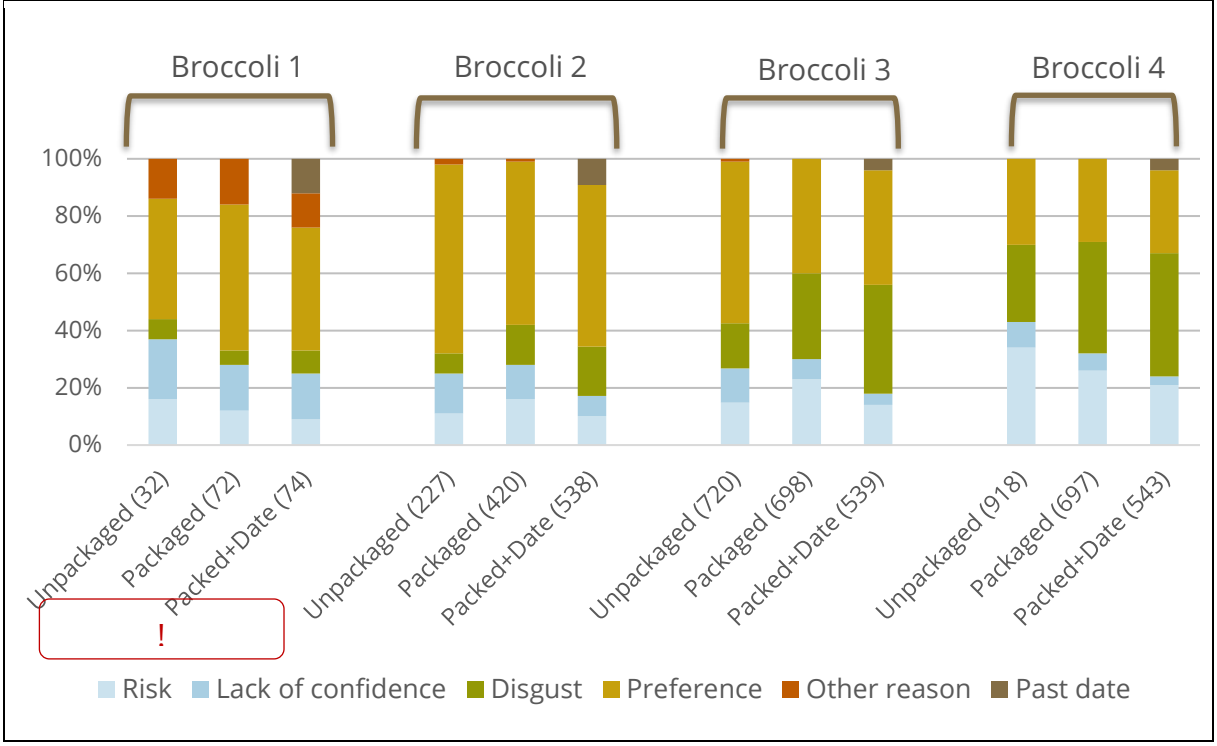
In considering the stated reasons for choosing 'Dispose' in the IAT it is worth recalling the visual condition of the broccoli in the images for different life-stages. Only Broccoli 1 depicted bright green broccoli. All the other stages had significant yellowing/browning: Broccoli 2 still had some green parts, but most florets were browned; Broccoli 4 depicted surface mould on top of the generally brown condition of the product.

Figure 18: Broccoli - Reasons given for disposal by those saying "dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



Looking at the trend in the reasons given for choosing 'Dispose' across the different product life-stages:

- Personal preference was the leading reason when the image depicted broccoli that was still in date (Broccoli 1) and at the first stage past the Best Before date (Broccoli 2). Preference covered a perception of lost freshness or no longer being appealing.
- Preference was also the leading reason for disposal for Broccoli 2 in all three tests: 66% in the 'Unpackaged' test, 57% in the 'Packaged' test and 56% in the 'Packaged with date' test.
- The percentage that cited preference reduced from Broccoli 2 to 3 in all three tests, then again to Broccoli 4 when it was no longer the leading reason in any of the tests.
- Disgust (to eat or touch) increased markedly as a reason in all three tests for Broccoli 3 and Broccoli 4. The percentage that cited disgust as a reason for disposal more than doubled for Broccoli 3 compared to Broccoli 2 in all three tests.
- In the two packaged tests, disgust overtook personal preference as the lead reason for choosing 'Dispose' for Broccoli 4 (39% in the 'Unpackaged' test and 43% in 'Packaged with date, compared to 27% in the 'Unpackaged' test).
- Risk also emerged as an important reason for Broccoli 4 in all the tests (34%, 26% and 21%). It became the leading reason cited in the 'Unpackaged' test.

Considering those results alongside the incidence of choosing 'Dispose' in the IAT (see Figure 16, page 70) it appears that personal preference was the main reason for the large uplift in the proportion choosing 'Dispose' for Broccoli 2 in the 'Packaged with date' test, and also the large increases in the other two tests for Broccoli 3 in the proportion who would dispose. In the two packaged tests, disgust appears to be an important additional driver, especially for Broccoli 3 and 4.

The IAT results suggest that the packaging itself might encourage a different evaluation of the product by citizens compared to the same product unpackaged. A comparison of the reasons given in the 'Unpackaged' and 'Packaged' tests confirms there was a difference in how the packaged product was perceived compared to the unpackaged broccoli when participants opted for 'Dispose'.

As described above, the key difference appears to be in the greater proportion who felt disgust in response to the packaged broccoli than the unpackaged broccoli at every life-stage depicted, except Broccoli 1. There also appears to be a greater perception of risk for the unpackaged broccoli at the last stage of deterioration shown, in place of disgust in the packaged tests.

Table 7: Broccoli: percentage that cited disgust as a reason for selecting 'Dispose' in the IAT.

Base: Participants who selected 'Dispose' for broccoli in the IAT and asked reasons for disposal Bases for individual cells shown in Figure 18.				
Test	**Broccoli 1**	**Broccoli 2**	**Broccoli 3**	**Broccoli 4**
Unpackaged	7%	7%	16%	27%
Packaged	5%	14%	30%	39%
Packaged with date	8%	17%	38%	43%

We could hypothesise here that once broccoli is no longer perfectly green, the presence of plastic shrink-wrap on a less-than-perfect product signals more than lost quality to some citizens, evoking visceral feelings of disgust that need to be avoided. Why they might feel that way would need to be explored further in qualitative research.

Looking at reasons given in the 'Packaged with date' test, at every stage that showed a date past the Best Before (Broccoli 2, 3 and 4) the presence of a date was associated with more participants choosing to dispose:

- 'Past the date' as a reason for disposal was mentioned by only a small minority of participants across all product life-stages.
- The percentage was greatest when the broccoli was in-date (Broccoli 1, 2 days before Best Before) when 12% gave this as a reason for disposal.
- The percentage declined over progressive stages, to 9% for Broccoli 2 and 4% for both Broccoli 3 and 4.

These results are surprising given that the explicit IAT results showed that a larger proportion of participants in the 'Packaged with date' test opted for 'Dispose' than in the tests where a date was not shown, at every stage that was past the Best Before date and especially for Broccoli 2 when 69% opted for 'Dispose'.

There were some notable differences between the 'Packaged with date' test and the 'Packaged' test where dates were not shown, which offer further insight:

- For the in-date broccoli (Broccoli 1) fewer participants cited personal preference if they saw a date than if they did not (43% and 51%). Since 12% cited 'past date' it appears that the presence of a date might proxy for what might otherwise be preference based on judgement.
- Broccoli 2 was the stage when there was the largest difference between the two tests in the proportion that chose 'Dispose' (69% 'Packaged with date' and 36% in the 'no date' test). However, personal preference was cited by similar proportions at this stage (57% and 56%) and was the main reason for choosing 'Dispose' in both tests.

Based on this result, and the small proportion of participants that cited the date label directly, we could hypothesise that the presence of a date label is somehow signalling a loss of freshness and appeal to a wider audience than for an equivalent packaged product without a date. Perhaps the presence of a date label is activating broader feelings about product quality that otherwise would not be activated if the date label was absent.

5.3.4 Difference between claimed willingness to eat past the date and IAT explicit response.

When participants were asked directly if they had eaten broccoli past the Best Before date in the past two weeks, 40% said they had. There was no statistically significant difference between the three tests in the proportion of participants who said this.

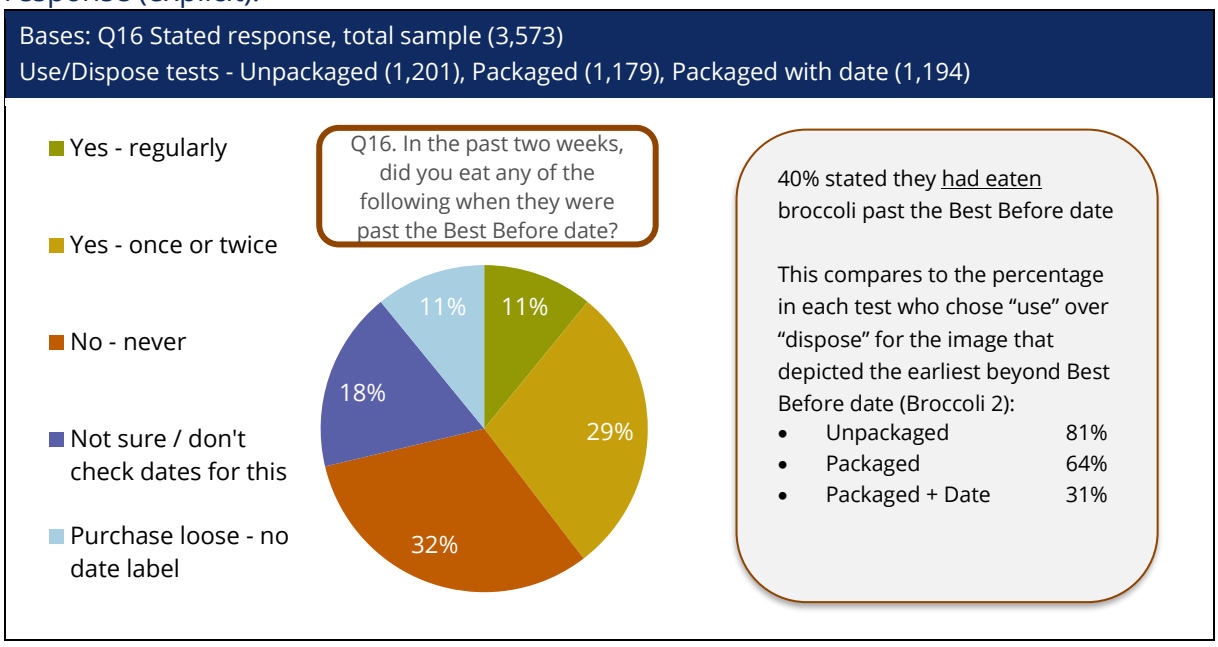
Broccoli 2 was the first stage which depicted broccoli that was beyond the Best Before date (12 days). Comparing the percentage who were willing to eat Broccoli 2 (i.e. chose 'Use') with the proportion who said they had eaten broccoli past the Best Before date, Figure 19 shows that:

- Fewer in the 'Packaged with date' chose 'Use' (31%) than stated they had recently eaten broccoli past the Best Before date (40%).
- Many more participants opted to 'Use' Broccoli 2 in the IAT in both the 'Unpackaged' test (81%) and the 'Packaged' test (64%) than might be expected on the basis of their stated recent behaviour.
- The proportion in the 'Unpackaged' test was nearly double what would be expected on the basis of reported behaviour.

These results support the earlier IAT findings that the presence of a date is associated with reduced willingness to eat past the Best Before compared to equivalent products where citizens do not see a date. The result that willingness to eat in the 'Packaged with date' test was less prevalent than stated recent behaviour could indicate that citizens are especially sensitive to the *specific* date on the broccoli, and that their stated behaviour likely related to dates that were closer to the Best Before date.

Whether the product was packaged or unpackaged appeared to make a difference to willingness to eat when broccoli was past the Best Before date. Even though willingness to eat at this 'turning point' for broccoli appeared to be lower when it was packaged rather than unpackaged, it still exceeded the reported prevalence of eating past the date.

Figure 19: Broccoli – difference between claimed willingness to eat past date and test response (explicit).



5.3.5 Assumptions and considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for broccoli are:

- **Possible differences in the relative visibility of states of deterioration between unpackaged and packaged broccoli at the later product life-stages.** We need to consider here whether it was easier to see the mould in the unpackaged images and whether the relative weighting between risk and disgust for Broccoli 4 between packaged and unpackaged would be replicated in a real-world setting with closer physical inspection.
- **Whether participants were responding to the *specific* dates shown on the product or an implicit *relative* scale derived from the dates included in the test.** The earliest image of a post-Best Before date broccoli was 12 days past the date, whilst the next earliest date was two days before the Best Before date. There was no opportunity to capture responses to products that had just passed the Best Before date. Because this was the earliest post-Best Before date that participants saw, we cannot be certain if they were responding to the *specific* date or a *relative* sense of the date that was unconsciously benchmarked against the other dates they saw in the test, for broccoli and the other products. The images were shown at random and quickly so there may have been an unconscious sorting process of dates going on. It is possible that the percentage who would dispose at this date might not be replicated in a test that included a set of more granular dates between the expiry of a Best Before and a few weeks past the date, or different products, because participants would be responding to a different 'post-Best Before' benchmark.
- **Because the IAT dates were far apart, the images may not have captured intervening states of deterioration between green and entirely brown broccoli.** Given the large proportion of participants who would dispose in both packaged tests at the earliest post-Best Before date shown in the IAT it would be worth investigating the intervening zone past the Best Before date to give greater insight on when after the Best Before citizens would be prepared to eat broccoli.

5.4 Cucumber

Table 8 shows the images that were used in each of the IATs for cucumber. The number of days before or after the Best Before date that was shown on screen for the 'Packaged with date' test are also included.

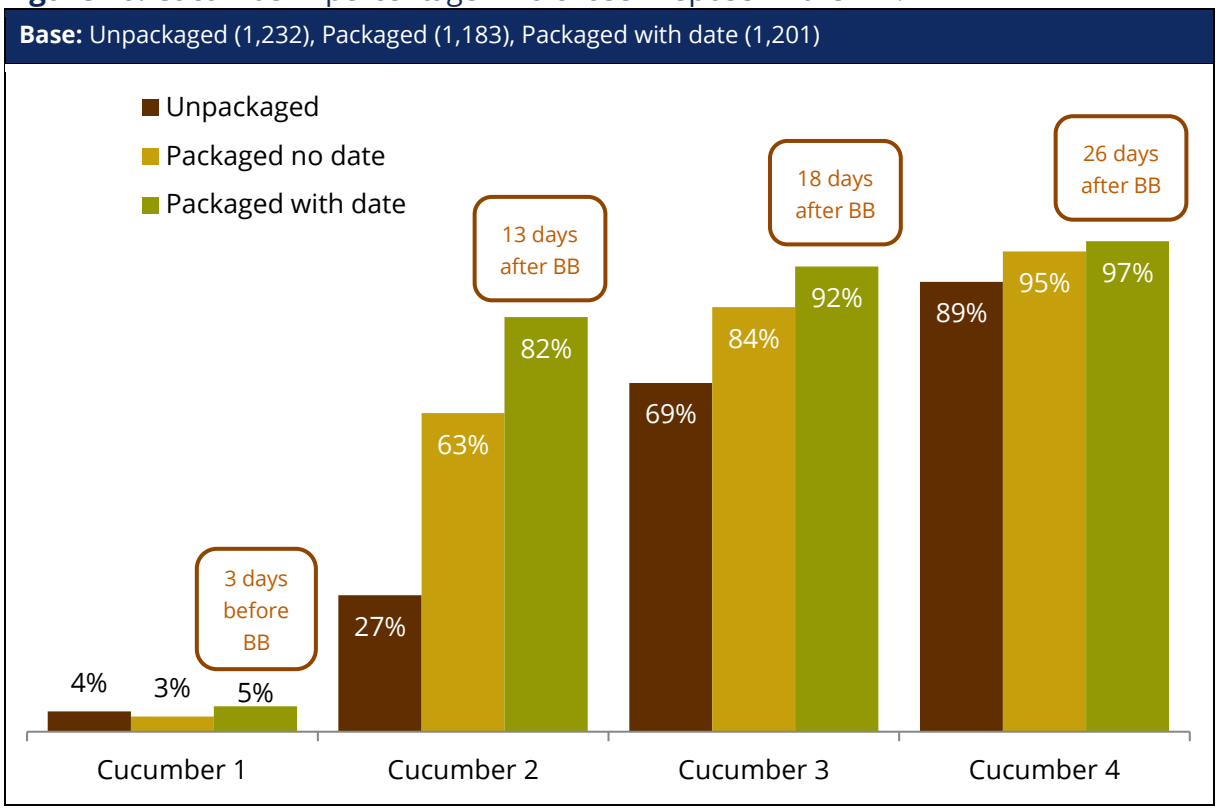
Table 8: Images used for cucumber in each of the IATs. The images are shown in order of deterioration where Cucumber 1 is the least, and Cucumber 4 is the most deteriorated.

	Unpackaged	Packaged	Packaged with date
Cucumber 1			 3 days before BB date
Cucumber			 13 days after BB date
Cucumber 3			 18 days after BB date
Cucumber 4			 26 days after BB date

5.4.1 Explicit responses

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 20 shows the percentage of participants that chose to dispose of the cucumber shown in Table 8.

Figure 20: Cucumber – percentage who chose 'Dispose' in the IAT.



The results shown in Figure 20 need to be considered in relation to the images that participants saw (as shown above). The images were determined by the age of the product not for comparable physical appearance. The appearance of the packaged cucumber clearly differed from the unpackaged image for all except Cucumber 1 and this will have contributed to the results described below.

In all three tests, very few participants (5% or less) chose 'Dispose' for Cucumber 1, when the image showed a cucumber that was three days before the Best Before date.

There was a notable switch from 'Use' to 'Dispose' for Cucumber 2 in all three tests, when the product was 13 days after the Best Before date. It was smallest in the 'Unpackaged' test where just over 1 in 4 participants said they would dispose (27%), rising to over 3 in 5 (63%) in the 'Packaged' test and more than 4 in 5 (82%) in the 'Packaged with date' test.

Cucumber 3 was the first stage at which a majority in the 'Unpackaged' test opted for 'Dispose' (69%). The percentage who would dispose in the two packaged tests increased again at this stage; and the proportion remained greater when participants saw a date (92% in the 'Packaged with date' test compared to 84% in the 'Packaged' test).

There was a further small uplift in the proportion who chose 'Dispose' in the 'Packaged with date' test for Cucumber 4 (from 92% at Cucumber 3 to 97%), a larger increase in the 'Packaged' test (84% to 95%) and an even greater uplift in the 'Unpackaged' test (69% to 89%). A difference in willingness to dispose between the 'Unpackaged' test and the two packaged tests remained but was less marked in comparison to earlier product life-

stages. Differences in the visual condition of the cucumber at this stage were especially apparent.

The explicit results indicate differences in citizens' responses to cucumbers of the same age if the product is packaged or unpackaged. In this research an equivalent product age produced images that looked different, especially when the cucumber was considerably past the Best Before date. However, even when the images looked more similar for Cucumber 2, which was two weeks past the Best Before, the presence of the packaging appears to have been a greater disposal trigger than if the cucumber was unpackaged.

We could further hypothesise that the presence of a date at the stage depicted by Cucumber 2 adds to the influence of packaging and encourages some citizens to dispose who would not do so in the absence of a date. This research cannot identify how many days past the Best Before this effect might start to play an important role, but the results suggest it is much earlier than the two weeks past the Best Before that participants were shown.

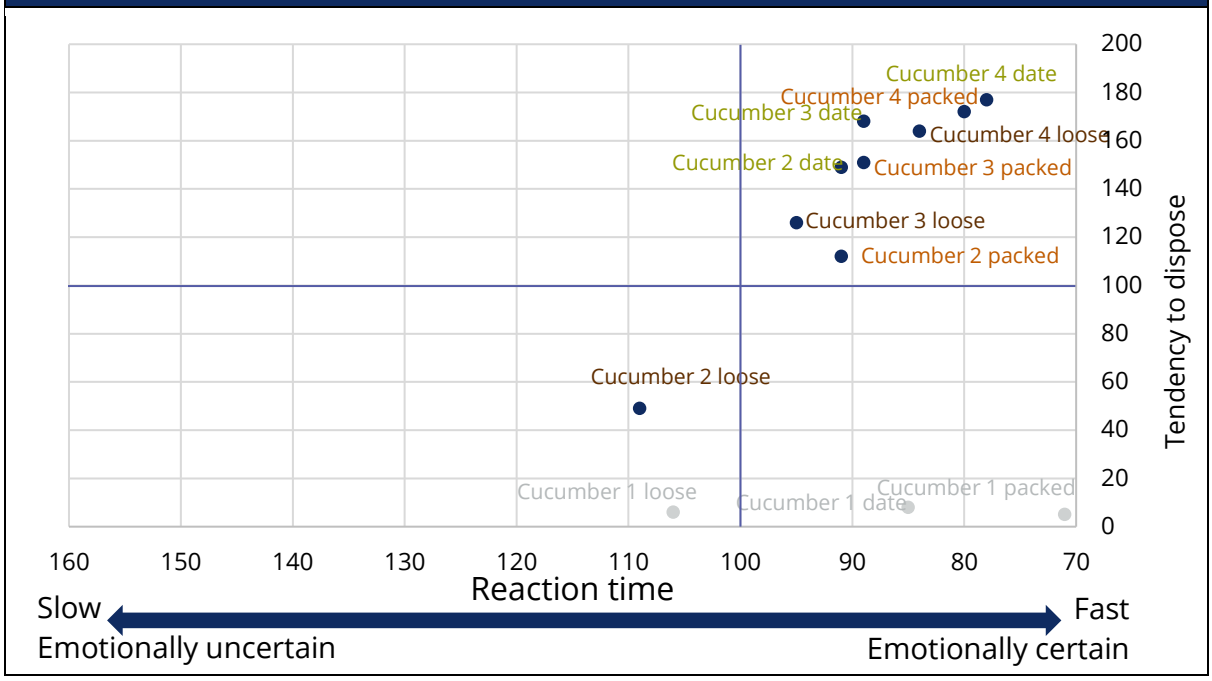
5.4.2 Implicit responses

The implicit results provide insight on how emotionally certain participants were when they selected 'Dispose' in response to each image. The faster the response, the more instinctive it is assumed to be. The results are described below in order of the product life-stages depicted in the IAT (Figure 21).

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 21 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

Figure 21: Cucumber – implicit responses, participants who would dispose.

Base: Loose (Unpackaged test, 1,232), Packed (Packaged test, 1,183), Date (Packaged with date test, 1,201)



Cucumber 1

- Very few (<100) participants in any of the tests chose 'Dispose' for Cucumber 1 so those implicit results are not described (but are shown in Figure 21).

Cucumber 2

- This was the point at which hypothetical disposal behaviours diverged substantially between the 'Unpackaged' test and the two packaged tests.
- Many more participants would dispose in the two packaged tests than in the 'Unpackaged' test (by +36 percentage points in the 'Packaged' test and +55 points in the 'Packaged with date' test) *and* the implicit results show that participants in those tests were equally certain about disposing.
- By contrast, those who saw the unpackaged Cucumber 2 were uncertain – and far fewer participants chose 'Dispose' at this stage than in the packaged tests.
- As well as an influence from the packaging we need to consider a possible influence from the images, with slightly more yellowing apparent on the packaged cucumbers.

Cucumber 3

- By the stage represented by Cucumber 3 the index shows that participants who would dispose were certain in all three tests, and more certain than they were for Cucumber 2.
- Participants who would dispose in the 'Unpackaged' tests were certain, but slightly less so, than those in the two packaged tests, who were equally very certain.

Cucumber 4

- Participants who chose 'Dispose' (a large majority in each test) were even more certain than for Cucumber 3 in all three tests.

- Those in the 'Unpackaged' test were again slightly less certain than those in the packaged tests.

The implicit results for cucumbers suggest that citizens are sensitive to any deviation from perfect greenness in cucumbers when visual appearance is the only measure of quality to rely on. Participants are emotionally certain about disposing for all states of the cucumber except when cucumbers are unpackaged, at the earliest stage of deterioration. At the important 'turning point' at Cucumber 2 the presence of packaging appears to have an important influence, with many more participants disposing and with greater certainty in the two packaged tests (though a possible influence from slight differences in the images needs to be considered).

For packaged cucumbers between 13 and 18 days after the Best Before date, those who see a date are more likely to throw it away than if they do not see a date, and they are certain about that choice. Once the product is very old (in this test 26 days post-Best Before date) very few would use the cucumber depicted and the influence of a date on disposal seems less relevant than the visual appearance.

5.4.3 Reasons for waste

Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'. Table 2 in Chapter 3.0 contains more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 22.

- Because so few participants in all three tests selected 'Dispose' for Cucumber 1, the results are described only for Cucumber 2 and subsequent stages (though results for all stages are shown in Figure 22.

On that basis, the trend in reasons across product life-stages is as follows:

- Personal preference (perceived loss of freshness and loss of appeal) was the leading reason given by participants for choosing 'Dispose' for Cucumber 2 in all three tests.
- The proportion citing preference at this stage was greatest in the 'Unpackaged' test and less in the two packaged tests (57% in 'Unpackaged', 47% in 'Packaged', and 44% in 'Packaged with date').
- In the two packaged tests disgust was correspondingly more important at this stage than in the 'Unpackaged' test (24% in 'Packaged' and 29% in' Packaged with date', compared to 15% in the 'Unpackaged' test).
- Cucumber 2 was the stage at which a large majority in both packaged tests opted to dispose (63% and 82%) whilst only a minority did so in the 'Unpackaged' test (27%), so the increase in feelings of disgust at this stage in the packaged tests is notable.
- Preference declined in importance as a reason for Cucumber 3 and Cucumber 4 in all three tests, as disgust and risk were cited by more participants.
- Reasons in the 'Unpackaged' test became more evenly spread between preference (31%), disgust (32%) and risk (27%) for Cucumber 4, whilst preference was vastly overtaken by disgust and risk in the packaged tests. It is important to bear in mind

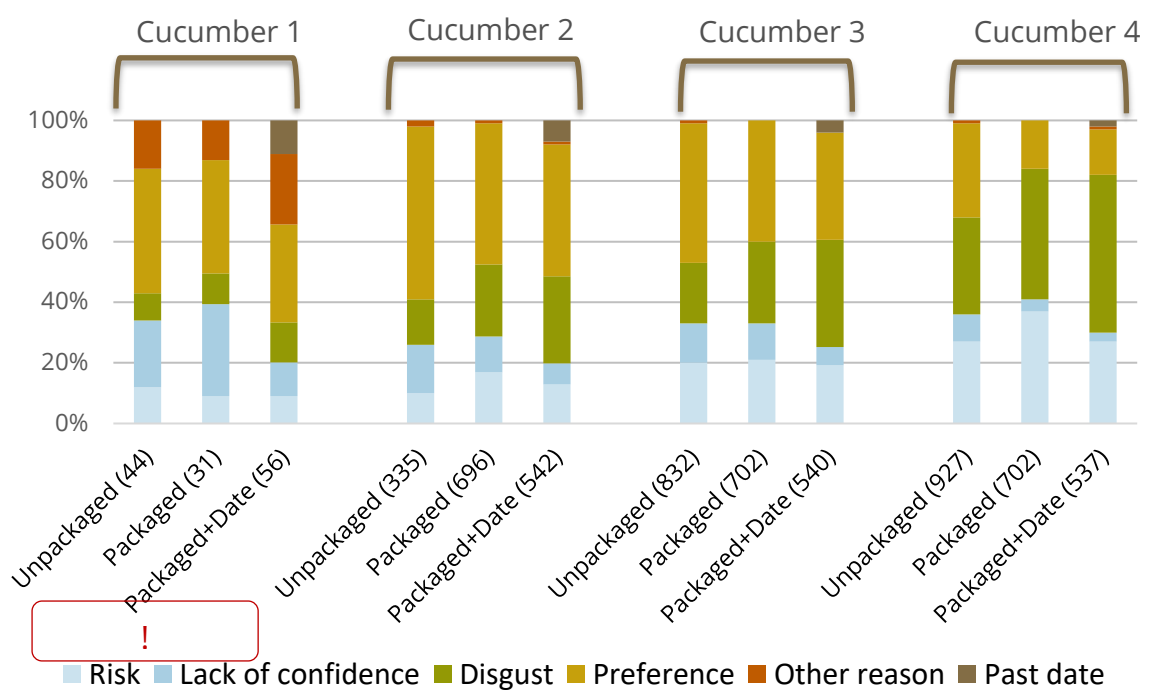
here the differences in the visual appearance of the packaged and unpackaged cucumbers in the IAT images.

Figure 22: Cucumber - Reasons given for disposal by those saying "dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



The IAT results showed that the proportion of participants who would dispose increased substantially in the two packaged tests for Cucumber 2, whilst only a minority opted for 'Dispose' in the 'Unpackaged test. That result suggested the presence of packaging was responsible for a large part of the uplift in the percentage who would dispose at that stage. The findings about reasons for choosing 'Dispose' further suggest that the packaging itself might prime some citizens to feel disgust about the product, which could be implicated in earlier and greater disposal than if the product is unpackaged and evaluated on the basis of its appearance and freshness.

Considering the possible influence of seeing a date on the product, only a small percentage of participants in the 'Packaged with date' test cited 'past date' directly as a reason for choosing 'Dispose' (7% for Cucumber 2, 4% for Cucumber 3 and 2% for Cucumber 4). There were however some notable differences between the 'Packaged' and 'Packaged with date' tests that suggest that the presence of a date influenced other perceptions about the product at different stages.

- For Cucumber 2, the proportion that cited risk and lack of confidence was lower in the 'Packaged with date' test (20%) than the 'Packaged' test (29%), a difference similar in size to the percentage that cited date directly (7%).
- Disgust was also cited by more in the 'Packaged with date' test (29% compared to 24%) for Cucumber 2, which was repeated for Cucumber 3 (35% and 40%) and Cucumber 4 (52% and 43%).

We could hypothesise from these results that the presence of a date amplifies a negative influence on some citizens' feelings about edibility or handling when they see a packaged cucumber that is past the Best Before date.

5.4.4 Difference between claimed willingness to eat past date and IAT explicit response.

When participants were asked directly if they had eaten cucumbers past the Best Before date in the past two weeks, 36% said they had. This was the lowest percentage for any of the products included in the research. Slightly fewer (33%) in the 'packaged with date' test stated they had eaten cucumber past the Best Before date.

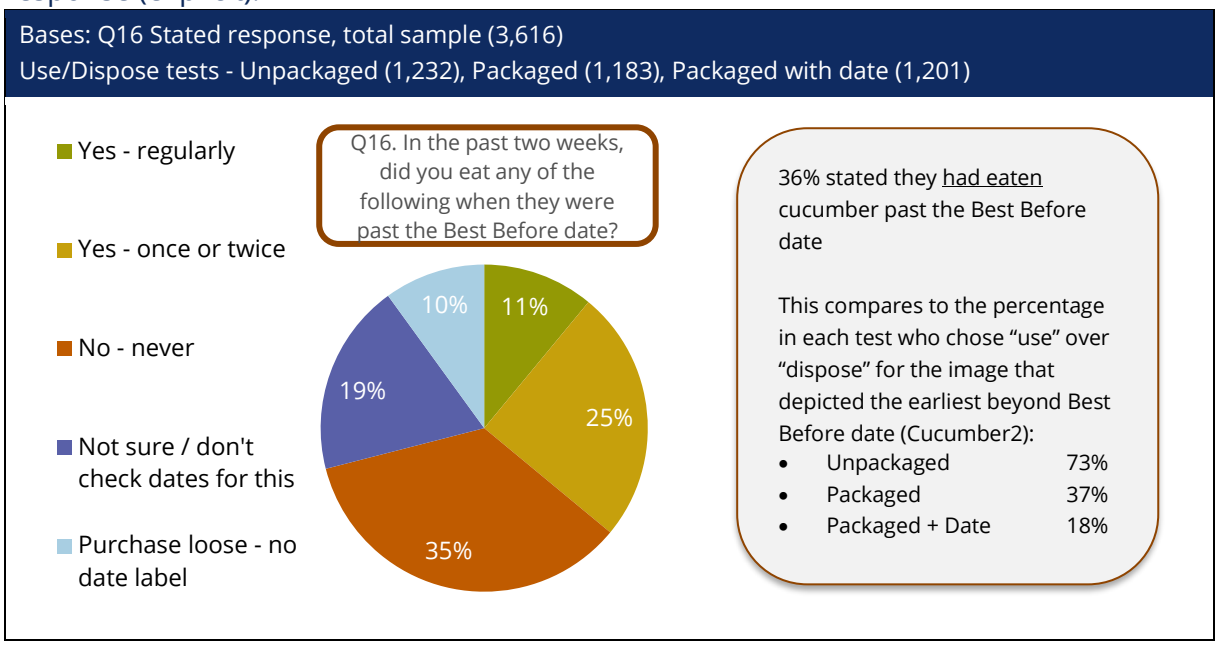
Cucumber 2 was the first stage that depicted cucumber beyond the Best Before date (13 days). Comparing the percentage who were willing to eat Cucumber 2 (i.e. chose 'Use') with the proportion who said they had eaten cucumber past the Best Before date, Figure 23 shows that:

- The percentage that was willing to use Cucumber 2 in the 'Packaged with date' test (18%) was much less than the percentage who stated they had eaten cucumber after the Best Before date in the past two weeks, by almost half.
- The percentage of participants in the 'Packaged' test without a date that were willing to use Cucumber 2 (37%) was similar to that which would be expected on the basis of stated behaviour.
- The proportion in the 'Unpackaged' test was much greater than in both the other tests, and on the basis of what might be expected from stated behaviour (73%).

The results for the two packaged tests most likely suggest that participants who said they had eaten cucumber beyond date had used products that were less aged than the ones depicted for Cucumber 2 in those tests. The results from the 'Packaged with date' test could suggest that the *specific* period past the Best Before date conveyed by the date label is especially important for cucumbers, on top of any deterioration in visual quality.

Looking at results for the 'Unpackaged' test separately, they suggest that many more citizens than indicated by stated behaviour would be willing to eat past the date when the cucumber is both unpackaged *and* does not have a Best Before date, for the age and quality of the cucumber depicted in Cucumber 2.

Figure 23: Cucumber – difference between claimed willingness to eat past date and test response (explicit).



5.4.5 Assumptions/considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for cucumber are:

- **The most important consideration for cucumber is the difference in the relative states of deterioration that were depicted for packaged versus unpackaged cucumber at each stage.** There were signs of worse deterioration in the packaged than unpackaged images for all cucumbers representing products past the Best Before date (Cucumber 2, 3 and 4). It is very likely that differences in the appearance of cucumbers at the same nominal stage in the test contributed to the differences that were observed between the unpackaged and packaged tests in citizens' propensity to dispose at given stages. For cucumbers it is therefore difficult to separate out effects on disposal of visual appearance and effects directly from packaging, although the reasons given for disposal do suggest there was some influence from the packaging itself.
- **Whether participants were responding to the *specific* dates shown on the product or an implicit *relative* scale derived from the dates included in the test.** The earliest image of a post-Best Before date cucumber was 13 days past the date, whilst the next earliest date was three days before the Best Before date, so there was no opportunity to capture responses to products that had just passed the Best Before date. Because this was the earliest post-Best Before date that participants saw, we cannot be certain if they were responding to the *specific* date or a *relative* sense of the date that was unconsciously benchmarked against the other dates they saw, for cucumber and the other products. The images were shown at random and quickly so there may have been an unconscious sorting process of dates going on. It is also possible that an implicit scale was different in the unpackaged test than the packaged tests, because of differences in amounts of deterioration shown in each. It is possible that the percentage who would dispose at this date might not be replicated in a test

that included a set of more granular dates between the expiry of a Best Before and a few weeks past the date, or different products, because participants would be responding to a different 'past the Best Before' benchmark.

- **Because the IAT dates were far apart, the images may not have captured intervening states of deterioration between fresher looking and disgustingly decayed cucumbers.** Given the large majority of participants who would dispose in both packaged tests at the earliest post-Best Before date shown in the IAT, it would be worth investigating the intervening zone past the Best Before date to give greater insight on buffer zones after the Best Before when citizens would be prepared to eat cucumber.

5.5 Potatoes

Table 9 shows the images that were used in each of the IATs for potatoes. The number of days before or after the Best Before date that was shown on screen for the 'Packaged with date' test are also included.

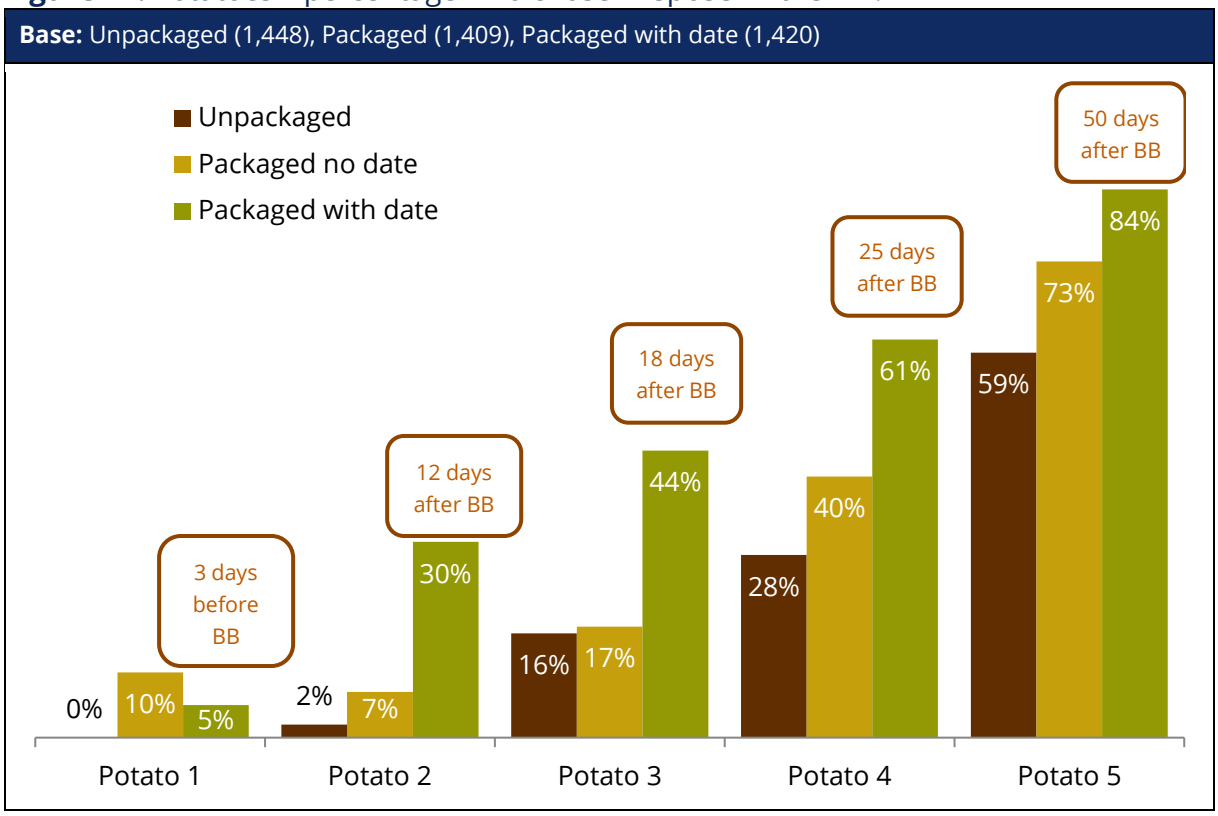
Table 9: Images used for potatoes in each of the IATs. The images are shown in order of deterioration where Potato 1 is the least, and Potato 5 is the most deteriorated.

	Unpackaged	Packaged	Packaged with date
Potato 1			 4 days before BB date
Potato 2			 12 days after BB date
Potato 3			 18 days after BB date
Potato 4			 25 days after BB date
Potato 5			 50 days after BB date

5.5.1 Explicit responses

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 24 shows the percentage of participants that chose to dispose of the potatoes shown in Table 9.

Figure 24: Potatoes – percentage who chose 'Dispose' in the IAT.



Almost no-one chose 'Dispose' for Potato 1 in the 'Unpackaged' test, when the potatoes were four days before the Best Before date. While few participants opted for 'Dispose' at this stage for the other fresh produce items, potatoes were the only product where the percentage was zero, in any of the tests.

By contrast, 10% of participants in the 'Packaged' test and 5% in the 'Packaged with date' test opted to 'Dispose' for Potato 1. The 10% in the 'Packaged' test was the highest percentage for any of the fresh produce items at this 'in-date' stage. We cannot discount that the image itself may have contributed: the finding that adding a date was associated with a smaller proportion choosing 'Dispose' may be indicative of this. Even so, when participants knew the product was within the Best Before date, a small number still chose to dispose compared to none in the 'Unpackaged' test.

The difference in willingness to dispose between those who saw packaged potatoes and those who saw unpackaged was maintained for Potato 2. The difference was small when no date was shown (2% in 'Unpackaged' and 7% in 'Packaged') but was markedly greater when participants saw a date in the 'Packaged with date' test (30%).

For Potato 3, there was no difference in the percentage that chose 'Dispose' in the 'Unpackaged' and 'Packaged tests (16% and 17%), but the proportion of participants choosing 'Dispose' was again much higher when a date was shown (44%).

Responses began to diverge between the 'Unpackaged' and 'Packaged' tests for Potato 4, when sprouting was more advanced (28% chose 'Dispose' in the 'Unpackaged' test and 40% in the 'Packaged' test). Even more participants in the 'Packaged with date' test opted to dispose at this stage (61%).

The differential in responses between tests remained for Potato 5. The difference in the proportion choosing 'Dispose' between the 'Unpackaged' test and 'Packaged with date' was especially large, and of a different magnitude than for the other fresh produce items. For potatoes, the difference was 25 percentage points; in the other tests it ranged from 1 to 12 percentage points.

The reason for this difference was the much lower percentage of participants that opted to 'Dispose' of Potato 4 in the 'Unpackaged' test than for any of the other fresh produce items at the final stage of deterioration depicted for each. While 59% of participants would dispose of potatoes at this stage the percentage for other produce items ranged from 76% (bananas) to 89% (cucumber).

For potatoes, the explicit IAT results suggest that the presence of a date was the most important influence once the product was in a state that corresponded with being past the Best Before date. The presence of a date alone appeared to encourage a sizeable minority of participants to dispose of Potato 2 and Potato 3 and to act in conjunction with an influence from packaging for Potato 4 and Potato 5, resulting in more (hypothetical) disposal for undated potatoes than when they were unpackaged.

The influence of packaging itself was less clear cut. It appeared to elicit slightly greater disposal when the potatoes were before, or up to two weeks after, the Best Before date. Whether the potatoes were packaged or loose appeared to make no difference once shoots were clearly visible on the potatoes for Potato 3. But it did appear to make a difference at the later life-stages when signs of deterioration other than shoots were more advanced. We cannot develop a clear hypothesis about the influence of packaging on willingness to dispose/use potatoes from these results.

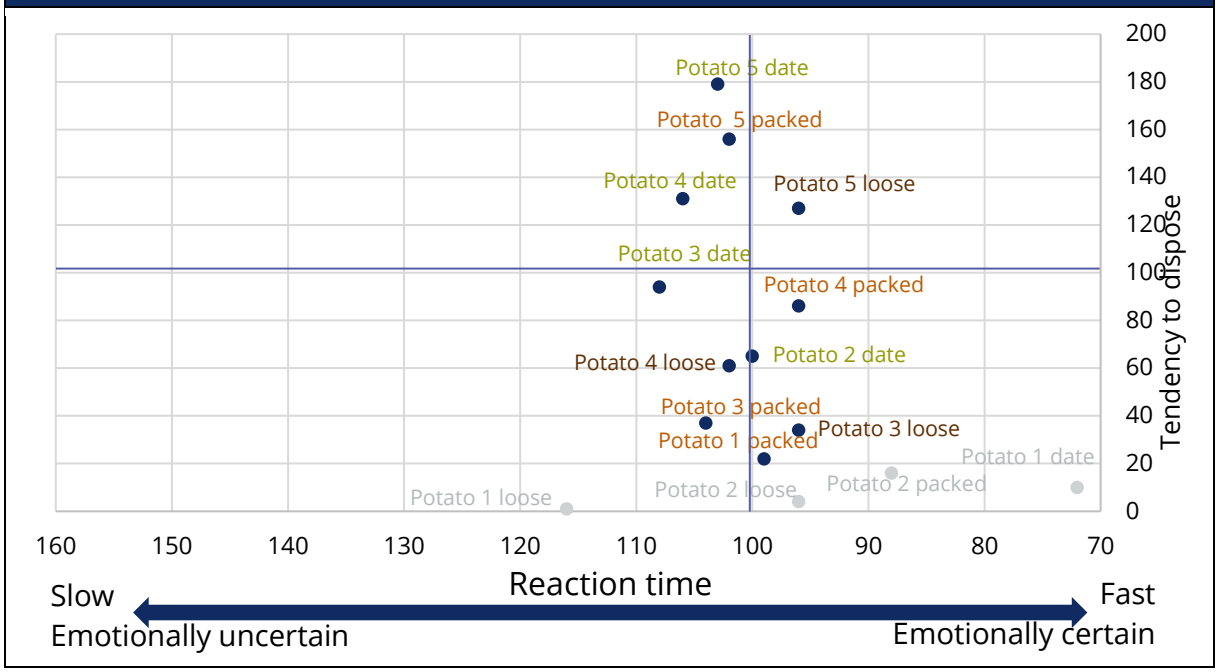
5.5.2 Implicit responses

Unlike for some of the other products in the IAT, the implicit scores for speed of reaction for potatoes were mostly close to the central axis in all three tests, at each product life-stage. It suggests that those who chose 'Dispose' at each point did not have to give much thought to their choices and were emotionally certain, or close to being certain, at every point. The implicit results are described below in order of the product life-stages depicted in the IAT (Figure 25).

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 25 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

Figure 25: Potatoes – implicit responses, participants who would dispose.

Base: Loose (Unpackaged test, 1,448), Packed (Packaged test, 1,409), Date (Packaged with date test, 1,420)



Potato 1

- Those in the 'Packaged' test that opted for 'Dispose' were certain, but only just.
- The results for the 'Unpackaged' and 'Packaged with date' tests can be ignored as the sample size is less than 100.

Potato 2

- The index for the 'Packaged with date' test suggests respondents were certain, but only just in their decision to dispose, and very many more of them would dispose at this stage (30%).

Potato 3

- Participants who saw loose potatoes were quicker to choose to dispose than those who saw packaged potatoes without a date, and a similar proportion of each opted for 'Dispose'.
- While many more opted to 'Dispose' in the 'Packaged with date' test, the index shows they took longer to decide, meaning they were slightly less certain than the smaller number of participants who chose 'Dispose' in the other two tests.

Potato 4

- Participants who chose 'Dispose' in the 'Packaged with date' test were once again the least certain, though like Potato 3, a much greater proportion of them would dispose than in the other two tests (60% compared to 40% in the 'Packaged' test and 28% in the 'Unpackaged' test).
- The index points to those in the 'Unpackaged' test being close to certain about their choice to 'Dispose' and those in the 'Packaged' test being certain, and the decision being more instinctive.

Potato 5

- Participants who chose 'Dispose' did it fastest in the 'Unpackaged' test, but it is worth remembering that far fewer opted for dispose in this test than the two packaged tests.
- The index points to those in the two packaged tests being less certain – but many more opted to 'Dispose'.

As seen in the explicit results, a greater percentage of participants in the 'Packaged with date' test - than in the other tests - chose 'Dispose' at every product stage that depicted potatoes past the Best Before date. The implicit results show those participants were slowest to choose at each of those stages (though slightly, rather than substantially, in most cases). We could hypothesise that the extra time they took to decide might be an indicator that at least some would be persuaded to use the product in that condition if a date was not shown on the packaging. This tallies with the hypothesis developed from the explicit results that, for potatoes, the date is a critical influence on disposal decisions, especially at the earlier stages when the product has gone past the Best Before date.

5.5.3 Reasons for waste

- Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' of in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'.

Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 26.

Figure 26 shows the reasons for disposal at each stage of deterioration. In reading these results it is important to bear in mind that many more participants opted to 'Dispose' in the 'Packaged with date' test than in the other two tests at all stages from Potato 2 (as described in section 5.5.1). The differences were especially large for Potato 2 and Potato 3: 30% and 44% would dispose at these stages in the 'Packaged with date' test; 7% and 17% in the 'Packaged' test; and 2% and 16% respectively in the 'Unpackaged' test. This means that the percentages reported below represent different numbers of participants in the three tests.

The trend in reasons for choosing 'Dispose' across product life-stages is as follows:

- Reasons relating to personal preference (loss of freshness and appeal) were the most frequently cited across all stages, in all three tests (except for Potato 5 in the 'Packaged with date' test where disgust was the most cited reason).
- The proportion citing preference was greater at each stage among participants in the 'Unpackaged' test than the 'Packaged' test, and least in the 'Packaged with date' test.
- A perception of risk (e.g. of food poisoning) and a general lack of confidence (e.g. in being able to judge whether the product is safe to eat) were jointly more prominent reasons given for disposing potatoes than other fresh produce items.
- This group of reasons was cited by 32% to 42% of participants (excluding the cases where the sample bases were small) in every test at every stage that depicted

potatoes beyond the Best Before date. Once again, the percentage of participants that cited those reasons was smallest in the 'Packaged with date' test.

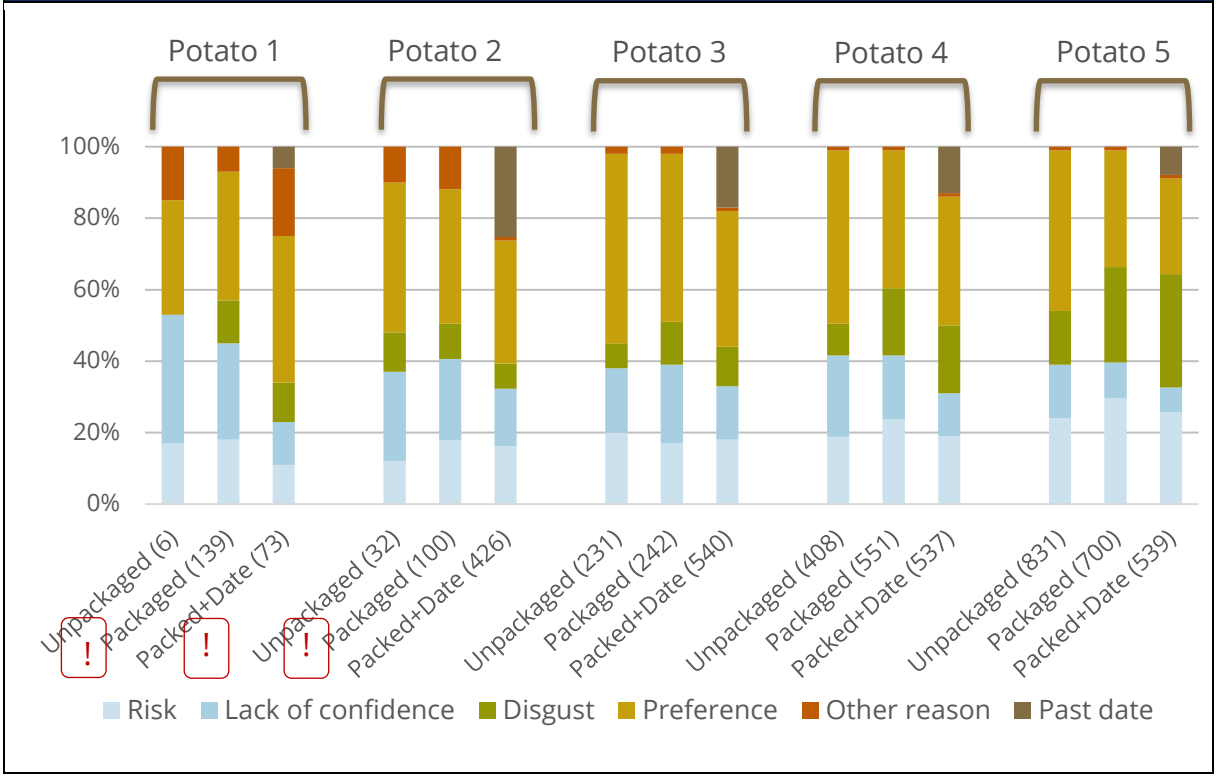
- Disgust appeared to be a less important reason for choosing 'Dispose' for potatoes at the earlier product life-stages than it was for some of the other products in the IAT (notably broccoli and cucumber).
- Within the potato tests, disgust was consistently cited by more participants in the two packaged tests than the 'Unpackaged' test for Potato 3, 4 and 5.
- For Potato 4, the proportion that cited disgust was twice as large in the two packaged tests (19% in both) as in the 'Unpackaged' test (9%). The difference remained nearly double ('Packaged') or double ('Packaged with date') for Potato 5. At this stage it was the leading reason given in the 'Packaged with date' test (32%).

Figure 26: Potatoes - Reasons given for disposal by those saying 'dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



Looking specifically at the 'Packaged with date' test:

- The product being 'past date' was cited by an important minority of participants at each product life-stage as a reason for choosing 'Dispose', and this helps to explain why fewer cited the other reasons than in the 'Unpackaged' and 'Packaged tests.
- 'Past date' was given as a reason by 25% of participants for Potato 2, 17% for Potato 3, 13% for Potato 4 and 8% for Potato 5. This was the highest proportion ascribed to the

date for any of the fresh produce items at each life-stage, except for Potato 2 where the percentage for Banana 2 was greater (30%).

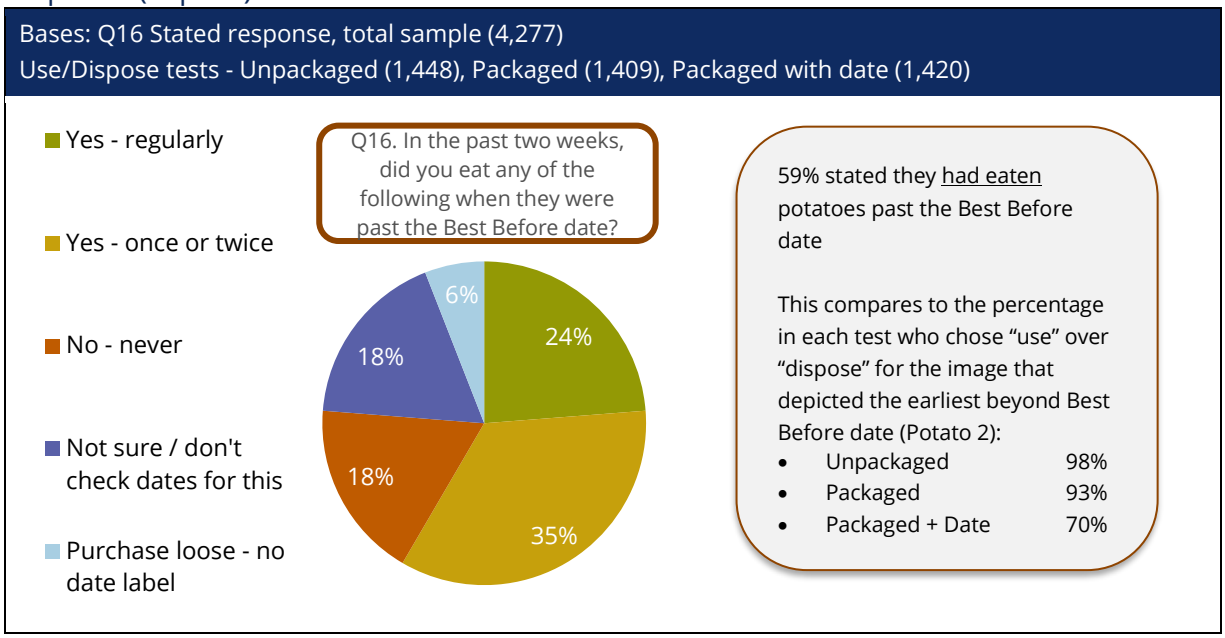
These results support the findings from the explicit and implicit IAT where it was suggested that the date itself was especially important in the decision to dispose for potatoes. However, it is also clear that the date was not solely responsible for the significant uplift in the percentage of participants who opted for 'Dispose' for Potato 2, 3 or 4 compared to the other two tests. The results suggest that the presence of a date also evoked other feelings amongst more participants (e.g. risk, lack of confidence, and lost quality) than when a date was not present.

Considering the specific role of packaging, the results above suggest that packaging can elicit feelings of disgust or mistrust in the product, which might not arise for a loose item of identical age when it is past the Best Before date. For potatoes, the difference that packaging might make to such feelings appeared to be more marked for the later product life-stages, for the age and condition of potatoes represented by Potato 4 and Potato 5.

5.5.4 Difference between claimed willingness to eat past date and IAT explicit response.

When participants were asked directly if they had eaten potatoes past the Best Before date in the past two weeks, 59% said they had (Figure 26). This was the highest percentage for any of the products included in the research. There was no statistically significant difference in this percentage between the three tests.

Figure 27: Potatoes – difference between claimed willingness to eat past date and test response (explicit).



Potato 2 was the first stage that depicted potatoes beyond the Best Before date (12 days). Comparing the percentage who were willing to eat Potato 2 (i.e. chose 'Use') with

the proportion who said they had eaten potatoes past the Best Before date, Figure 27 shows that:

- The percentage that was willing to use Potato 2 exceeded the percentage that would be expected from the level of stated behaviour in all three tests.
- The extent of stated behaviour was similar to the percentage that chose 'Use' in the 'Packaged with date' test for Potato 3 (56%), which was 18 days past the Best Before rather than 12 days for Potato 2.
- At the life-stage depicted by Potato 3 more than 80% of participants in the other two tests were willing to use the potatoes.

The results support the explicit IAT results in suggesting that more citizens would be willing to eat potatoes past the Best Before date if a date is not shown for products of equivalent age than when a date is shown.

5.5.5 Assumptions/considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. An additional consideration specifically for potatoes is:

- **Whether participants were responding to the *specific* dates shown on the product or an implicit *relative* scale derived from the dates included in the test.** The earliest image of post-Best Before date potatoes was 13 days past the date, and the oldest was 50 days past the date, when a sizeable minority indicated they would continue to use the potatoes. We cannot be certain if participants were responding to the *specific* date or a *relative* sense of the date that they unconsciously benchmarked against the other dates they saw, for potatoes and the other products. The images were shown at random and quickly so there may have been an unconscious sorting process of dates going on. It is possible that the percentage who would dispose at these dates – including eating potatoes 50-days past the Best Before date potatoes - might not be replicated in a test that included a set of more granular dates, because participants would be responding to a different 'past Best Before' benchmark at the earliest and latest dates shown.

5.6 Cheese

Table 10 shows the images that were used in each of the IATs for cheese. The number of days before or after the Best Before date that was shown on screen for the 'Packaged with date' test is also included. With the exception of Cheese 3, the dates used in the 'Packaged with date' test are substantially further away from the Best Before date than any other products in this research.

The dates for Cheese 1 and Cheese 2 were guided by evidence from a recent survey of UK supermarkets that shows the available product life of cheddar cheese can be up to 113 days, with an average of 64 days[64]. For Cheese 3 and Cheese 4 dates, a strong evidence base is lacking as to an approximate number of days beyond the Best Before that the product would reach the level of deterioration depicted in the images. Nevertheless, Cheese 3 and Cheese 4 dates were guided by previous research in this area and dairy Technical Specialists at WRAP. The dates for each deterioration stage were chosen using the assumption that the cheddar had remained unopened throughout stages 1 to 4 of its deterioration.

Table 10: Images used for cheese in each of the IATs. The images are shown in order of deterioration where Cheese 1 is the least, and Cheese 4 is the most deteriorated.

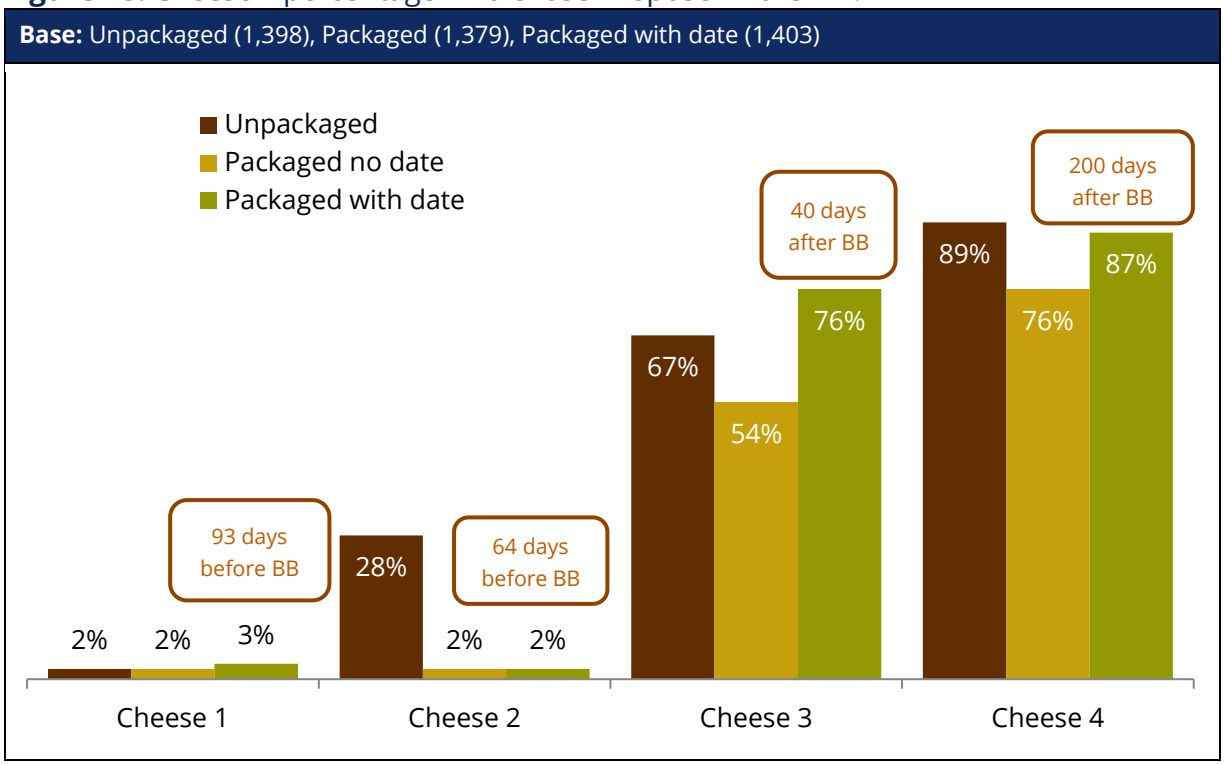
	Unpackaged	Packaged	Packaged with date
Cheese 1			 93 days before BB date
Cheese 2			 64 days before BB date
Cheese 3			 40 days after BB date
Cheese 4			 200 days after BB date

[64] *Retail Survey 2019. Helping Consumers Reduce Food Waste Through Better Labelling and Product Changes. WRAP, 2019.* https://wrap.org.uk/sites/default/files/2020-08/Retail-Survey-2019.pdf

5.6.1 Explicit responses

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 28 shows the percentage of participants that chose to dispose of the cheese shown in Table 10.

Figure 28: Cheese – percentage who chose 'Dispose' in the IAT.



For Cheese 1, which was three months before the Best Before date, very few participants opted for 'Dispose' across all three tests. There was no difference between the tests in the percentage that would dispose at this stage.

That remained the case for Cheese 2, which was still two months within the Best Before date when participants saw packaged cheese. In contrast, more than a quarter of participants who saw unpackaged cheese (28%) chose 'Dispose'. The beginnings of white spots were clearly visible on the unpackaged cheese whereas there were few visible signs of deterioration on the packaged cheese.

At the life-stage depicted by Cheese 3, spots of green mould were visible in both the packaged and unpackaged images. This prompted a very large increase in the percentage of participants that would dispose in all three tests. More who saw unpackaged cheese (67%) would dispose at this stage than who saw packaged cheese without a date (54%), which might again reflect the relative visibility of signs of deterioration. The highest percentage was in the 'Packaged with date' test (76%) when the cheese was nearly six weeks past the Best Before date. The only difference between the two packaged images was the addition of a date.

For Cheese 4 the percentage opting for 'Dispose' remained lowest in the 'Packaged' test (76%) but at this stage – when extensive mould could be seen in the images – there was no significant difference between the 'Unpackaged' and 'Packaged with date' results.

From the results we could hypothesise that the presence of packaging obscured some of the signs of deterioration in quality that were more visible in the images where cheese was shown unpackaged. In this research packaging appeared to reduce the probability of cheese being disposed, in the absence of a Best Before date. Whether the difference in desire to dispose between packaged and unpackaged cheese would be sustained in a real-world setting - where citizens would be able to inspect for signs of deterioration when they open the cheese - is open to question.

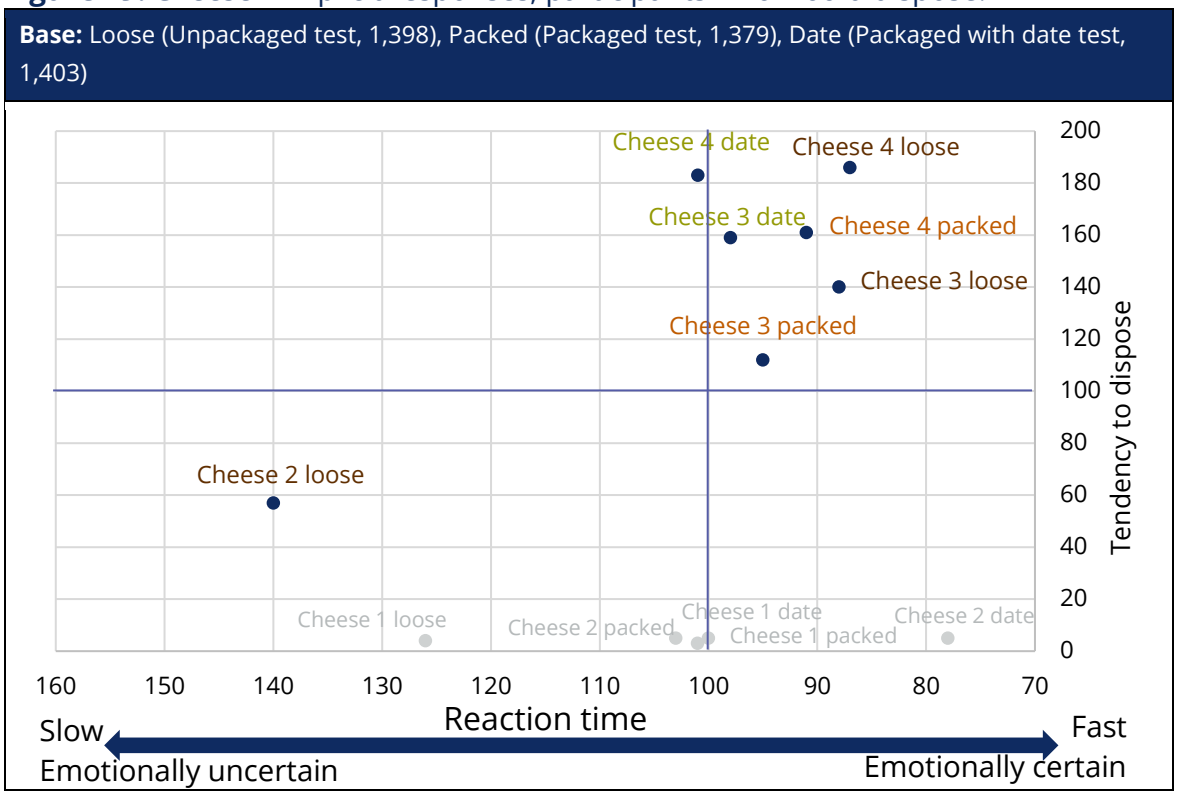
The results for the difference from adding a date are less open to question. There was a clear difference in willingness to use the cheese that was past the Best Before date by many weeks. The presence of a date prompted greater (hypothetical) disposal of cheese when it was past date. The length of time beyond the Best Before date when this effect would start to play an important role cannot be determined from the current research.

5.6.2 Implicit responses

Unlike the other products in the IAT, the results for cheese suggest that participants were, generally, instinctively certain whenever they chose 'Dispose', except for Cheese 2 in the 'Unpackaged' test when the index indicates they deliberated for longer (Figure 29). The implicit results are described below in order of the product life-stages depicted in the IAT.

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 29 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

Figure 29: Cheese – implicit responses, participants who would dispose.



Cheese 1

- Very few (<100) participants in any of the tests chose 'Dispose' for Cheese 1 so those implicit results are not described (but are shown in grey in Figure 29).

Cheese 2

- In the 'Unpackaged' test, the 28% of participants that opted for 'Dispose' appeared to be relatively uncertain about that decision, taking 40% more time than the average to decide.
- Very few (<100) participants in the 'Packaged' and 'Packaged with date' test chose 'Dispose' for Cheese 2 so those implicit results are not described (but are shown in grey in Figure 29).

Cheese 3 and Cheese 4

- Scores for participants who chose 'Dispose' at these stages were in the upper right quadrant of the chart in both the 'Unpackaged' and 'Packaged' tests, which indicates emotional certainty (i.e. instinctiveness) about their choice.
- The index for participants who would dispose in the 'Packaged with date' test showed they took slightly longer to decide, though were broadly certain. We need to consider here whether the very long dates required a degree of cognitive effort, which is being reflected in the results, as well as participants responding to the date itself once they had worked it out. For example, the Best Before date for Cheese 4 was in July 2020 and the survey was conducted in January 2021.

The results overall suggest – with the exception of Cheese 2 in the 'Unpackaged' test – that decisions tended to be instinctive in response to the images of the condition of cheese. They support the suggestion in the explicit results that those in the 'Packaged'

test did not take time to look closely at the condition of the cheese inside the pack, which might have obscured some of the blemishes on the cheese when those were not far advanced.

The results for Cheese 2 in the 'Unpackaged' test are perhaps the most interesting, because they indicate that those who were prompted to dispose by the condition of the cheese had to think about it. The product was still in-date so it would be an important opportunity to save cheese from being wasted if those who are most sensitive to minor blemishes are persuadable that the quality is still good.

5.6.3 Reasons for waste

- Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'.

Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 30.

The reasons given by participants for choosing 'Dispose' in the IAT are described only for those stages and tests where more than a very few participants opted for 'Dispose'. The results for all stages are shown in Figure 30 for completeness.

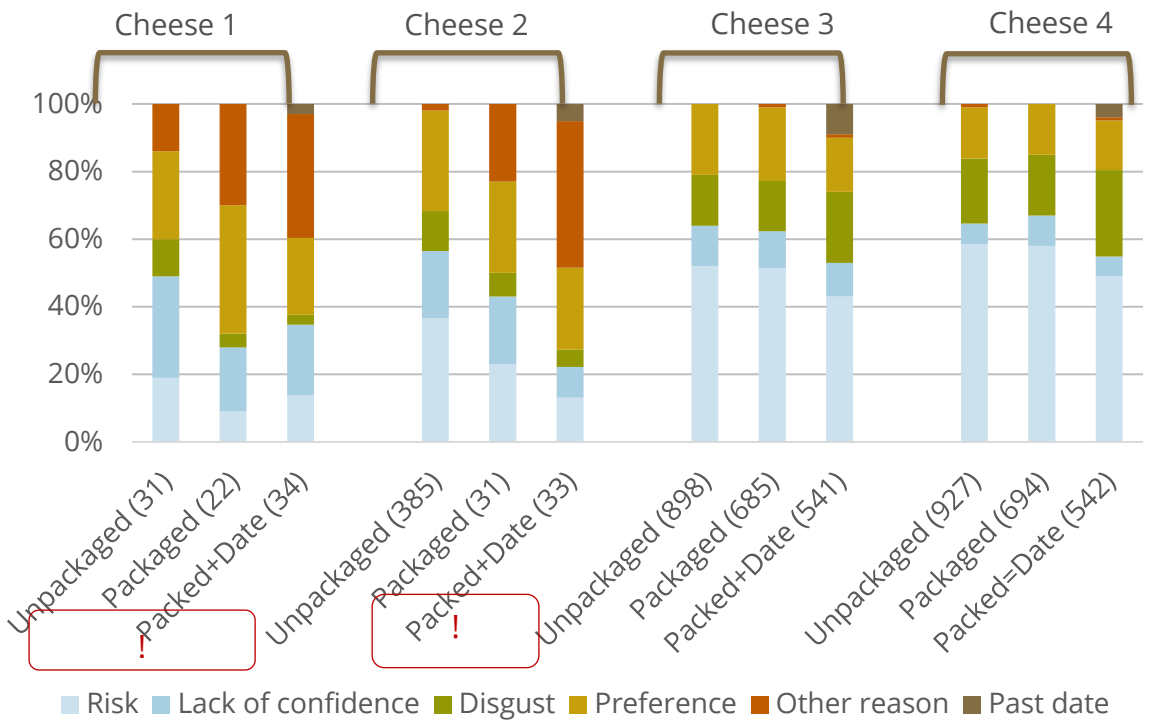
A combination of perceived risks around food safety and a lack of confidence were cited most frequently as the main reason for disposing of cheese, as well as personal preference for some participants. Risk covered an expectation of getting food poisoning as well as a more general sense that the risk of eating was not worth taking. Lack of confidence covered being able to judge whether the product was OK to eat or knowing how to use the product in the state depicted.

Figure 30: Cheese - Reasons given for disposal by those saying "dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



The trend in reasons across product life-stages is as follows:

- In the 'Unpackaged' test for Cheese 2, risk and lack of confidence together were the main group of reasons (57% combined: 37% of participants cited risk and 20% cited lack of confidence).
- A further 30% cited personal preference, which was the highest percentage for this reason at any stage in any of the tests.
- The percentage that would dispose due to personal preference was lower for Cheese 3 (21% in 'Unpackaged', 22% in 'Packaged' and 16% in 'Packaged with date'), and even less for Cheese 4 (15% in all three tests).
- Risk and lack of confidence combined were the leading reasons for choosing 'Dispose' for Cheese 3 and Cheese 4. That group of reasons was cited by more than 3 in 5 participants (63% to 67%) in the 'Unpackaged' and 'Packaged' tests. The proportion was lower in the 'Packaged with date' test, cited by 53% for Cheese 3 and 56% for Cheese 4.
- The product being past the date was not an important reason for choosing 'Dispose' for Cheese 3 and Cheese 4. In the 'Packaged with date' test, 9% cited the date for Cheese 3 and 4% did so for Cheese 4.

There was a notable difference in the pattern of reasons given for Cheese 3 and Cheese 4 between the tests where a date was not shown and the test where a date label was seen. The percentage that cited 'past date' in the 'packaged with date' test does not account for all of the difference observed. As Figure 30 illustrates *fewer* participants in the 'Packaged with date' test cited risk as a reason and more cited *disgust*. Whilst risk was still the most cited reason in this test (43% for Cheese 3 and 50% for Cheese 4), disgust was the next prevalent reason at these product life-stages (21% and 26%).

We could hypothesise that the presence of a date evokes different emotions for some citizens than when a date is not shown, for a product of similar age. An important caveat is the very long time past the Best Before date that was shown in the images. This length of time may have evoked feelings that the cheese was not only risky but would also be revolting. Responses were balanced between those who would dispose because it would be disgusting to eat and those who felt it would be disgusting to touch. Further research would be needed to identify if such feelings would be evoked by cheese nearer to the Best Before date.

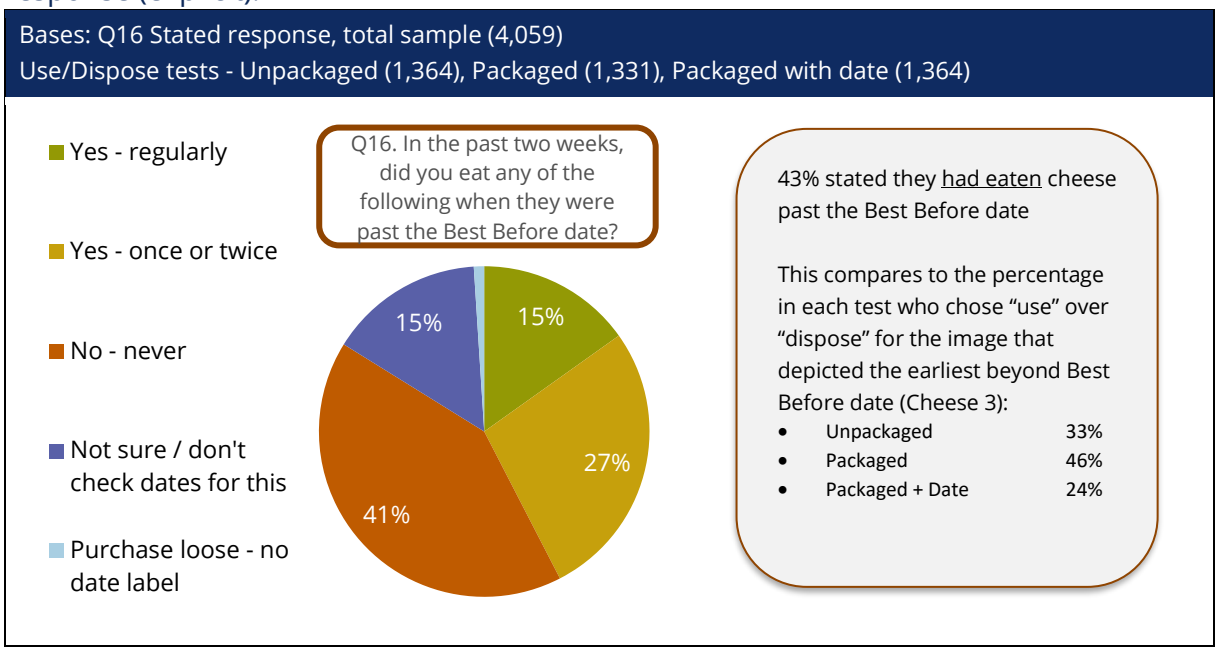
5.6.4 Difference between claimed willingness to eat past date and IAT explicit response.

When participants were asked directly if they had eaten cheese past the Best Before date in the past two weeks, 43% said they had (Figure 31). There was a small statistically significant difference in this percentage between the three tests: 45% in 'Unpackaged', 43% in 'Packaged' and 39% in 'Packaged with date'.

Because the dates shown on the products in the test were such a long time after the Best Before date, a comparison between stated behaviour and 'willingness to use' from the IAT may offer less insight than it does for the other items that were shown with a Best Before date.

Even so, the gap between the proportion of participants who were willing to use Cheese 3 in the 'Packaged with date' test (24%) and the proportion who had eaten cheese past date in this sample (39%) offers a useful indicator that there is a threshold after the Best Before date up to which a sizeable minority of citizens would be willing to eat. Further research would be required to establish where that threshold is.

Figure 31: Cheese – difference between claimed willingness to eat past date and test response (explicit).



5.6.5 Assumptions/considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for cheese are:

- **The 'Unpackaged' test condition may not have reflected the usual experience of most participants**. Participants were not asked directly whether they buy packaged or unpackaged cheese, but just 1% indicated they buy cheese unpackaged when asked if they had eaten it past the Best Before date in the past two weeks. The usefulness of the comparison between the unpackaged and packaged tests is probably therefore limited to indicating how citizens would react to cheese of the ages shown in the test when it is removed from the packaging. The tests are more useful for identifying a date label effect, subject to the following consideration.
- **The earliest date past the Best Before in the test was 40 days after the Best Before**, which means that the results are not a reliable guide to - precisely - how long citizens would continue to use cheese after the Best Before date, or when they would throw it away, or when a probable date effect kicks in. It is possible that the percentage who would dispose at these dates – including eating cheese 40 days past its Best Before date - would not be replicated in a test that included a set of more granular dates, because participants would be responding to a different 'post-Best Before' benchmark.

5.7 Milk

As described in Chapter 3.0 the scope of the IATs for dairy products was different from the fresh produce tests, although the mechanism was the same and the milk images were included alongside the fresh produce items. Milk was included in the 'Packaged' test and the 'Packaged with date' test. In this section we refer to the two tests as:

- 'No date' – which was the 'Packaged' IAT.
- 'With date' – which was the 'Packaged with date' test.

In the 'With date' test, milk was shown with a Use By, rather than a Best Before date. In the latest WRAP Retailer Survey in 2019, 0% of milk carried a Best Before date compared with 100% carrying a Use By date[65]. Since that survey, WRAP have worked closely with Arla who switched from Use By to Best Before dates on all Arla own brand milk[66]. Therefore, at present, most milk in the UK carries a Use By but some carries a Best Before. It was beyond the scope of this research to run two 'With date' tests for milk, one with Use By and one with Best Before dates. However, a follow-up piece of research was commissioned by WRAP to investigate the difference in disposal decisions between Use By and Best Before dates on yogurt and milk, using a similar methodology to an IAT. This will be published later in 2022.

Two images of milk were shown at different stages of freshness: in this section they are referred to as Milk 1 (fresh) and Milk 2 (some visible splitting). The 'fresh' milk was shown with three different dates in the 'With date' test. The following labels are used in the description of the results:

For milk seen by participants in the 'No date' test:

- Milk 1a – fresh, no date
- Milk 2a – split, no date

For milk seen by participants in the 'With date' test:

- Milk 1b – fresh, before Use By date (-4 days)
- Milk 1c – fresh, on Use By date
- Milk 1d – fresh, past Use By date (+4 days)
- Milk 2b – split, past Use By date (+6 days)

Table 11 shows the images that were used in each of the IATs for milk. The number of days before or after the Use By date that were shown on screen for the 'With date' test is also included for reference.

[65] *Retail Survey 2019. Helping Consumers Reduce Food Waste Through Better Labelling and Product Changes. WRAP, 2019. Table 8.* https://wrap.org.uk/sites/default/files/2020-08/Retail-Survey-2019.pdf

[66] *Courtauld Commitment 2025 Annual Report 2020, WRAP. Page 19.* https://wrap.org.uk/sites/default/files/2021-01/The-Courtauld-Commitment-2025-Annual_Report-2020.pdf

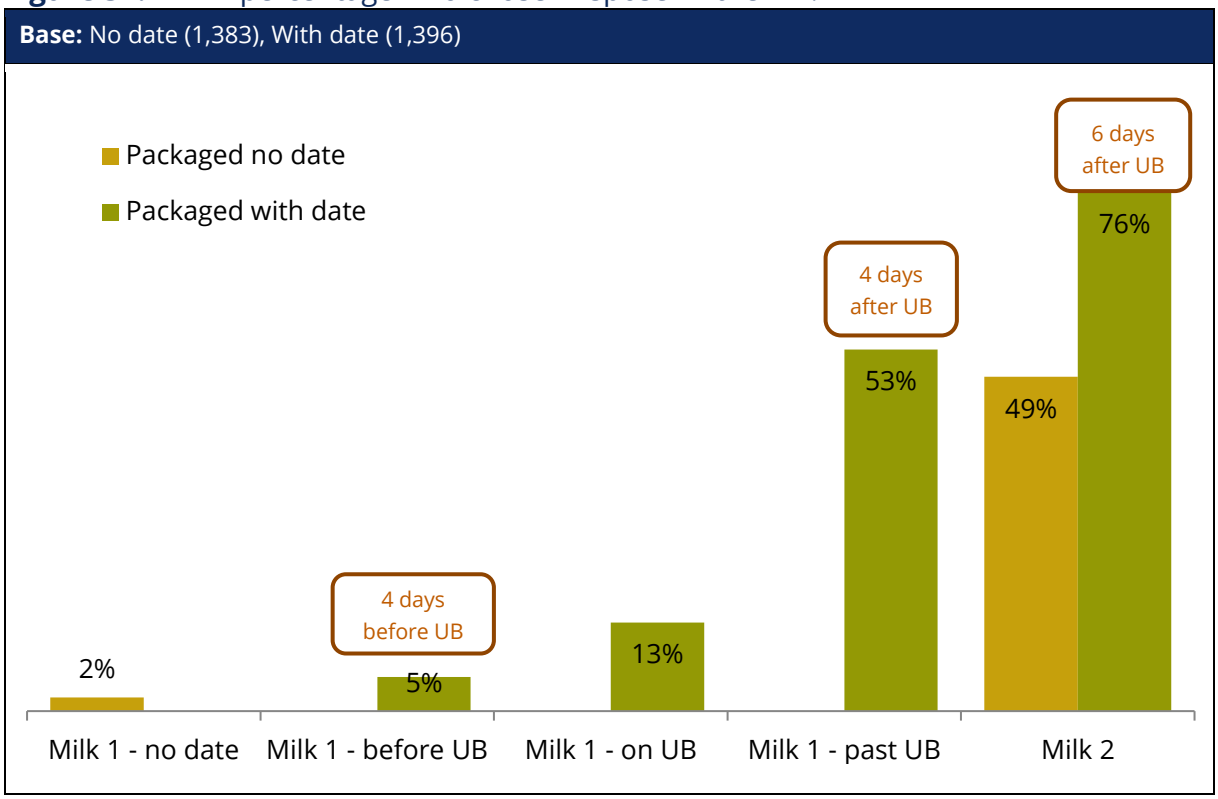
Table 11: Images used for milk in each of the IATs.

Milk 1 (fresh	Milk 2 (gone off / split)
	
■ 1a - No date ■ 1b - 4 days before Use By date ■ 1c - On the Use By date ■ 1d - 4 days after Use By date	■ 2a - No date ■ 2b - 6 days after Use By date

5.7.1 Explicit responses

The explicit responses refer to the binary response of 'Use' or 'Dispose' to the image shown on screen in the IAT. Figure 32 shows the percentage of participants that chose to dispose of the milk shown in Table 11.

Figure 32: Milk – percentage who chose 'Dispose' in the IAT.



Few participants chose 'Dispose' for fresh milk that was either undated (2% in the 'No date' test) or before the Use By date (5%) in the 'With date' test.

In the 'With date' test the proportion of participants who would dispose more than doubled when the label showed the same milk on the Use By date (13%). The impact of the date was even more marked (for milk of the same appearance) when the label showed the milk was four days past the Use By date, when 53% opted for 'Dispose'.

When the milk was visibly split (Milk 2a/b) three-quarters (76%) of participants in the 'With date' test would throw it away. In the 'No date' test it was much less, at half the participants (49%).

When participants were asked directly about the extent to which they rely on dates to make decisions to eat or dispose, 42% of participants in the 'With date' test said they rely wholly or mostly on date labels. When those who said they use a mix of dates and judgement is included the proportion rises to 72%. We could hypothesise from the IAT results that the label triggered 'Dispose' for all or most of those who rely on date labels plus some of those who say they also use judgement, even when the milk was fresh-looking, but four days after the Use By date.

Another indicator of sensitivity to dates for milk was the association in the data between reliance on dates and reported behaviour. Across the combined sample from the three tests, those who rely on dates were far less likely than those who use their own judgement to have used milk past the Use By date. The difference was statistically significant. The percentage that stated they had used milk past the Use By date was[67]:

- 23% of those who rely entirely or mostly on the date label for deciding about milk.
- 42% of those who said they use a mix of the date and judgement.
- 51% of those who said they rely mostly or entirely on their own judgement.

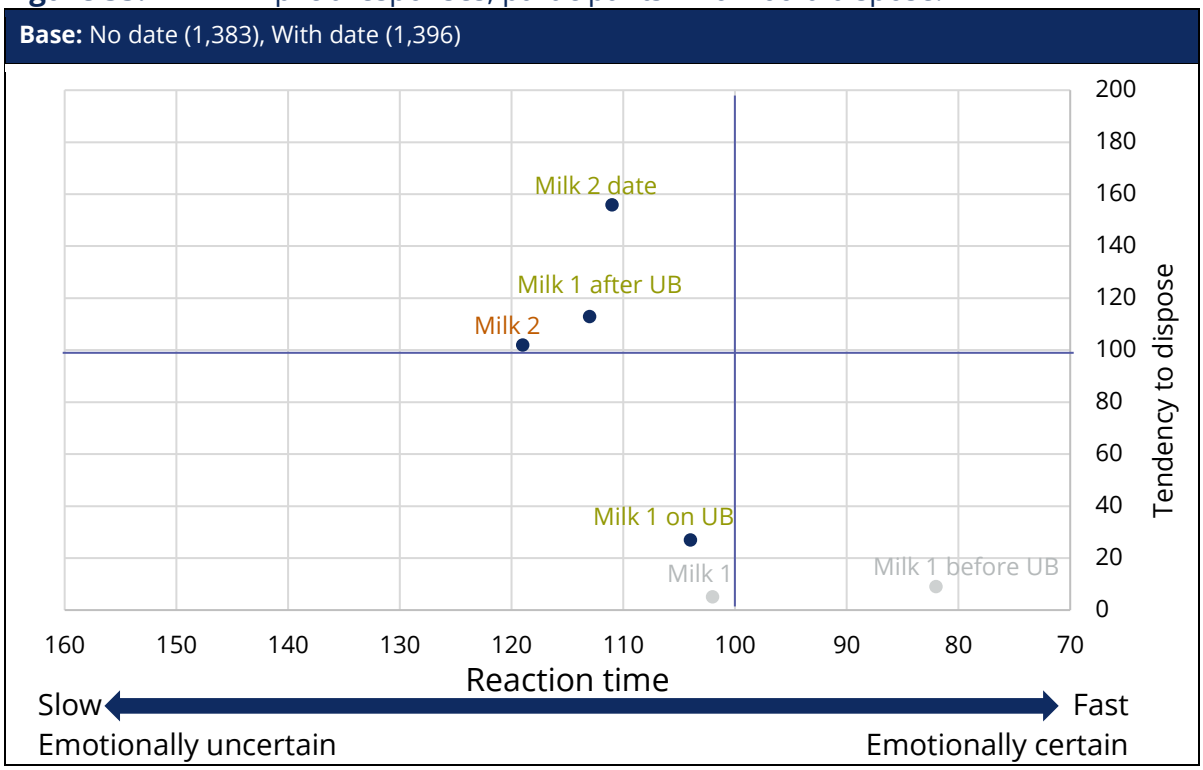
5.7.2 Implicit responses

The results for milk are described in turn for the two types of milk shown – fresh milk and split milk. The identical image of fresh milk was shown in different versions: without a date, and with different dates before, on and after the Use By date; the split milk was shown with and without a Use By date.

Images where fewer than 100 participants chose 'Dispose' are coloured in grey on Figure 33 below. These data points have large confidence intervals around the mean reaction time scores and so emotional certainty is not interpreted.

[67] *Base sizes: Rely entirely/mostly on date (1,519), Mix of date and judgement (1,229), Mainly/entirely judgement (1,372)*

Figure 33: Milk – implicit responses, participants who would dispose.



Fresh Milk 1

- The 13% that opted for 'Dispose' for Milk 1c (on Use By date) were marginally uncertain.
- The index shifted to greater hesitancy for Milk 1d (After the Use By date) when there was a large uplift in the percentage who would dispose.
- Very few (<100) participants in the 'No date' and 'Before the Use By' tests chose 'Dispose' for Milk 1, so those implicit results are not described (but are shown in grey in Figure 33).

Split Milk 2

- There was greater uncertainty about disposing the undated milk (2a) than the milk that was 4 days past the Use By date (2b).
- This could suggest that those disposing the dated milk were relying more on the Use By date and less on their own judgement – and this was linked to more participants choosing 'Dispose' for the split milk.
- For Milk 2a, the absence of a date when there is visible decline in product quality may be the reason for greater hesitancy about choosing 'Dispose' than when a date was shown, though this was not investigated further.

The index scores taken altogether indicate that there was a small minority of participants who would dispose of milk when it was before or on the Use by date and they did not need to think about that decision for very long. For milk past the Use By date most participants would dispose, but there was some hesitation in deciding to do so, more so when the milk was closer to the Use By date.

The results for the milk that was shown on its Use By date is concerning from a food waste perspective. It indicates there is a minority of citizens (13% in this test) who are

highly sensitive to dates and barely hesitate about their decision to dispose. It is also worth noting here that in the explicit questions asked after the IAT, 19% of participants in the 'With date' test said they rely entirely on dates for deciding whether to throw away milk. At least some of these participants appeared to be interpreting the 'on-date' label as a signal to dispose.

5.7.3 Reasons for waste

- Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'.

Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 34.

A perception of food safety risk and lack of confidence were important reasons for choosing 'Dispose' for milk at all stages, together with disgust when it was visible that the milk had split (Milk 2a/b). The date itself was also a notable reason, especially at the earliest point past the Use By date (+4 days).

Figure 34 shows the detailed results for all the milk images included in the tests: the following description excludes Milk 1a, which only 2% of participants said they would dispose.

Milk 1b (before the Use By date)

- The data on reasons for disposal support a suggestion that the 5% of participants who would 'Dispose' of milk at this stage had their own reasons, which was reflected in the instinctive response to dispose in the implicit IAT results.
- 42% of this small number of participants cited 'other reasons' – i.e. reasons other than safety or preference.

Milk 1c (on Use By date)

- There was no single dominant reason why participants opted to dispose of milk displaying the Use By date, but safety was clearly the leading concern.
- The three most important reasons were risk (cited by 27% of participants), preference (25%) and lack of confidence (20%). Uncertainty about being able to judge safety was the main reason underlying a lack of confidence.

Milk 1d (+4 days past Use By date)

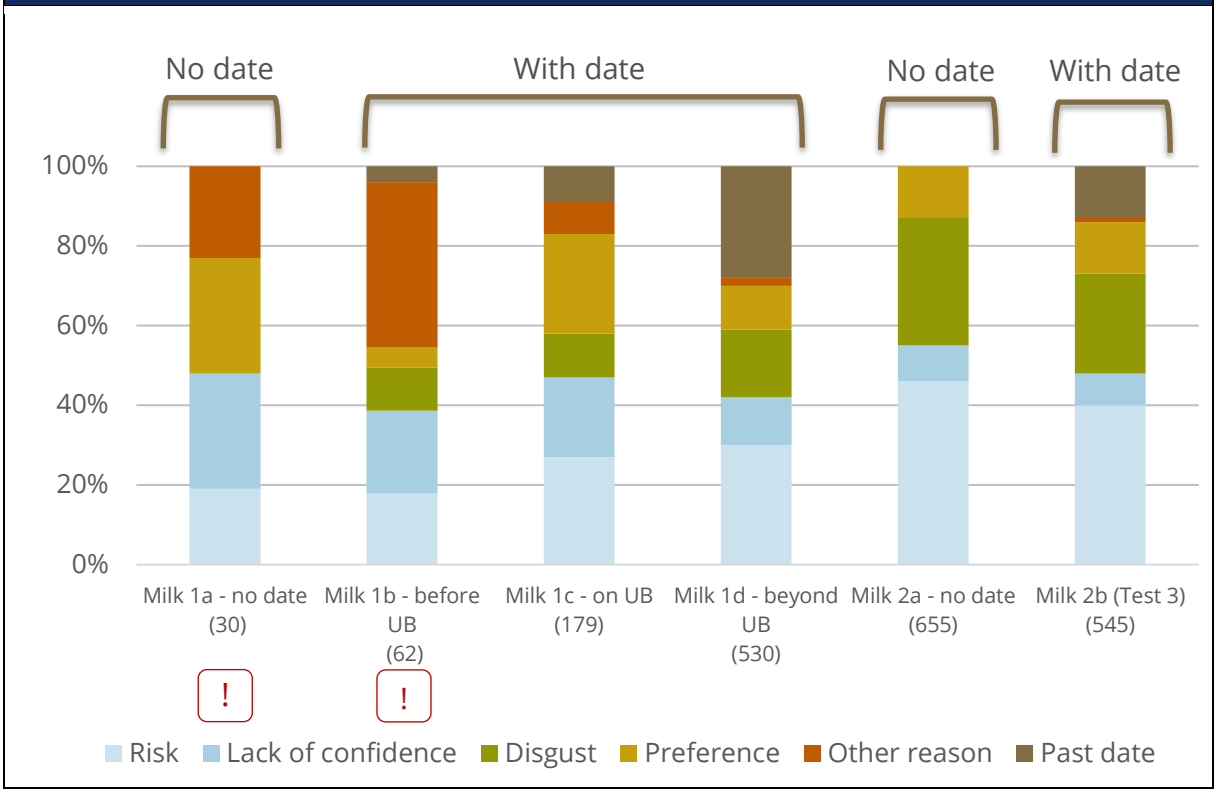
- The date itself was a notable reason for prompting a choice to 'Dispose' (28% of participants), as well as perceived risk (30%).
- The date mainly appears to have displaced preference and lack of confidence as reasons. The proportion of respondents who cited preference (11%) and lack of confidence (12%) reduced substantially compared to Milk 1c.
- At the same time, disgust as a disposal trigger increased from 11% of participants for Milk 1c to 17% for Milk 1d.

Figure 34: Milk - Reasons given for disposal by those saying "dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



For Milk 2a and 2b ('No date' test and 'With date' test, +6 days past Use By) it should be borne in mind that 76% of participants said they would dispose at this stage in the 'With date' test compared to 49% in the 'No date' test. The percentages for reasons shown in Figure 34 are based on those who chose 'Dispose' (e.g. 10% in the 'With date' tests represents more citizens overall than 10% in the 'No date' test). The results show:

- The visible splitting of the milk appears to have influenced feelings of disgust as a reason for disposal: disgust increased to 25% of participants who opted for 'Dispose' in the 'With date' test. The proportion was greater (32%) of those who opted to dispose when they did not see a date label.
- Risk was the other main reason for choosing 'Dispose', cited by 40% for those choosing 'Dispose' for Milk 2a and 46% for Milk 2b.
- The difference between the two tests for risk and disgust was equal to the percentage who cited 'past date' in the 'With date' test, so we can suggest that the date was proxying for those two reactions for milk at that stage of deterioration.

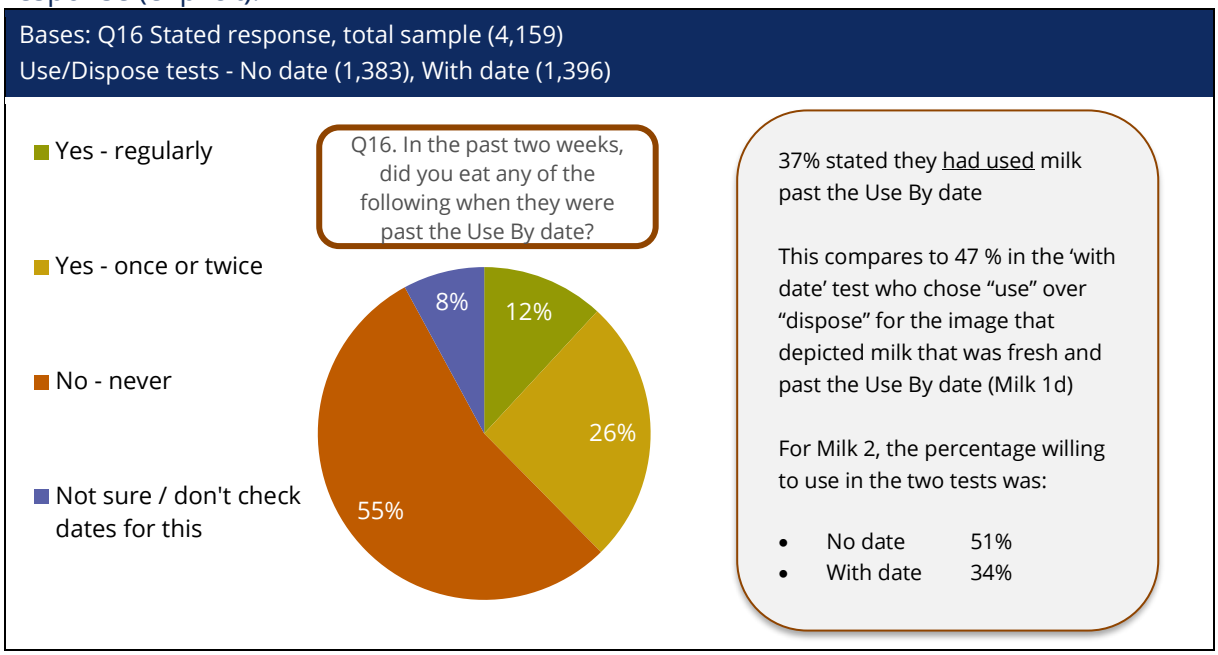
These results support the explicit and implicit IAT findings that the date itself acts as an important trigger for (hypothetical) disposal when milk is recently beyond the Use By date. It also supports a hypothesis similar to some of the other products that the date

label somehow evokes feelings of disgust for some citizens that might otherwise be experienced as a preference, and those feelings are one of the causes of greater disposal. Further research would be required to substantiate this hypothesis. If such an effect exists, it may have implications for waste prevention.

5.7.4 Difference between claimed willingness to eat past date and IAT explicit response.

When participants were asked directly if they had used milk past the 'Use By' date in the past two weeks, 37% said they had (
Figure 35 Figure 35). There was no statistically significant difference in the proportion who had done this between the two tests where participants saw milk.

Figure 35: Milk – difference between claimed willingness to eat past date and test response (explicit).



A greater percentage of participants selected 'Use' in the 'With date' test for the milk that was past the Use By date (47%) than would be indicated by stated behaviour in that sample (34%). This may indicate that some citizens would be willing to use milk for longer past the Use By date than the four days depicted. That hypothesis would require further research. The results of Milk 2b, where 34% said they would use the milk could suggest that the threshold is somewhere between 4 and 6 days, though the visual condition of the milk in the images is also a consideration.

Looking at the results for the milk that was six days past the Use By, the fact that the proportion willing to use was higher in the 'No date' than 'with date' IAT further suggests that more citizens would use the older milk (+6 days past Use By date) if there was no date on the product, even in the visual condition shown.

5.7.5 Assumptions/considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for milk are:

- **The tests included images of undated as well as dated milk.** While undated milk is unlikely to ever be offered to citizens, it was included as a useful test condition to explore the influence of dates. The results indicated a strong reliance on dates once the milk was past the Use By date, as well as before the Use By date for the small number of citizens who would dispose of milk earlier. The differences in results observed between the undated and dated dairy products are perhaps best used in industry discussions about adopting less conservative dates.
- **It is possible that showing the milk in glass bottles introduced some bias into the way in which participants evaluated it**, if they normally buy cartons or plastic bottles. Using images of bottles was the only way to show split milk clearly. We believe that any such bias was probably small, but we cannot be certain.
- **WRAP knows that the influence of sensory experience is important in citizens' evaluations of whether to dispose of milk** and, for some, knowing how long milk has been open for. The full complex array of influences could not be captured in these tests and it should be considered that the propensity to dispose recorded in the research might not be the same in research that is able to replicate real-world experience more closely.
- **Whether participants were responding to the *specific* dates shown on the product or an implicit *relative* scale derived from the dates included in the test.** The results showed a very large uplift in disposal' between the Use By date and +4 days past the date. The research method means we cannot determine whether participants were responding to the *specific* dates shown on the product or a *relative* sense of the date that was unconsciously benchmarked against the other dates they saw, for milk and the other products. The images were shown at random and quickly so there may have been an unconscious sorting process of dates going on. It is possible that the percentage who would dispose at this earliest past-Use By date might not be replicated in a test that included a set of more granular dates, or different products, because participants would be responding to a different 'past Use By' benchmark.
- **There was a large gap between dates used for each deterioration stage.** To inform a possibility of applying less conservative dates on milk, it would be worthwhile to investigate the intervening zone past the Use By date to provide more precise insight on how long a buffer to give to those who are currently using milk past the date.
- **In the UK milk is currently sold with either a Use By or a Best Before date but participants were only shown Use By dates in the 'With date' test.** Whilst participants were shown images of milk with a Use By date in the 'With date' test, we cannot be certain that the participants would have answered the same if they were shown a Best Before date. Findings from the latest WRAP Retail Survey show that in 2019 100% of milk was sold with a Use By date[68], however, since then WRAP has worked closely with Arla who switched from Use By to Best Before on all Arla own brand milk[69].

[68] *Retail Survey 2019: Helping Consumers Reduce Food Waste Through Better Labelling and Product Changes. WRAP, 2019. Table 8.* https://wrap.org.uk/sites/default/files/2020-08/Retail-Survey-2019.pdf

[69] *Courtauld Commitment 2025 Annual Report 2020, WRAP. Page 19.* https://wrap.org.uk/sites/default/files/2021-01/The-Courtauld-Commitment-2025-Annual_Report-2020.pdf

Food Labelling Guidance by WRAP, the FSA and Defra[70] recommends the following:

- Apply Use By for foods which, from a microbiological point of view, are highly perishable and are therefore likely, after a short period, to constitute an immediate danger to human health. Food cannot be sold, redistributed or consumed after this date.
- Apply Best Before for all other foods, to indicate quality, where a date is required. Food can be sold, redistributed and consumed after this date.
- Do not use a Display Until label. To avoid confusing citizens, use other mechanisms for stock control.

WRAP's 2019 Retail Survey showed that the application of date labels for milk was in line with best practice guidance, however, correct use of Use By for food safety reasons could not be checked. This is because it is the responsibility of the food business to use the guidance and their own detailed knowledge of each product to determine whether there is a food safety risk and therefore a need for a Use By date.

It was beyond the scope of this research to test whether the findings presented here would be any different if we showed participants the exact same images of milk but with a Best Before date. Therefore, this research only provides insights about Use By dates.

[70] *WRAP Labelling guidance. Best practice on food date labelling and storage guidance, WRAP, 2019.* *https://wrap.org.uk/sites/default/files/2020-07/WRAP-Food-labelling-guidance.pdf*

5.8 Yogurt

Yogurt was included in the 'Packaged' test and the 'Packaged with date' test. In this section we refer to the two tests as:

- 'No date' – which was the 'Packaged' IAT.
- 'With date' – which was the 'Packaged with date' test.

In the 'With date' test, Yogurt was shown with a Use By, rather than a Best Before date. Whilst some brands and retailers do display Best Before dates on yogurt, most yogurts in the UK are sold with a Use By date. In the latest WRAP Retailer Survey in 2019, only 16% of yogurts carried a Best Before date compared to 84% with a Use By date[71]. It was beyond the scope of this research to run two 'With date' tests for yogurt, one with Use By and one with Best Before dates. However, a follow-up piece of research was commissioned by WRAP to investigate the difference in disposal decisions between Use By and Best Before dates on yogurt and milk, using a similar methodology to an IAT. This will be published later in 2022.

Yogurt was shown at four different stages of freshness/deterioration in both tests. In the 'With date' IAT images of Yogurt 1 and Yogurt 2 were each shown with a variety of different dates – before, on and after the Use By date (Table 12 and Table 13). That produced nine different versions of the images. Participants in the 'No date test' saw four; those in the 'With date' test saw seven. The following labels are used in the description of the results.

Table 12: Labels used in the results to identify versions of the yogurt images in the IAT.

Yogurt	1		2			3	4
No date	1a		2a			3a	4a
With date	1b	1c	2b	2c	2d	3b	4b
Relative to Use By	Before -17 days	After + 5 days	Before –5 days	On date	After +5 days	After +12 days	After +19 days

Table 13 shows the images that were used in each of the IATs for Yogurt. The number of days before or after the Use By date that were shown on screen for the 'With date' test is also included for reference.

[71] *Retail Survey 2019. Helping Consumers Reduce Food Waste Through Better Labelling and Product Changes. WRAP, 2019. Table 8.* https://wrap.org.uk/sites/default/files/2020-08/Retail-Survey-2019.pdf

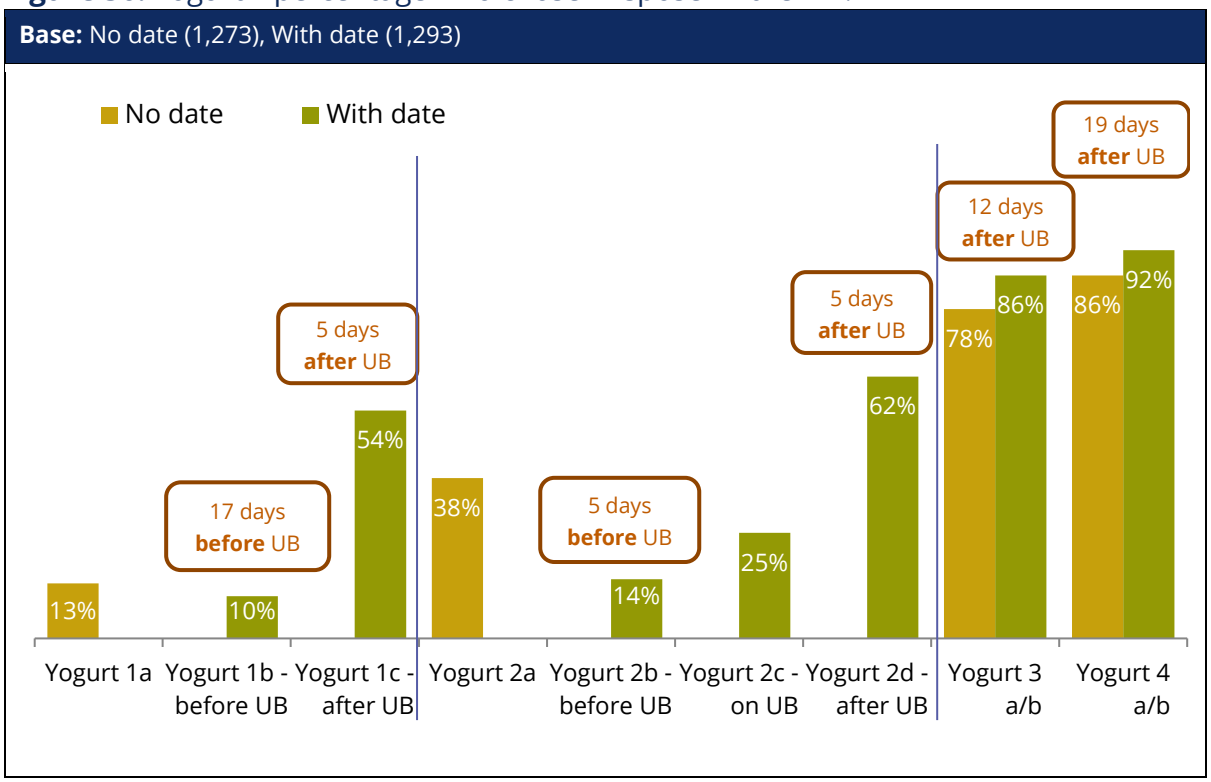
Table 13: Images used for yogurt in each of the IATs. The images are shown in order of deterioration where Yogurt 1 is the least, and Yogurt 4 is the most deteriorated.

Yogurt 1	Yogurt 2	Yogurt 3	Yogurt 4
			
■ No date ■ 17 days before Use By ■ 5 days after Use By	■ No date ■ 5 days before Use By ■ On Use By date ■ 5 days after Use By	■ No date ■ 12 days after Use By	■ No date ■ 19 days after ■ Use By

5.8.1 Explicit responses

The explicit responses refer to the binary response of 'Use' or dispose' to the image shown on screen in the IAT. Figure 36 shows the percentage of participants that chose to dispose of the yogurt shown in Table 13.

Figure 36: Yogurt – percentage who chose 'Dispose' in the IAT.



A similarly small percentage of participants would dispose of Yogurt 1 when they saw it without a date (13%) or with a date that was well within the Use By date (-17 days) (10%). That response switched dramatically when the label showed that the same yogurt was five days past the Use By, when 54% said they would dispose.

The role of the date label appeared to be different when the Yogurt had visible liquid on the surface. In this visibly less perfect condition, the presence of a date appeared to protect against an urge to dispose, when the date label shown was before or on the Use By date. It seems that although there was some liquid present on the surface of the yogurt, the product still being 'in date' seemed to offer reassurance to participants:

- More participants in the 'No date' test (38%) would dispose of Yogurt 2 than those in the 'With date' test (14%) when the date label was 5 days before the Use By date.
- For the image indicating that Yogurt 2 was on the Use By date the percentage of participants that would dispose increased to 25% in the 'With date' test, but this remained less than those who saw the undated yogurt.
- Once again there was a dramatic switch when participants thought the yogurt was five days past the Use By date according to the label, when 62% opted for 'Dispose' in the 'With date' test. This was many more than would dispose of the yogurt with the liquid when they did not see a date (38%).

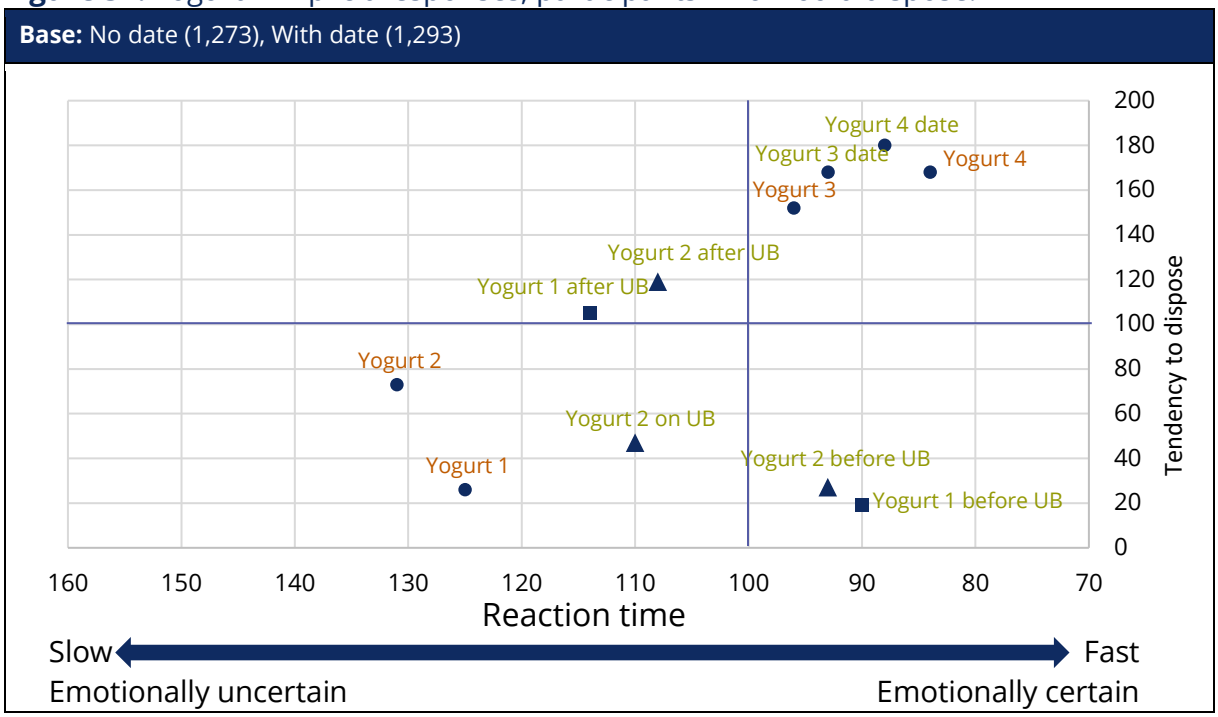
The results for Yogurt 2 demonstrate the critical influence that dates can have on disposal for a relatively fresh product. The proportion who would dispose of the identical Yogurt 2 ranged from 14% to 62%, simply depending on which date was shown with the image.

By the time there was visible mould on the surface (Yogurt 3 and 4) a large majority of participants in both tests would dispose, recording a substantial increase from the images that showed liquid, but no mould (i.e. Yogurt 2). The date appeared to make a further contribution to participants' inclination to choose 'Dispose', with an eight percentage point gap for Yogurt 3 between the 'No date' and 'With date' tests (78% and 86% respectively) and a six percentage point gap for Yogurt 4 (86% and 92%).

5.8.2 Implicit responses

The results are described for each test separately and then the responses for yogurt at similar stages of freshness/deterioration compared between the two tests. Results are shown in Figure 37. Unlike every other product in this research, more than 100 participants chose 'Dispose' for every image in each test, therefore all data points in Figure 37 below are described.

Figure 37: Yogurt – implicit responses, participants who would dispose.



'No date' test

- Participants took longer to choose 'Dispose' for Yogurt 1a and Yogurt 2a than was registered for any of the images where Use By dates were shown. That indicates they felt uncertain and had to think about the decision.
- There was even more uncertainty about Yogurt 2a (liquid showing) than Yogurt 1a (fresh), although the percentage that would dispose increased substantially.
- Reactions switched completely to instinctive, indicating certain, decisions to 'Dispose' for the two mouldy yogurts (Yogurt 3a and 4a), and a large majority of participants did so.

'With date' test

- Reaction times indicate certainty in opting for 'Dispose' by the participants who chose 'Dispose' for yogurts that were either before the Use By date or were mouldy and many days past the Use By date (bottom right and top right quadrants).
- It is worth remembering that the proportion who would dispose before the Use By date was small (10% for Yogurt 1b, and 14% for Yogurt 2b).
- There was some hesitation about choosing 'Dispose' for yogurt that was on the Use By date or recently past the Use By date (+5 days), for both the freshest-looking yogurt (1c) and the yogurt showing surface liquid (Yogurt 2c on-date and Yogurt 2d past date).
- In fact, least certainty about disposing was recorded for the freshest-looking yogurt past the Use By (Yogurt 1c), when just over half (54%) opted for dispose.
- Like the 'No date' test, decisions to dispose of Yogurt 3b and 4b were rapid, which suggests those choices were instinctive in response to the poor product quality shown in the images. Most (86% and 92%) would dispose at these stages.

The results suggest that citizens are not entirely secure in the decisions they make to dispose of on-date or recently past its Use By date yogurt, especially if its appearance is fresh, even though a Use By date is meant to indicate that the product is no longer safe to eat.

That accords with the survey question about eating past the Use By/Best Before date in the past two weeks, in which 38% of participants said they had used milk and yogurt after the Use By date (Figure 7, page 51). We cannot tell from this research whether those participants misunderstand Use By dates as Best Before dates, or whether they are knowingly eating past the date. If they are, a large minority could be relying on their own judgements about yogurt which has implications for citizen education campaigns.

5.8.3 Reasons for waste

- Immediately following the IAT, participants were shown a selection of up to 10 images that they had chosen to 'Dispose' of in the test. For each of those images, participants were asked to select the main reason for choosing 'Dispose'.

Table 2 in Chapter 3.0 provides more detail about how the question was asked and the detailed reasons included in the response themes shown in Figure 38.

An increasing perception of risk is a clear trend across the product life-stages in both tests, as the proportion of participants who gave that as a reason for disposal increased across the stages. Disgust is, similarly, a more prevalent reason at subsequent life-stages, in both tests. The role of Use By dates appears to be most important for the freshest yogurt, but is less relevant for the mouldy yogurts, when it is cited by a small minority of participants as a reason for choosing 'Dispose'.

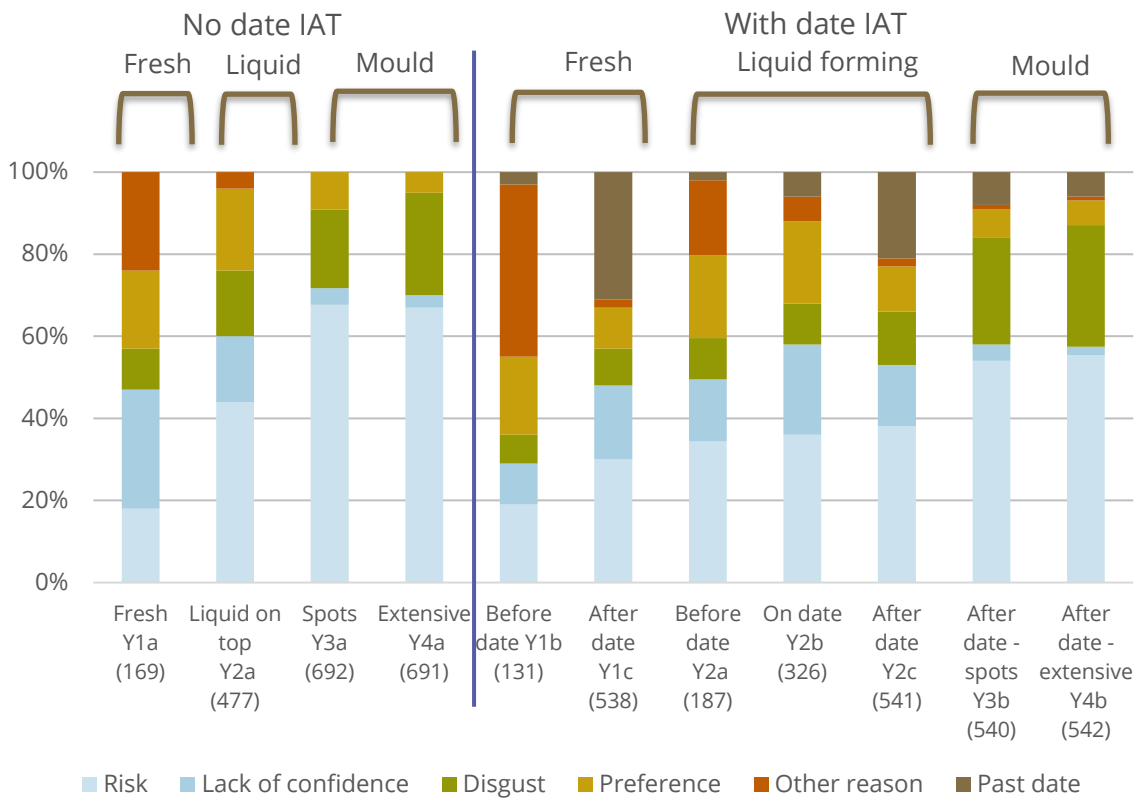
Figure 38 shows the reasons given by those who said they would dispose in response to each of the nine images included in the IAT. Because a different set of images was shown in each test, the results are described first for the 'No date' test then for the 'With date' test, followed by a comparison between the tests where important differences were observed.

Figure 38: Yogurt - Reasons given for disposal by those saying "dispose" at each stage of deterioration.

Q14. You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.

Bases in brackets: participants who selected dispose for that image in the IAT and asked for a reason at Q14.

! denotes a small base – i.e. only a small number of respondents selected "dispose" for the product at that stage. The percentages shown for these small bases need to be viewed with care: the confidence intervals around the percentages are large.



'No date' test

- The principal reasons throughout the stages were related to concerns about food safety (i.e. a combination of risk and lack of confidence).
- Together those two reasons were cited by 47% of participants who would dispose of the freshest yogurt (1a), 60% when liquid was visible (Yogurt 2a), and 71% and 70% for the two mouldy yogurts (3a and 4a).
- The balance between a lack of confidence and perceived direct risk shifted between the younger and older yogurts, and as more participants would dispose.
- Lack of confidence was cited by 28% of those who would dispose of Yogurt 1a (which 13% of participants would do at that stage), declining to 16% for Yogurt 2a and less than 5% for Yogurts 3a and 4a, when most participants would dispose.
- The proportion that would dispose because of perceived risk jumped from 18% for Yogurt 1a to 44% in response to the image showing surface liquid (Yogurt 2a) and to 67% for the two images depicting mouldy yogurt (Yogurt 3a and 4a)

- Personal preference was cited by a similar percentage of participants for Yogurt 1a and 2a (19% and 20%), but this plummeted when mould was visible (9% for Yogurt 3a and 5% for Yogurt 4a).
- Disgust was instead the second most prevalent reason for choosing 'Dispose' for the two yogurts with mould (19% for 3a and 25% for 4a) and was also cited by more than 1 in 10 (16%) for the yogurt with surface liquid (2a).
- For the freshest yogurt (1a) there was also a set of reasons not captured in the survey, which had prompted a quarter of the 13% of participants who would dispose of yogurt at that stage.

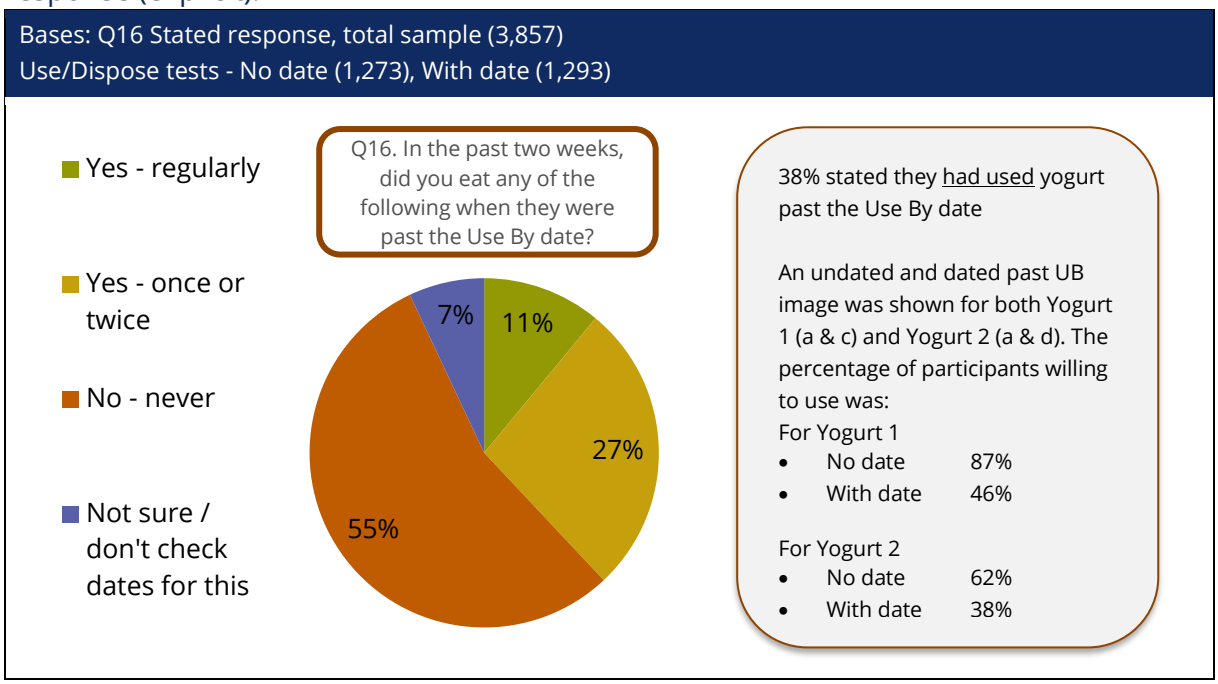
'With date' test

- As was the case for in-date milk, a large percentage (42%) of the 1 in 10 participants who would dispose of fresh yogurt (1b) cited 'other reasons' (i.e. not to do with preference or safety). It was also a factor for the in-date yogurt with liquid (cited by 18% who would dispose).
- The date itself was an important reason for choosing 'Dispose' when the same fresh yogurt was shown with a date that signalled it was five days past the Use By date. That reason was given by 31% of participants who would dispose at that stage (when more than half of the participants would dispose).
- 'Past the date' was an important reason why participants would dispose of Yogurt 2b that showed surface liquid, cited by 21%, though it was overtaken by perceived risk as the most prevalent reason (38%).
- Being 'past the date' was not an important reason for choosing 'Dispose' for the mouldy yogurts, for which perceived risk and disgust were the leading reasons.
- In the 'With date' test, the percentage that cited lack of confidence was greatest for the yogurt with the liquid and a Use By date that was five days past the date (Yogurt 2c): 22% gave that reason.

5.8.4 Difference between claimed willingness to eat past date and IAT explicit response.

When participants were asked directly if they had used yogurt past the Use By date in the past two weeks, 37% in the combined sample across the three tests said they had (Figure 39). A further 7% were not certain or don't check dates on yogurt.

Figure 39: Yogurt – difference between claimed willingness to eat past date and test response (explicit).



Looking only at the two tests in which participants were shown yogurt there was a small, not statistically significant, difference in the proportion that stated they had used yogurt past the Use By date. Notably, there was a statistically significant difference between the tests in the proportion of participants who said they never did (55% in 'No date', 60% in 'With date').

In the 'No date' IAT, the proportion of participants who were willing to use the freshest yogurt (Yogurt 1) vastly exceeded the proportion who said they had used yogurt past the Use By date (38% in this test). The same was true for Yogurt 2, even though the proportion of participants willing to use was less. This result could suggest that the visual condition of neither yogurt signalled that they were past the Use By date, for most participants.

The results were different in the 'With date' test for Yogurt 1, where the image was shown with a label five days past the Use By date. Here, it is interesting to look at the difference between the proportion who opted for 'Dispose' in the IAT and the proportion in this test who stated they had "never" used yogurt past the Use By date (60%). For the freshest yogurt (1c), 54% of participants chose 'Dispose'; for the yogurt displaying surface liquid (2d) 62% chose dispose.

The results suggest that the visual condition as well as the Use By date played a role in prompting a choice to dispose of yogurt at five days past the Use By date; but the presence of the date itself was likely a major factor in prompting disposal among citizens who usually avoid eating out-of-date yogurt.

These results further support the hypotheses from the explicit and implicit IAT results, that the Use By date is a crucial signal for disposing of fresh-looking yogurt and that a

product with a longer Use By date of equivalent visual condition might not be thrown away.

5.8.5 Assumptions/considerations

Considerations that apply to all products in the IAT are outlined in Chapter 3.0 in section 3.3. Additional considerations specifically for yogurt are:

- **The tests included images of undated as well as dated yogurt.** While undated yogurt is unlikely to ever be offered to citizens, it was included as a useful test condition to explore the influence of dates. The results indicated a strong reliance on dates once the yogurt was past the Use By date, as well as before the Use By date for the small number of citizens who would dispose of yogurt earlier. The differences in results observed between the undated and dated dairy products are perhaps best used in industry discussions about adopting less conservative dates. The findings also provide useful insights on how citizens evaluate a slightly split yogurt differently from a fresh one with an identical Use By date, and therefore concerns that could be addressed in behaviour change interventions.
- **It is possible that showing opened yogurt introduced some bias into the way in which participants evaluated it,** because other research has indicated that the length of time a product has been open for is a decision-making factor for some citizens. Using images of open yogurt was the only way to show stages of deterioration clearly. We cannot determine if this introduced a bias or by how much.
- **WRAP knows that the influence of sensory experience is important in citizens' evaluations of whether to dispose of dairy products.** The full complex array of influences on disposal decisions could not be captured in these tests and it should be considered that the propensity to dispose recorded in the research might not be the same in research that is able to replicate a real-world experience more closely.
- **Whether participants were responding to the specific dates shown** on the product or an implicit relative scale derived from the dates included in the test. The results showed a very large uplift in disposal' between the Use By date and +5 days past the Use By date. The research method means we cannot determine whether participants were responding to the specific dates shown on the product or a relative sense of the date that was unconsciously benchmarked against the other dates they saw, for yogurt and the other products. The images were shown at random and quickly so there may have been an unconscious sorting process of dates going on. It is possible that the percentage who would dispose at this earliest post-Use By date might not be replicated in a test that included a set of more granular dates, or different products, because participants would be responding to a different 'past Use By' benchmark.
- **There was a large gap between dates used for each deterioration stage.** To inform a possibility of applying Best Before dates and/or less conservative dates on yogurt, it would be worthwhile to investigate the intervening zone past the Use By date to provide more precise insight on how long a buffer those who are currently using past the date give to yogurt.
- **In the UK yogurt is currently sold with either a Use By or a Best Before date but participants were only shown Use By dates in the 'With date' test**. Findings from the latest WRAP Retail Survey show that in 2019, 84% of yogurt was sold with a Use By

and 16% with a Best Before date[72]. Evidence suggests that citizens are likely to use yogurt for approximately one day longer if it carries a Best Before instead of a Use By date[73]. Whilst participants were shown images of yogurt with a Use By date in the 'With date' test, we cannot be certain that the participants would have answered the same if they were shown a Best Before date.

Food Labelling Guidance by WRAP, the FSA and Defra[74] recommends the following:

- Apply Use By for foods which, from a microbiological point of view, are highly perishable and are therefore likely, after a short period, to constitute an immediate danger to human health. Food cannot be sold, redistributed or consumed after this date.
- Apply Best Before for all other foods, to indicate quality, where a date is required. Food can be sold, redistributed and consumed after this date.
- Do not use a Display Until label. To avoid confusing consumers, use other mechanisms for stock control.

WRAP's Retail Survey in 2019 showed that the application of date labels for yogurt was in line with best practice guidance, however, correct use of Use By for food safety reasons could not be checked. This is because it is the responsibility of the food business to use the guidance and their own detailed knowledge of each product to determine whether there is a food safety risk and therefore a need for a Use By date.

It was beyond the scope of this research to test whether the findings presented here would be any different if we showed participants the exact same images of yogurt but with a Best Before date. Therefore, this research only provides insights about Use By dates.

[72] *Retail Survey 2019: Helping Consumers Reduce Food Waste Through Better Labelling and Product Changes. WRAP, 2019. Table 8.* https://wrap.org.uk/sites/default/files/2020-08/Retail-Survey-2019.pdf

[73] *The effect of date labels on willingness to consume dairy products: Implications for food waste reduction. Thompson et al. (2018).* https://doi.org/10.1016/j.wasman.2018.05.021

[74] *WRAP Labelling guidance. Best practice on food date labelling and storage guidance, WRAP, 2019.* https://wrap.org.uk/sites/default/files/2020-07/WRAP-Food-labelling-guidance.pdf

6.0 Discussion

The IAT research aimed to develop insights on the deterioration stage at which citizens would dispose of certain food items and the influence of date labels and packaging on their decision. The results will help WRAP, its partners and stakeholders to identify ways to help citizens use these food items for longer, to prevent waste.

The Discussion covers:

- Findings about the effect of date labels on disposal decisions, including insights about citizens' willingness to eat past the date on the date label (Section 6.1)
- Whether disposal decisions are influenced by the product being packaged or unpackaged (Section 6.2)
- Insights provided by the reasons given for disposal about the effects of the date label and packaging (Section 6.3)
- Supporting evidence from the IAT reaction times (Section 6.4)

The preceding sections of the report have referred to 'participants' in the IAT. In this chapter we refer to 'citizens' because the survey samples were large and structured to reflect the known profile of the UK population, so there is confidence in being able to generalise from the results, subject to the caveats outlined in Chapter 3.0.

6.1 Influence of date label

This section discusses the influence of a date label on citizens' decision to dispose of food products. The overarching findings are presented first, followed by product-specific findings that are considered relevant for food waste prevention initiatives.

6.1.1 Overarching findings

The research provides clear evidence of a date label effect on (hypothetical) disposal decisions for the food items covered in the IAT. The effect is almost always to increase the percentage of citizens that would throw away a food item at a given stage of deterioration.

In some cases, it appears mainly to be the date that is prompting more citizens to want to dispose compared to when a date is not shown. In other cases, there appears to be a combined packaging-plus-date effect. The discussion here focuses on the differences between the 'Packaged with date' IAT and the 'Packaged' IAT to explore the date effect. The date label was the only difference between the two tests in the images that participants saw. This gives us confidence that the results observed are attributable to the presence of the date. The possible influence of packaging ('Packaged' test) on disposal choices when compared to loose products ('Unpackaged' test) is discussed later, in section 6.2.

The size of the date label effect appears to be greatest for the earliest stage of deterioration shown in the images of a post-Best Before/Use By date product. The date-

label effect at this stage is compared across products in Table 14, showing differences in the percentage that would dispose at that stage in the two tests.

Table 14: Influence of inclusion / exclusion of date label on choice to dispose or use for packaged items at the first stage of deterioration past Use By or Best Before date shown in the IAT.

With date	Days past date	IAT image	'Dispose' Packaged test (no date)	'Dispose' Packaged with date test	'Date effect' Percentage point difference	Rely on date - entirely/mostly[75]
Apple	24	Apple 2	7%	46%	+39	10%
Bananas	13	Banana 2	2%	29%	+27	9%
Broccoli	12	Broccoli 2	36%	69%	+33	10%
Cucumber	13	Cucumber 2	63%	82%	+19	11%
Potatoes	12	Potato 2	7%	30%	+23	8%
Cheese	40	Cheese 3	54%	76%	+22	20%
Milk – fresh	On-date	Milk 1a	2%	13%	+11	37%
Milk – fresh	4	Milk 1c		53%	+51	
Milk – split	6	Milk 1d	49%	76%	+27	
Yogurt – fresh	5	Yogurt 1a/1d	13%	54%	+41	40%
Yogurt – surface liquid	On-date	Yogurt 2a/b	38%	25%	-13%	
Yogurt – surface liquid	5	Yogurt 2a/c		62%	+24	

Sizeable effects are also present for the subsequent stages of deterioration. The effect is further sustained, but smaller, for all products shown at the end of their life, except Cucumber 4 where the difference is not statistically significant. At those later product

[75] *Q. 15/16 Combined sample across the three tests, 4,559: the percentage that stated they rely entirely or mostly on date.*

life-stages the effect is still notable for bananas, potatoes, and cheese, where the difference in the proportion who would dispose is more than 10 percentage points between the 'Packaged' and 'Packaged with date' tests. The date effect at every stage of deterioration for each product is shown in the product-specific findings in section 6.1.2.

The results indicate that the date label itself is acting as a trigger for citizens to dispose, over and above any visual assessment of the quality of the product. Its influence is greatest when products are past the Best Before/Use By date and retain some freshness, when visual signs of deterioration are minor. As deterioration advances and becomes more visible, a date still prompts greater disposal. Although by that late-stage, disposal choices are driven by judgements about quality based on product appearance – at least for the very aged products shown in the IAT (where Best Before dates of 26 - 50 days past the Best Before were shown for the fresh produce items).

It seems likely that the presence of dates is switching on the date sensitivity of those citizens who are the most reliant on product dates for judging product edibility. We can further suggest that citizens who rely on judgement as well as dates are being swayed in their judgement towards disposal, more so than if they did not see a date. As shown in Table 14, the size of the date effect observed is far greater than the proportion of 'date driven' participants (i.e. those who say they rely entirely or wholly on dates) for every product. There is also a possibility that some citizens are being primed to feel they *need* to rely on dates by seeing a date. As shown in Chapter 4.0, a greater percentage of participants said they rely on dates in the 'Packaged with date' test, after they had seen the images with dates, than in the other two tests where dates were not shown.

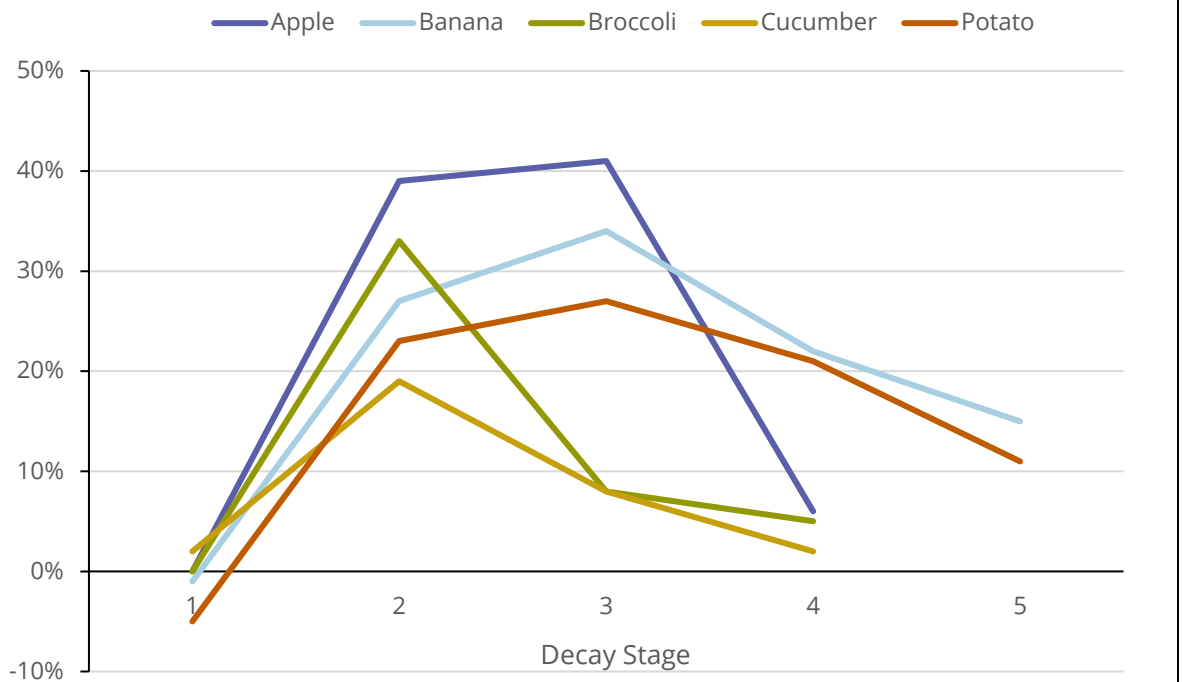
While the results indicate an important influence of the date label in driving disposal - especially when products are nearest to the Best Before/Use By date - it needs to be acknowledged that the IAT could not capture other likely influences on disposal decisions. Disposal decisions in real-world settings are complex and multi-faceted and include important sensory cues in addition to the visual cues provided in these tests. It is possible that some of the participants in these tests would make a different decision if they could smell or feel the products; but we cannot say if this would have enhanced or reduced the date-label effect observed.

6.1.2 Product-specific findings

In addition to the overarching findings, which apply to all products, there are further insights for individual products that have implications for actions to support citizens food waste prevention. These are grouped together for products where the findings were similar. Figure 40 summarises the date effect for fresh produce items at every stage of deterioration whilst Table 15 brings together the results for milk and yogurt.

Figure 40: Date effect – summary for fresh produce items.

Percentage point difference in the % of participants that would dispose in the 'Packaged with date' IAT compared to the 'Packaged- no date' IAT at each deterioration stage (1-4/5)



Stage 1: low date effect for all products.

Stage 2: high date effect for all products.

Stage 3: high date effect for App, Ban & Pot, low effect for Broc & Cuc

Stage 4: Quite high date effect for Ban & Pot but low for App, Broc & Cuc.

Stage 5: Date effect still quite high for Ban & Pot but lower than stage 4.

Apples, bananas and potatoes

Of the fresh produce items, the date-label effect is clearest for these products, resulting in more disposal at an early life-stage past the Best Before date. The presence of a date continues to add a 'disposal premium' to how many citizens would dispose at all product life stages, even at the end of product life when signs of deterioration are advanced.

In the absence of dates, a majority of citizens would apparently continue to use apples and potatoes for a long period past the nominal Best Before date if a date is not seen, up to at least 36 days for apples (73% would 'Use') and 25 days for potatoes (60%)[76]. Slightly less than a majority (44%) would use bananas at this stage (33 days past the Best Before)[77]. It is only by the very last stage of deterioration shown in the IAT images (44 to 50 days) that a large majority would dispose of these three items. This finding suggests there could be a threshold date somewhere between these two long dates when the balance tips from use to dispose for a majority of citizens.

[76] *Apple 3 and Potato 4 in this test. The dates are 'at least' because the next date shown was 50 days after the Best Before date for both products.*
[77] *Banana 4.*

Closer to the nominal Best Before date (at the earliest life-stage shown in the images of a post-Best Before date product[78]) more than 90% of participants would continue to eat when a date is not shown. It is still a majority at this stage, but very much less, in the presence of a date (54% for apples, 71% for bananas, 70% for potatoes).

A comparison between choosing 'Use' in the IAT and stated recent behaviour provided further evidence that many citizens are currently eating well beyond the Best Before dates that are usually applied to these products. The percentage who said they had eaten after the date in the past two weeks was closest to the percentage who would 'Use' in the 'Packaged with date' IAT for the images that were 19 - 24 days past the Best Before date. As noted above, many more would eat an equivalent quality product past that stated date threshold if a date was not displayed.

These findings suggest that many citizens would be willing to use these products for much longer than a usual Best Before date would indicate. It implies there is scope to consider either removing dates from these products altogether or applying less conservative Best Before dates. On potatoes, for example, other WRAP evidence shows that Best Before dates are very conservative at 3.9 days on average for 2.5kg bags of white potatoes[79]. The discrepancy in hypothetical disposal depending on whether participants saw a date or not may also support a case for educating citizens about ways to preserve or judge quality/safety after the Best Before date.

Some caution needs to be attached to interpreting the specific dates shown in the research as the actual dates at which citizens would dispose. It was only possible to show a small number of dates with large intervals between them. Therefore, it is possible that citizens were responding to a perceived scale of acceptability that could have been implied by the *relative* difference in dates, allied to the images of degrees of deterioration, rather than to the *specific* date shown on the label. Further research with greater granularity of dates would be required to ascertain where the buffers and thresholds exist for prolonged willingness to eat past the Best Before date. This caveat also applies to the discussion about the other products below.

Broccoli and cucumber

A date-label effect in favour of disposal was also evident for cucumber and broccoli; but for these two products there appears to be less tolerance to a decline in product quality after the Best Before date (as depicted in the IAT images), as well as a possible influence from the packaging itself. The possible role of packaging is discussed in later sections.

Unlike the other fresh produce items, a majority would dispose at the earliest life-stage depicted past the Best Before date (+12 days for broccoli and +13 days for cucumber). For cucumber, that was the case in both the dated and undated tests, which suggests even greater sensitivity to visual quality than for broccoli. In contrast to the other fresh produce items, a large proportion (63% for cucumber and 36% for broccoli) would dispose at this stage when they did not see a date. In the IAT when participants did see a

[78] *12 days for potatoes, 13 for bananas, 24 for apples.*

[79] *Helping consumers reduce food waste through better labelling and product changes, WRAP, 2019. Page 12* https://wrap.org.uk/sites/default/files/2020-08/Retail-Survey-2019.pdf

date, there was a further 'disposal premium' with even more opting to dispose (83% and 69%).

The comparison between the stated behaviour of eating past the Best Before date and willingness to use in the IAT provided further support for the suggestion that citizens are not willing to keep these products for as long as apples, bananas and potatoes. Some 2 in 5 had eaten these products after the Best Before date in the past two weeks. However, in the IAT where participants saw dates, less than 1 in 5 would use the 12-day past Best Before cucumber; slightly fewer (31%) than indicated by stated behaviour would use broccoli.

The results suggest that the *specific* period past the Best Before date conveyed by the date label is especially important for these products, on top of any deterioration in visual quality. That seemed particularly important for broccoli, where the gap in the proportion who would dispose was 33 percentage points between the two tests at the earliest date past the Best Before date. The 'date disposal premium' was 19 percentage points for cucumber, though even more participants disposed at that stage than for broccoli.

The findings for broccoli and cucumber indicate there may be less scope for extending Best Before dates than for the other products, although the evidence could support a case for removing dates, given the additional impact on top of visual quality. The findings could point to other strategies to support citizens to prevent waste, such as encouraging good stock rotation to make certain these items are used first, rescue strategies to prevent or overcome signs of deterioration, or changing perceptions on judging freshness and eating quality.

Cheese

Cheese was shown with a Best Before date in the IAT, but a different 'scale' of dates was depicted than for the fresh produce items. Two images were a long time before the Best Before date; two images were a long time after (+40 days and +200 days). The selection of dates was driven by the state of deterioration that WRAP wished to show to participants.

As with the fresh produce items, there is clear evidence of the date-label effect on disposal at both of the advanced deterioration stages shown in the test (each with visible large patches of mould). Because no near-Best Before dates for relatively fresh cheese were shown, we cannot comment on the likely scale of a date effect for cheese that is only recently beyond the Best Before date and appears good to eat.

There is some evidence that citizens are willing to eat cheese past the Best Before date: 43% say they have done this in the past two weeks. Because of the long dates used in the tests, a comparison between this figure and the proportion who would use cheese in the IAT is less useful than for the other products. But it does indicate there is a threshold time after the Best Before date up to which a sizeable minority of citizens would be willing to eat. Further research would be required to establish where that threshold exists.

Milk and yogurt

The tests for milk and yogurt were different again. They explored the effect of showing dates compared to no dates, and the relative influence of dates before, on and past the Use By date for perfectly fresh and slightly older split milk and yogurt with surface liquid. The undated images were included in the IAT to explore how citizens respond to different dates, compared to a benchmark based on visual appearance alone. Table 15 summarises the results for a date effect.

Table 15: Date effect – summary for milk and yogurt.

Areas shaded in grey indicate that an image was not shown in the IAT for that stage.

			Percentage point difference from when date was shown			
Visible deterioration	IAT image	% that would 'Dispose' in the 'No date' IAT	Before Use By	On Use By	Past Use By	Days past Use By shown in image
Fresh	Milk 1	2%	+3	+11	+51	4
	Yogurt 1	13%	-3		+41	5
Early deterioration	Milk 2 split	49%			+27	6
	Yogurt 2 liquid	38%	-24	-13	+24	5
Late deterioration	Yogurt 3	78%			+8	12
	Yogurt 4	86%			+6	19

The results for both milk and yogurt demonstrate considerable sensitivity to the Use By date, and whether the product is in-date or past the Use By date. For the perfectly fresh-looking products, there was a dramatic switch from a small number who would dispose on or before the Use By date to over half of participants wanting to dispose of the item after the Use By date (+4 days for milk, +5 days for yogurt).

The only difference in the images shown to participants was the date, so that differences in the prevalence of wanting to dispose cannot be attributed to differences in actual product quality based on visual appearance. It is plausible that the presence of a date influenced relative perceptions of quality, and this is discussed later in relation to reasons given for disposal.

When milk and yogurts have further visual signs of deterioration, a large majority, but not everyone, is likely to dispose if the date is past the Use By. A quarter of participants in this test would still use the split milk at 6 days past the Use By date, and nearly 38% would use the yogurt with surface deterioration at 5 days past the Use By date. Even

more would use the yogurt with liquid if it was still in date (86%) or on the Use By date (75%) (this wasn't asked for the split milk).

Also, of interest for these visually less-than-perfect products was the difference in the proportion who would dispose of milk or yogurt depending on whether they saw an image with a date or an undated image. Based on visual quality alone far fewer (a quarter of participants or more) would choose to dispose than when a date was seen. This suggests that the date, and possibly that it was a Use By rather than Best Before date, was signalling clearly that the product was no longer good or safe to use.

A similar analysis for the fresh-looking milk and yogurt is even more stark. Few would dispose in response to the undated image (Table 15). An additional 51% of participants would dispose of milk and an additional 41% would dispose of yogurt when the same image carries a date label that is 4 or 5 days (respectively) past the Use By date. Again, this suggests that participants responded largely to the product being beyond date, rather than the quality represented in the visual image.

These findings support two different possible strategies for encouraging citizens to use dairy products for longer. Since the Use By date is shown to be a crucial signal for disposing of fresh-looking yogurt and milk, the findings point to extending dates where it is safe to do so, and the product is still palatable. Data relating to the latter can be found in The Shelf-Life Report[80].

This research cannot indicate where the thresholds are for extending dates and retaining consumer acceptability, in terms of the number of days past the Use By or Best Before date. Further research would be required and possibly also research that can access other sensory-based influences on decision making, ideally in real-world settings. From previous research we know that smell, taste, and open life can be important influences on willingness to use dairy products. The WRAP Food Waste Tracker survey from 2017 shows that 69% of citizens use smell and 40% use taste to tell when milk is no longer OK to drink. In comparison, 35% use either the Use By date (28%) or "Use Within" message (7%)[81].

The evidence also indicates there is a portion of the population that needs to be assured that using milk on the Use By/Best Before date is safe and the quality unimpaired (as long as their fridge is at the correct temperature). The few who are highly date-sensitive may need to be reassured that a safety buffer does not need to be left ahead of the date shown on the product. This includes the 10% - 14% who would dispose of yogurt before the Use By date and 13% who would throw away milk *on* date and 5% *before* the Use By. Further qualitative research would be needed to pinpoint what these citizens need to be persuaded about.

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[80] *The impact of packaging and refrigeration on shelf life, WRAP, 2022: https://wrap.org.uk/resources/report/helping-people-reduce-fresh-produce-waste*

[81] *Food Waste Omnibus survey December 2017, WRAP, Unpublished. Sample size: 1808. Multiple responses could be selected by participants. These data are also cited in Figure 4 page 12: Opportunities to Reduce Waste along the Journey of Milk, from Dairy to Home, WRAP, 2018 https://wrap.org.uk/resources/case-study/opportunities-reduce-waste-along-journey-milk-dairy-home*

6.2 Influence of packaging (without a date)

The findings for the influence of packaging compared to when products are unpackaged are less clear-cut than for the effect of date labels on packaged products. More methodological limitations apply to this comparison. These include:

- In addition to one set of images being packaged and one being unpackaged, the images in the two tests did not always show identical products at the same stage of deterioration. The selection was driven by showing products of an equal age in relation to a normal Best Before date and the deterioration in the packaged products may have looked different from the unpackaged ones.
- While every effort was made to reduce any influence arising from differences in visibility between the packaged and unpackaged images, it is possible that some of the signs of deterioration were less visible in some of the packaged images or that dark areas within the packaging could have been viewed as deterioration.
- Following on from that, it had to be assumed in the test that when participants saw the image, it was the first time they had assessed the quality of the product (i.e. bought the product and kept it away from sight at the back of the fridge/cupboard). In a real-world setting many citizens would keep and store the products in regular view and so could inspect them periodically for signs of deterioration. We could not account for what would happen in the real-world when citizens would remove items from the packaging for storage or for closer inspection before deciding whether to use them.
- The results need to be considered in the context that the 'Unpackaged' condition may have been artificial for many participants, because they generally buy these products packaged. In this research, for example, only 1% stated they buy cheese unpackaged when asked if they ate past the Use By/Best Before date in the past two weeks. It was 15% for bananas and between 6% to 10% for the other products.
- The tests could not make allowance for the likely multiple influences on disposal choices in real-world settings, including important sensory factors. That limitation applies equally to the findings about date label effects.

As a result of the assumptions and limitations, the findings about the role of packaging have been treated with caution and the discussion is restricted to important observations that can be supported by the evidence. One of the other WRAP reports published alongside this report is exploring the impact on food waste of packaged versus loose uncut fresh produce in more detail[82].

Where differences were observed between the 'Packaged' and 'Unpackaged' tests, these provide an indicator that different quality assessments were being made by IAT participants according to whether they saw packaged or unpackaged products. There is no influence of a date label in these comparisons. Some results may indicate that packaging was influencing the quality assessment made by participants in certain ways and this aspect is explored further in the section on reasons for disposal.

[82] *Modelling the impact of selling products loose or in packaging, WRAP, 2022: https://wrap.org.uk/resources/report/helping-people-reduce-fresh-produce-waste*

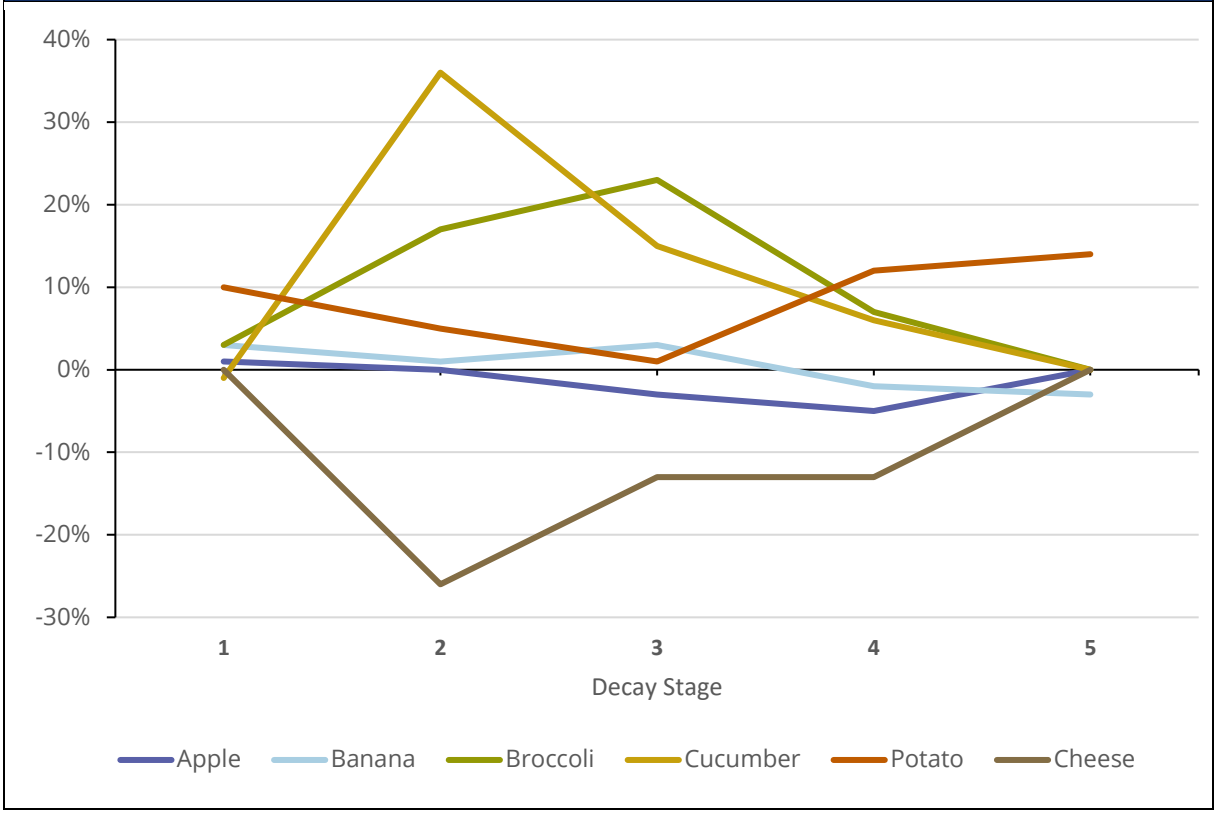
As in the previous section on date labels, the results are summarised for the earliest stage of deterioration when a product was past the equivalent of a normal Best Before date, though of course dates were not shown in either of 'Unpackaged' or 'Packaged' tests (Table 16). The percentage point difference between 'Packaged' and 'Unpackaged' tests is shown for all stages in Figure 41.

Table 16: Difference in the percentage that chose 'Dispose' in the 'Packaged' and 'Unpackaged' tests for items at the first stage of deterioration past the Best Before date.

With date	Days past date	IAT image	'Dispose' Unpackaged test (loose products)	'Dispose' Packaged test (no date)	Percentage point difference
Apple	24	Apple 2	7%	7%	0
Bananas	13	Banana 2	1%	2%	+1
Broccoli	12	Broccoli 2	19%	36%	+17
Cucumber	13	Cucumber 2	27%	63%	+36
Potatoes	12	Potato 2	2%	7%	+5
Cheese	40	Cheese 3	67%	54%	-13

Figure 41: Possible packaging effect – summary for fresh produce items and cheese.

Percentage point difference in the % of participants that would dispose in the 'Packaged' IAT compared to the 'Unpackaged' IAT at each deterioration stage (1-4/5)
Please note that the effect of packaging on disposal is unclear for many of the products and caution is needed when interpreting this figure. See text below for further explanation.



Apples and bananas
Little or no effect from packaging versus unpackaged products was detected for apples and bananas for all the product life-stages shown in the tests.

Potatoes
The results for potatoes are unclear. There did appear to be a packaging effect, which may have enhanced disposal at later product stages, and possibly a small effect at the earliest stages, but not for the intermediate stage (Potato 3). Caution is needed in interpreting this to mean that loose potatoes are less likely to be thrown away. It is plausible that the relative visibility of dark spots and sprouting in the two tests contributed to these results. It should also be borne in mind that Potato 5 had an advanced post-Best Before date (+50 days). Waste prevention strategies could focus on helping citizens to use optimal storage solutions for potatoes. Further research, which could also access sensory cues such as smell and feel, would be needed to verify these tentative findings.

Broccoli and cucumber
As noted in the previous section, broccoli and cucumber were the two products where an effect from packaging appeared to be the greatest when a product was past its Best Before date. Whilst acknowledging there was a discrepancy in the visual quality of the images for this stage, most notably for cucumbers, it is worth saying these were the only

products in shrink-wrap and that the results could also have been affected by the use of this type of packaging. This is explored further in relation to the reasons given for disposal in the next section.

Cheese
As noted in the discussion about a date effect, the dates that were shown on cheese were very far apart and the image representing the most 'recent' post-Best Before was 40 days past the date with clearly visible and widespread mould. That was easier to see in the unpackaged version of the cheese. Unsurprisingly, packaging appeared to protect cheese from a decision to dispose, with fewer participants saying they would dispose if they saw packaged cheese than if they saw unpackaged cheese. A similar, but even larger, protective effect was apparent for cheese shown 64 days before the Best Before date and only minor blemishes.

The findings for cheese need to be set in the context that IAT participants are unaccustomed to buying or using unpackaged cheese. The results can probably best be interpreted to indicate that strategies for helping citizens to use cheese for longer should focus on guidance on the best ways to wrap and store cheese once it is opened (e.g. in airtight containers/bags), to prevent the kinds of deterioration depicted in the unpackaged images. Further sensory research may be required for cheese to explore how to encourage citizens to prolong product life and how to go about it.

6.3 Reasons for waste

Immediately following the IAT, participants were asked to select the main reason why they had chosen 'Dispose' for a selection of up to 10 images. The detailed reasons were grouped into themes in the presentation of the results (Table 17). The insights point to ways in which date labels influence disposal decisions and to opportunities for engaging citizens in using the products for longer.

Table 17: Recap on grouping of reasons for choosing 'Dispose' in the IAT.

Theme	Prompts included in the survey question	
Risk	Wouldn't want to risk it / take the chance	Unsafe / risk of food poisoning
Lack of confidence	Not confident in judging whether it's still ok to eat	Not confident/sure how to use it once it's reached this point
Disgust	It would taste bad / disgusting	Don't want to touch it / gross
Preference	Lost its freshness/goodness	No longer appealing
Past date	It's gone past the date on the label	

There were important differences between the fresh produce items and dairy products (this time including cheese) in the reasons why participants would dispose. There were also important differences within these product groups for items at different stages of deterioration, including the role that date labels appear to play either directly or

indirectly. The discussion considers fresh produce and dairy separately, then the specific role of dates and packaging.

6.3.1 Fresh produce

Personal preference (perceived freshness and product appeal) was a leading reason for choosing to dispose of fresh produce items across all three tests.

It was particularly influential in the earlier product life-stages when the items were closest to the Best Before date and when there was a large uplift in the proportion that would dispose. Preference tended to become less important as a disposal driver at the later product life-stages, when it was either joined or overtaken by disgust and risk, as deterioration became more visible and dates (in the 'Packaged with date' test) were many weeks past the Best Before date. Further qualitative research would be needed to explore how perceptions of freshness change in response to Best Before dates and how normative models of what freshness, quality and safety look like could be redefined.

The reasons given for disposal help to explain why the uplift in disposal for broccoli and cucumber was greater at an earlier stage than for apples, bananas and potatoes and why it increased in the packaged test without dates as well as where dates were shown. Personal preference was the main reason given at stage 2 for both products, but the visual appearance (including a possible role of the shrink-wrap packaging) appears to have provoked a substantial rise in the number citing disgust for cucumber at this stage, and for both broccoli and cucumber at stage 3.

Disgust was experienced by a greater proportion of participants at an earlier stage for these two items, which could be an important barrier to encouraging citizens to use these products past the Best Before date. It supports the suggestion made in the previous section that waste prevention strategies for these products need to encourage citizens to use the products before they start to deteriorate and also to offer storage guidance that would prevent or delay the 'yucky' aspects of deterioration.

The results for potatoes were also interesting. Lack of confidence and risk was cited across the stages and by more participants than for the other produce items, although preference was still the leading reason for disposal across the product life-stages. While we cannot rule out that the images may have contributed to uncertainty for potatoes, it seems plausible that a sizeable minority of citizens is uncertain what the signs of deterioration mean for product quality and therefore cite lack of confidence rather than preference. These findings for potatoes point to a need to educate citizens about the relationship between signs of deterioration and continuing product quality, also about de-packaging and optimal storage strategies.

6.3.2 Dairy

Food safety concerns were the leading reason for choosing to dispose of dairy products, alongside personal preference in the earlier life-stages and rising disgust at later stages. These concerns relate to actual risk and feelings of being able or confident to judge risk.

The results for cheese are strongly linked to the very long periods past the Best Before dates shown on the products, so it is not surprising that risk and lack of confidence in product safety dominated the reasons for disposal. As noted earlier, research that provides a more granular examination of consumer preferences in relation to Best Before dates, possibly combined with an exploration of sensory influences, would be required to offer more insight.

For both milk and yogurt, the large uplift in disposal for the freshest-looking milk when it showed a Use By date of four days past the date was attributable to the date label itself, together with perceptions of risk and lack of confidence. This supports the assertion made earlier that the Use By date itself is acting as a strong trigger to dispose when these products are recently past the date.

The date also appears to be driving disposal decisions indirectly by confirming citizens' concerns about risk. That would not be surprising if the Use By is being correctly understood as a safety indicator, but we cannot confirm that from this research. However, it is also interesting to note that when the same images of fresh milk and yogurt were shown without a date, very few would choose to dispose. This suggests that it is risk symbolised in a Use By date, rather than an assessment of risk based on the product's appearance, which is driving these decisions. It also suggests there could be scope to educate about risk and quality to reduce disposal if the label was a Best Before date instead of a Use By date, but this would need to be investigated further.

For the intermediate yogurt, which was shown with liquid on the surface, the Use By date might be exaggerating implicit concerns about risk based on the product's appearance (which was the same in the two IATs). Risk was the most cited reason when a date was or was not shown, but far more participants opted to dispose when the yogurt showed a date. Educating about risk linked to signs of deterioration in quality would be important if either Use By dates were extended or labels were switched to Best Before dates for yogurts.

The date appears to be a relatively unimportant reason for disposal of the split milk and the mouldy yogurts shown in the tests, where an increase in the proportion that cited disgust (likely based on product appearance) mirrored the reduction in the proportion that cited the date, when compared to the fresher milk and yogurt.

6.3.3 The role of the date label in reasons to dispose

According to preferences stated in the survey, the proportion of citizens that rely entirely or mostly on dates when making a choice to keep or dispose is greatest for fresh dairy products at 2 in 5 citizens. It is 1 in 5 for cheese and 1 in 10 or less for fresh produce items. There is a further cohort that uses a mix of dates and judgement as a basis for making decisions.

The date label was not directly the reason for choosing to dispose in the IATs. The product being 'past date' was cited as the main reason by a minority of participants for every product at every stage.

It appeared to be most influential at the 'turning points' for each product - when the product shown in the images was first past the Use By/Best Before date and it was the first stage when a large minority or a majority of participants opted to dispose. The important role of the date label in influencing the disposal of dairy items at that stage was discussed in more detail above.

'Past the date' was cited less as a reason at the later product stages when more participants would dispose, when products were several weeks past the Best Before date (for produce items and cheese) and multiple signs of physical deterioration were evident in the images. It is likely that the information offered by the date label was less relevant than the appearance of the products at these later stages.

The relative importance of the date itself in driving disposal decisions at the earliest 'turning point' stage differed between products. It was greatest for milk and yogurt – unsurprising because they were shown with Use By dates – and for bananas (28%, 31% and 30% respectively). Next were potatoes (25%) and apples (21%) then, much less, broccoli (12%), cheese (9%) and cucumber (7%). As noted in the discussion above, more participants opted to dispose of these last three products at the first stage past the Best Before, most likely because of the physical signs of deterioration shown. The date was therefore less relevant as useful information for decision-making, as it appears to be for all the products once they are well past the Best Before date and visible signs of deterioration are advanced.

The findings suggest that the date label plays an important influential role at the marginal point when a product retains some freshness but is flagged as being of lesser quality by the information provided on the date label.

The increase in the percentage of participants that would dispose at this first point past the Best Before/Use By date cannot be explained wholly by the proportion that cited 'past the date'. It seems likely that the presence of the label is triggering not only those who will not eat past the date on principle (who might cite the date) but also those whose judgements about quality are strongly influenced by knowing the age of the product, as well as its visual appearance. The date label may be signalling that the product is 'just too old' to use.

This hypothesis is supported by the findings that showed differences in the reasons given for disposal between those who were shown a date and those who did not see dates. A common theme across products was that the presence of a date appeared to encourage more participants to cite factors such as risk or disgust more frequently than where dates were not shown for an identical product, for which judgements about disposing were more likely to be based on reasons relating to preference (e.g. perceptions of freshness).

It is plausible that the presence of a date label is somehow signalling a loss of freshness and appeal to a wider audience than for an equivalent packaged product without a date. Perhaps the symbolism of the date is switching on latent feelings and concerns that would not be triggered to the same extent in the absence of a date? For example, it might disproportionately evoke feelings that the product is unsafe to eat, unpleasant or

revolting, as in the findings for broccoli and cucumber, for yogurt with surface liquid and for some of the other products at later stages past the Best Before date (e.g. bananas).

Whatever the psychological process, different judgements about quality and edibility appear to be made in the presence of a date, compared to when a date is not present. These findings suggest that any initiative to encourage citizens to use products past a Best Before date would need to challenge citizens' assumptions about quality and freshness that are wrapped up in the symbolism of being beyond the Best Before.

The findings in this report provide a starting point for further research into the factors that drive judgements about usability and safety when products are past the Best Before date. In situations where producers might be considering a switch from Use By to Best Before dates, there will be additional challenges that relate to what the dates signify. We could argue that citizens are programmed to be vigilant about risk for fresh dairy, in part because these products have historically carried a Use By date that acts as a cliff-edge safety marker for those that understand Use By dates. Recognition of inherent food poisoning risks will obviously also be a major factor. Both aspects are likely reflected in the high proportion of participants who cited risk as a disposal reason in the IATs for milk and yogurt, whether they saw a date or not.

The possibility of a latent association between date and risk may need to be challenged where Best Before dates are used on these products, and education offered on how to judge safety and quality when citizens have leeway to decide when to dispose. The findings suggest that would be particularly true for yogurts that display early signs of deterioration, specifically liquid separation.

6.3.4 The influence of packaging on reasons to dispose

Whilst it was generally difficult to isolate the influence of packaging from influences related to the visual appearance of the product, a small number of instances were identified for fresh produce items where it possibly contributed to decisions to dispose.

Packaging (with and without dates) was often associated with a greater proportion of participants citing risk and a lack of confidence for disposal at earlier product life-stages, where those who saw unpackaged products were more likely to cite personal preference instead. The disposal reasons given for broccoli and cucumber in particular, and potatoes at the later life-stages, indicated that the packaging encouraged a different evaluation of the product compared to the same product seen unpackaged.

Risk and disgust were more strongly associated with cucumber and broccoli than other produce items. That might have been a direct influence of the packaging type itself, or the packaging in conjunction with the visual quality of the product. We also need to consider if there was an influence from the specific images shown and whether the findings would be replicated in closer to real-life research settings. Further research would be needed to identify why the combination of appearance, packaging – and date where it is shown – appears to result in a greater and earlier disposal of these two products relative to the Best Before date.

If these findings are correct, they further support the earlier suggestion that use-for-longer strategies for broccoli and cucumber need to focus on avoiding the various cues that would signal 'revolting' or 'unsafe' from arising. This aspect would need to be addressed alongside concerns about a loss of freshness in initiatives that seek to shift preferences towards using these products for longer. The initial findings from this research would need to be explored in more detail, including qualitative methods.

6.4 Time of response in IAT

The implicit results offer insights on how emotionally certain (or instinctive) citizens' choices were. Evidence of hesitation or deliberation about deciding to dispose could hint towards opportunities for behaviour change interventions to nudge judgements about product quality in favour of using products for longer. Equally there could be opportunities to extend citizens' capability to judge edibility, quality and safety where they currently rely on date labels as a judgement heuristic (i.e. where dates prompt automatic decisions to dispose).

Care is needed in how far the findings from the implicit results can be taken. The number of images in these IATs introduced nuances that would not be present in a more typical, simpler IAT; and it could not capture the full array of factors that go into disposal decisions, especially sensory ones. There is some suspicion that aspects of the images (e.g. how easy it was to see deterioration inside packaging) may have influenced reaction times in some instances. Whilst the findings provide useful pointers; they should be evaluated alongside other evidence and/or further research.

The discussion focuses on a small number of promising insights. General insights are:

- When a product shows advanced visual signs of deterioration, disposal decisions are generally instinctive. Mould or the appearance of rotting is associated with rapid decisions, whether the item is unpackaged, packaged, or has a date.
- There is relatively more deliberation about disposing products at earlier stages of deterioration when the items appear fresh or show only small signs of deterioration.
- Packaged cucumber (stages 2 and 3) and broccoli (stage 3) were the exceptions to this general finding. Those who disposed of packaged cucumber and broccoli at those stages were certain, including for cucumber that was almost all green. The findings suggested that citizens may be particularly sensitive to signs of deterioration in these packaged products at earlier stages of deterioration than for other products, though the precise triggers – and their relationship to packaging - would need to be explored further.

These findings could suggest that the most promising opportunities for shifting citizens' judgements in favour of keeping products for longer are when products are shortly after the Best Before date, focusing on what the early signs of deterioration mean for product freshness and quality. It also points to encouraging 'in-use' strategies to prevent products reaching the later stages of deterioration depicted in the IAT (stages three to five), because by that point, citizens will be certain the product is beyond saving. Those strategies could include advice on which products to use up first (based on evidence

about deterioration rates), where and how to store for optimal life, and when freezing a product would be beneficial.

The explicit IAT results showed that the presence of a date label was generally associated with a greater proportion of participants who would dispose, compared to when a date was not shown. A comparison between the implicit results for the two packaged tests provides further information on whether the date appeared to be acting as a decision-making short-cut (or heuristic), which could be substituting for judgement and thereby augmenting disposal.

- For apples, broccoli and cucumber choices to dispose were more certain when there was a date label.
- The picture for potatoes and bananas was inconclusive. There was little variation in reaction speeds between the packaged tests with and without dates at all stages.

The most interesting implicit result for cheese was for the unpackaged cheese that was well within the Best Before date, but which had some surface blemishes (Cheese 2). Those who wanted to dispose of this cheese[83] were very uncertain, which could point to an opportunity to educate and reassure citizens about the implications of lactic crystals and minor discoloration on cheese, including when it is newly opened or stored outside its original packaging. As noted in relation to reasons for disposal, perceptions that cheese is risky are a leading prompt for choosing to dispose.

The results for milk and yogurt also point to scope for educating about early signs of deterioration and what those mean for safety and quality. Whilst undated milk and yogurt are unlikely ever to be offered to citizens, they were included as a useful test condition to explore the influence of dates. The implicit results indicated that the date label is acting as a heuristic, which may not be surprising because it was shown as a Use By date. Those who would dispose of the undated older milk and both the undated yogurts – fresh and with surface liquid - were far more uncertain about the decision than those who saw a date. If there was to be a switch to Best Before dates for either of these products, the implicit results perhaps indicate that citizens would need guidance to decide how to judge when the product should be thrown away.

The implicit results also point to a more immediate issue where in-date dairy products are being thrown away, as the citizens who do so appear to be doing it without hesitation. That included 13% of citizens who would dispose of fresh milk on the Use By date and 14% who would dispose of the yogurt with surface liquid 5 days *before* the Use By date. Risk and/or lack of confidence about being able to judge safety were important reasons why both were chosen for disposal in the IAT, as well as perceptions about freshness and appeal.

[83] *Cheese 2 was the slowest index data point (apart from the negligible % who disposed Apple 1 loose) of all products and decay stages in this research. In total, 28% of the sample (n=391) wanted to dispose of cheese.*

7.0 Assumptions, lessons learned and ideas for future research.

This research involved several methodological decisions that must be considered when drawing conclusions from the results. These are presented below alongside the key lessons learned and ideas for future research.

7.1 Key assumptions and considerations

1. **Participants made decisions about disposal based on images of food items.**

An IAT elicits fast responses to images on-screen and records both the response (explicit) and speed of response (implicit) reactions of the participants. By its very nature the IAT part of the survey cannot take into consideration other sensory cues such as smell, touch or taste that participants would also rely on when making 'real-world' decisions about food disposal. For example, it is entirely plausible that some participants that chose to 'Use' the perfect-looking or slightly dull-looking apples (Apple 1 and Apple 2) could have chosen to dispose of these apples if when bitten into, they had a woolly texture. Likewise, perfect-looking milk can also smell 'off' and perfect-looking broccoli could be limp in texture. Therefore, it is impossible to know if, or even how, the results might differ if participants were able to interact with the real products.

2. **Citizens that de-packaged food items in the home**

Building on the previous point, since participants were making decisions based on images alone, the packaging itself may have obscured the view of the products. For example, glare on shrink-wrapped products (cucumber and broccoli) or packaging with prominent labels (large red label on the cheddar cheese). In real life, citizens would likely inspect the product from different angles, hold the product closer to inspect it more thoroughly and some may even de-packaged the item. Once de-packaged, any signs of deterioration could become more obvious and participants that chose 'Use' in the IAT in this research could change their mind to 'Dispose'. For cheese, the apparent 'protective' effect of the packaging for older products may not be real.

3. **Length of dates used in the 'Packaged with date' test.**

For food items that had a long gap between dates for each deterioration stage, citizens generally took a longer time to decide whether to dispose. It is possible that the slower reaction times for these products could be related to the cognitive work required to figure out how long ago the dates were, rather than an emotional reaction to the product age implied by the date (or indeed any visual signs of deterioration).

4. **Determining the 'threshold date' i.e., the date when more citizens would dispose of a food item than would use it.**

Since there were several days (sometimes a few weeks) between the dates for each deterioration stage, it is not possible to determine the exact date when more citizens would dispose than would use a particular food item.

5. **Differences in the use of a Best Before or Use By date for dairy items.**

In this research, Use By dates were used in the 'Packaged with date' IAT for milk and yogurt. It is not possible to know if participants would dispose of food items at the same stage of deterioration if they were shown a Best Before date instead of a Use By date. Participants were not asked about their knowledge or use of Use By and Best Before dates, so it is not possible to explore whether any gaps in knowledge about date labels could be driving disposal behaviours.

6. **Difficulties interpreting the speed of response as potentially different factors at play that are difficult to control for.**

In theory, the speed of response is a direct proxy for emotional certainty, however, there are other factors that could impact speed of response. At a product level, some products inherently have greater visual signs of deterioration than others. For example, when bananas ripen, they change from green to yellow to brown whereas the visual signs of deterioration for apples are much more subtle (e.g. dullness and wrinkles). Participants may have answered quickly for products with obvious visual signs of deterioration and slower for products with more subtle signs of deterioration that require a longer amount of time to inspect. As mentioned previously, the packaging itself may have obscured the view of some products and so participants took longer to inspect them. Finally, for some products with Best Before dates a long time in the past (apples, potatoes, cheese) participants may have taken a long time to respond as they were working out how long ago the dates were in the past. Whilst the explicit part of the test results was incredibly useful for determining differences in disposal decisions, the images used may not have been entirely suited to the 'reaction times' part of the survey. The reaction times were difficult to interpret as multiple factors could be at play and so interpretations were nuanced.

The proportion of participants who opted for dispose must always be borne in mind when interpreting the reaction times. For example, in the early stages of deterioration, participants may be quick to respond (and therefore emotionally sure) but those participants may only represent less than 10% of the UK population so this information may be of limited use.

7. **Consistency between loose and packaged images.**

There were some inconsistencies between the level of visual deterioration for loose products and their packaged equivalents. For example, loose images for Broccoli 3, Broccoli 4, Cucumber 3 and Cucumber 4 appeared "less deteriorated" than the equivalent "packaged" images (Table 6 and Table 8). As a result, direct comparisons between loose and packaged were not possible, and so any influence of packaging (in isolation) on decision to dispose cannot be determined. Additionally, comparisons of the reaction times between IATs may not be reliable.

8. **Timing of the survey**

Due to the Covid-19 pandemic, the survey element of this research was substantially delayed and launched in January 2021. Therefore, participants would have been asked

about products with a Best Before date in the previous year. This may have caused some participants to take longer to react and some to react quickly as the date may have appeared to be further in the past than it was. During the time of the survey, participants would have been in a National Lockdown and whilst we anticipate that food waste behaviours may have been impacted by the lockdown, the impact is unquantifiable.

7.2 Ideas for future research

Future research of a similar nature would likely benefit from the methodological design of an IAT using the binary option of 'Use' or 'Dispose' for a carousel of randomised images. This is because the carousel approach forces a quick and perhaps more 'real' response in comparison to a traditional survey that gathers claimed responses. The implicit part of the test is not strictly necessary to understand both the levels of, and the reasons for, food waste.

Substantial care must be taken in future research, that uses either an IAT or a carousel of images, to ensure that the images for each deterioration stage in each IAT are like-for-like. This will enable reliable comparisons between IAT tests.

The results from this research should be compared to results from sensory-based surveys or 'hall tests' where citizens can interact directly with products at different stages of deterioration. This would enable an understanding of the relative influence of other senses on food disposal whilst assessing the accuracy and reliability of the findings presented here. Alternatively, the explicit part of the IAT could be used in a real-world setting where other sensory cues are available, and participants simply choose 'Use' or 'Dispose' for each food item and deterioration stage. Furthermore, qualitative research could help explore the various roles of date labels in not only people disposal decisions, but also managing food in their home.

Date labels shown on-screen in the IAT could be expressed as "1 day past", "2 days past", "3 weeks past" to reduce the cognitive load on participants. Mitigating for cognitive load could lead to quicker reaction times, which may represent a much more instinctive/emotional response to the date label. At present it is difficult to disentangle the relative influence of this factor on the reaction times. Additional dates could also be shown in the 'Packaged with date' IAT to understand sensitivity of disposal around the date displayed on-pack[84]. This would work best alongside 'hall-tests' to capture sensory experience.

[84] *Following this research, WRAP commissioned research to examine the sensitivity of different days before, on or after the Best Before and Use By date for milk and yogurt.*

8.0 Conclusions

The results of the IAT research will help WRAP, its partners and stakeholders to identify opportunities to encourage citizens to use food that is still safe and good to eat, which they might ordinarily decide to throw away. Preventing edible food from going to waste is a national priority and an important way to help tackle the climate crisis.

The evidence in this report is part of a wider package of WRAP-led research projects which is aiming to:

- Help deliver the challenging targets for citizen food waste prevention.
- Update best practice guidance for dairy products and uncut fresh produce, to reduce household food waste.
- Inform discussions on the removal of plastic packaging on uncut fresh produce items.

This research provides strong evidence about the influence of date labels on citizens' disposal decisions for fresh produce and dairy items. It also supports insights on the reasons why citizens respond to Use By and Best Before dates in the way they do, and identifies the opportunities to educate citizens about judging product quality.

8.1 Date labels and food waste

For uncut fresh produce items

- The most significant finding from this research is the clear influence of the date label on disposal decisions for a substantial minority of the population. For every fresh produce item where participants were shown a product with a Best Before date, significantly more chose 'Dispose' than those who saw the exact same image without a date. This is consistent with previous evidence, which used a range of methods to explore how date labels can influence disposal decisions.
- Products are typically good to eat after that date has passed. Nevertheless, this research demonstrates that when citizens were shown photos of identical products, the number that chose to discard them significantly increased when a Best Before date in the past was used (albeit when other quality cues were not provided). This finding is true for all products and stages of deterioration except for the most deteriorated image of a Cucumber, where the effect of a Best Before date was not statistically significant[85].
- The Best Before date had the greatest impact on disposal when photos of products were slightly less than perfect with only minor signs of visual deterioration (i.e., image 2 in the IAT) (Figure 40). The Best Before date signalled to participants to dispose of almost perfect-looking fresh produce items that were not thrown away in the test without a date label.
- Substantially more citizens indicated that they would throw away fresh produce items in the IAT than those that said they had recently thrown the item away. This suggests that the Best Before date affects people's decisions much more than is indicated by a

[85] *The percentage that would throw away Cucumber 4 was 97% in the 'Packaged with date' test and 95% in the 'Packaged' (without a date) test. When comparing results between tests, the margin of error is ±3.6 percentage points if the results are close to 10% or 90%. Since the difference between the tests is only 2%, the observable difference is not considered statistically significant.*

traditional survey that asks what people have done in the recent past. Therefore, surveys that ask about recent behaviour likely underestimate the 'true' impact of the Best Before date on disposal.

Table 18: Percentage that chose to 'Dispose' of slightly less than perfect fresh produce, with and without a date.

Product	Percentage that chose to dispose when shown image of slightly less than perfect fresh produce		Percentage point difference: 'Best Before impact'	Number of days beyond the Best Before date
	Without a date	With a date		
Apples	7%	46%	+39	24 days beyond the Best Before
Bananas	2%	29%	+27	13 days beyond the Best Before
Broccoli	36%	69%	+33	12 days beyond the Best Before
Cucumber	63%	82%	+19	13 days beyond the Best Before
Potatoes	7%	30%	+23	12 days beyond the Best Before

For dairy items

- Propensity to waste products was significantly increased by the presence of a date.
- This finding is true for all dairy products that were beyond the date, irrespective of whether the product was in perfect condition, had minor deterioration or advanced deterioration.
- However, for the products with a Use By date (milk and yogurt) propensity to waste products was significantly *reduced* by the presence of the date when the product was *before* the date. In these instances, the date provided a level of reassurance that the product was safe to eat.
- Similarly, for yogurt that had some surface liquid, propensity to waste was significantly *reduced* by the presence of the date – but only when the yogurt was *on* the date. For yogurt *on* the date, the presence of the date provided a level of reassurance that the product was safe to eat, despite the surface liquid.
- The greatest influence of the date on disposal is for products beyond the Use By date that are in perfect condition (i.e. image 1 of fresh milk and yogurt) (Table 15). The Use By date was signalling to participants to dispose of fresh-looking products.
- Substantially more citizens chose to throw away dairy items in the IAT than in the survey questions that examined claimed behaviour. What the results of this research suggest is that the Best Before date (for cheese) and the Use By date (for milk and yogurt) affects people's decisions much more than is indicated by a traditional survey. Therefore, surveys that examine claimed behaviour likely underestimate the 'true' impact of the Best Before/Use By date on disposal.
- This research provides evidence that Best Before dates on cheese and Use By dates on milk and yogurt act as a key signal to citizens to dispose of these products. Actions to prolong the available life of dairy products should be prioritised where it is safe to do so.

Table 19. Percentage that chose to 'Dispose' of dairy products with and without a date. Results shown for products that were either on, or beyond the date.

Product	Percentage that chose to dispose when shown image of dairy products with and without a date		Percentage point difference: 'Best Before impact'	Number of days beyond the Best Before date
	No date	With date		
Cheese 3	54%	76%	+22	40 days beyond the Best Before
Fresh milk	2%	13%	+11	On the Use By
Fresh milk	2%	53%	+51	4 days beyond the Use By
Split milk	49%	76%	+27	6 days beyond the Use By
Fresh yogurt	13%	54%	+41	5 days beyond the Use By
Yogurt with surface liquid	38%	25%	-13	On the Use By
Yogurt with surface liquid	38%	62%	+24	5 days beyond the Use By

8.2 Reasons for disposal

For the fresh produce items, the main reason for disposal for all the products was personal preference, whereas for the dairy products the main reasons for disposal were risk and lack of confidence. Effective food waste interventions should utilise messaging that is tailored to the specific reasons for disposal for a particular product. This could include messages that mitigate risk and/or increase confidence to consume dairy products that are within the date label.

The results also provide further evidence about the reasons why date labels play such an important role in disposal decisions. The findings suggest that the date may also amplify the number of people who feel disgust when an item is past the date. Even when shown images of food that would be perfectly good enough to eat, when a food product was shown past the date, substantially more people would throw it away, and a greater proportion of those that would dispose of it felt disgust.

It should be noted that it has not been possible to determine why respondents felt the way that they did, nor has it been possible to determine the precise number of days past the date that feelings of disgust, or indeed any other feelings, start to play an important role. However, this research does provide convincing evidence that date labels are not just information about product safety and quality, they evoke wider emotions that amplify perceptions of a decline in product quality.

8.3 Visual deterioration and food waste

For some fresh produce and dairy items, citizen's decision to dispose were highly sensitive to even small signs of visual deterioration – in particular, for broccoli,

cucumber, and yogurt. For apples and potatoes, there was less sensitivity. This demonstrates that actions to extend product life and encourage optimum storage conditions in the home, could help to reduce food waste, especially for items when sensitivity is high and product life is shorter. Actions to 'use-up' or freeze these items before they reach more advanced stages of deterioration could also reduce household food waste.

8.4 Packaging and food waste

Another key finding from this research is that there was no significant and consistent influence of packaging on disposal decisions across all the products and deterioration stages that were tested. The results for the five fresh produce items demonstrated a negligible and inconclusive influence of the packaging on citizens' decisions about when they would throw the products away. The impact of packaging varied by product and stage of deterioration and could just as likely be a product of the images used in the survey as opposed to any direct influence of the packaging itself.

8.5 Implications of this research for household food waste prevention

For uncut fresh produce

- This research provides evidence that, when citizens were shown photos of identical products with and without Best Before dates, these dates did not support citizens' ability to judge when to use or dispose of their fresh produce. This was consistent with previous research on this topic. Therefore, selling uncut fresh produce without any date label could reduce household food waste for some products.
- An important consideration relating to removing Best Before dates from fresh, uncut produce is whether date labels significantly influence when and how much people consume items and people may use date labels to a greater or lesser extent for a whole range of decisions. For example, on the one hand, people may use these dates to manage the food within their homes, helping them to eat up items before they go off. This dynamic could mean the Best Before date helps people to reduce household food waste in these instances. On the other hand, for some people, an approaching Best Before date could lead people to consider the quality deteriorating and reduce consumption, leading to more household food waste in these instances. Nevertheless, the findings from this research do suggest that removing Best Before dates could reduce household food waste.
- There is scope to reduce household food waste by targeted messaging around consumption or freezing of fresh produce that looks slightly less than perfect before it reaches more advanced stages of deterioration.
- Actions to encourage optimum storage conditions in the home could help to reduce food waste, especially for items where sensitivity to deterioration is high and product life is shorter, such as for cucumber and broccoli.

For dairy products

- This research provides evidence that Use By dates provide a protective measure when products are within date, but when products are on, or after the date, they prompt higher disposal.

- There is scope to reduce waste of dairy products by extending the Best Before date of cheese and the Use By dates of milk and yogurt to give citizens more time to consume products before they pass or reach the date.
- Alternatively, the finding that a product of equivalent age and visual condition is less likely to be thrown away when a date is not shown, could point towards adopting Best Before dates alongside consumer education to support citizens' judgements about quality and safety.
- Targeted messaging around consumption of dairy products that are on the Use By date is also an area where food waste reduction initiatives could be focussed.
- Encouraging citizens to freeze dairy products up to the Use By date is another initiative that could help reduce dairy waste in the home.
- Actions to extend product life and encourage optimum storage conditions in the home could help reduce food waste, especially for items where sensitivity to deterioration is high and product life is shorter, such as milk and yogurt.

- For the products with a Use By date (milk and yogurt) propensity to waste was significantly *reduced* by the presence of the date when the product was *before* the date. In these instances, the date provided a level of reassurance that the product was safe to eat.
- Similarly, for yogurt that had some surface liquid, propensity to waste was significantly *reduced* by the presence of the date – but only when the yogurt was *on* the date. For yogurt *on* the date, the presence of the date provided a level of reassurance that the product was safe to eat, despite the surface liquid.
- The greatest influence of the date on disposal is for products beyond the Use By date that are in perfect condition (i.e. image 1 of fresh milk and yogurt) (Table 15). The Use By date was signalling to participants to dispose of fresh-looking products.
- Substantially more citizens chose to throw away dairy items in the IAT (that were beyond the date) than those that said they had recently thrown the item away.
- This research suggests that the Best Before date (for cheese) and the Use By date (for milk and yogurt) affects people's decisions much more than is indicated by a traditional survey. Therefore, surveys that examine claimed behaviour likely underestimate the 'true' impact of the Best Before/Use By date on disposal.
- This research provides evidence that Best Before dates on cheese and Use By dates on milk and yogurt act as a key signal to citizens to dispose of these products. Actions to prolong the available life of dairy products should be prioritised where it is safe to do so.

Appendix 1

A: Survey script

ASK ALL

Q1	**Are you…?** SINGLE CODE		
	Male	1	
	Female	2	
	Other (write in)	3	
	Prefer not to say	4	

ASK ALL

Q2	**Please enter your age in the box below** SINGLE CODE		
	Add age	1	

ASK ALL

Q3	**In which part of the UK do you currently live?** SINGLE CODE		
	England	1	
	Wales	2	
	Northern Ireland	3	
	Scotland	4	

ASK IF Q3=1

Q4	**In which region of England do you live?** SINGLE CODE		
	South West	1	
	South East	2	
	London	3	
	East Midlands	4	
	West Midlands	5	
	East of England	6	
	Yorkshire & Humberside	7	
	North East	8	
	North West	9	

ASK ALL

Q5. Please indicate which of the following best describes your working status BOTH before March 2020, and today taking into account any changes due to the impact of the Coronavirus pandemic. SINGLE CODE FOR EACH

Pre -Covid 19 (before March 2020)	Today
	1. Currently furloughed from a full-time role / reduced hours / employer imposed temporary leave of absence because of the Coronavirus
	2. Currently furloughed from a part-time role / reduced hours / employer imposed temporary leave of absence because of the Coronavirus
1. Working full time - working 30 hours per week or more	3. Working full time - working 30 hours per week or more
2. Working part-time - working between 8 and 29 hours per week	4. Working part-time - working between 8 and 29 hours per week
3. Self-employed - working 30 hours per week or more	5. Self-employed - working 30 hours per week or more
4. Self-employed - working between 8 and 29 hours per week	6. Self-employed - working between 8 and 29 hours per week
5. Not working but seeking work or temporarily unemployed or sick	7. Not working but seeking work or temporarily unemployed or sick
6. Not working and not seeking work	8. Not working and not seeking work
7. Student	9. Student
8. Retired on a state pension only	10. Retired on a state pension only
9. Retired with a private pension	11. Retired with a private pension
10. House person, housewife, househusband, etc.	12. House person, housewife, househusband, etc.

ASK ALL

Q6	**What is your gross household income before tax?** SINGLE CODE		
	Less than £10,000	1	
	£10,000-£19,999	2	
	£20,000-£29,999	3	
	£30,000-£39,999	4	
	£40,000-£49,999	5	
	£50,000-£69,999	6	
	£70,000-£89,999	7	
	£90,000+	8	
	I'd prefer not to say	9	

ASK ALL

Q7	**Social class classification Qs**		
	A	1	
	B	2	
	C1	3	
	C2	4	
	D	5	
	E	6	

ASK ALL

Q8	**Which of the following best describes your living situation?** SINGLE CODE		
	I live on my own	1	
	My partner and I live together without any children	2	
	I live with my children with no partner	3	
	My partner and I live with our children	4	
	I live in a shared house / with friends	5	
	I live in student halls of residence with a shared kitchen	6	
	Living with parents/other family	7	
	Something else (write in)	8	

ASK IF Q8, 3-4

Q9	**What age groups do the children who are living at home fall into? Please write in how many children of each age group you have or leave blank if you have no children of that age at home**		
	0-5	[__]	
	6-10	[__]	
	11-17	[__]	
	18+	[__]	

ASK ALL

Q10	**Which of the following do you ever buy or eat? Please select all that apply.** MULTICODE, RANDOMISE 1-8 BUT KEEP 1-3 AND 4-8 TOGETHER		
	Fresh milk (dairy)	1	
	Yoghurts	2	
	Cheddar cheese	3	
	Fresh potatoes	4	
	Apples	5	
	Fresh broccoli	6	
	Cucumber	7	
	Fresh banana	8	
	None of the above [SINGLE CODE]	9	

CLOSE IF Q10=9 OR Q10=LESS THAN 3 CODES ACROSS 1-8

ASK ALL

Q11	**Please read the following statements that people have made about food. Can you tell us to what extent you agree or disagree with each?** RANDOMISE A-D. SINGLE CODE FOR EACH					
		Definitely agree	Tend to agree	Neither agree nor disagree	Tend to disagree	Definitely disagree
A	For me, food is just fuel to live	1	2	3	4	5
B	The price of food doesn't really matter as long as I know that the quality is good	1	2	3	4	5
C	I enjoy cooking and preparing food	1	2	3	4	5
D	I often feel under time pressure in my day-to-day life	1	2	3	4	5

ASK ALL

Q12	**To what extent do you decide what you are going to eat for main meals in advance?** SINGLE CODE. REVERSE SCALE SO HALF SEE 1-4; HALF SEE 4-1		
	I know what almost all of the main meals will be for the next week	1	
	I know what most of the main meals will be for the next week	2	
	I know what a few of the main meals will be for the next week	3	
	I usually decide on the day	4	

IAT

INTRO SCREEN – IN ADDITION TO STANDARDISED TEXT RE. THE TEST PARAMETERS AND THE USE OF THE Z AND M KEYS, ADD THE FOLLOWING (OR SIMILAR)

You are about to see a number of images of different food products that you say you eat. Imagine these are products that you have purchased and currently have stored at home.

Do not worry if they do not look exactly like the products you have. For example, if you see an image of a red apple but only buy green apples, imagine that it is a green apple.

For each image, you will be asked what you would do with the product. Would you:

- **Use (i.e. eat it as it is, cook it, freeze it to use another time); or**
- **Dispose (i.e. put in the general rubbish, food waste caddy, down the sink, compost, feed to animals, etc.)**

Once again, imagine these are products you have already purchased and have stored at home – not a product that you are looking to purchase in the supermarket.

[ADDITIONAL FOR DATE LABEL TEST: **Every product will have a Best Before or a Use By date, shown below the product. These all relate to today (i.e. the day you are completing the survey)]. TODAY'S DATE IS: [insert date of survey].**

ASK ALL

Q13	**IAT: approximately 30 images; 1 attribute (USE; DISPOSE).** ONLY SHOW PRODUCTS SELECTED AT Q10, 1-8

ASK IF 1 OR MORE IMAGES SELECTED FOR 'Dispose'. SELECT MAX 10 IMAGES FROM 'Dispose' LIST

Q14	**You will now see a selection of the food items that you said you would dispose of, rather than use. For each product, please tell us which of the following was the MAIN reason why.** CAROUSEL. RANDOMISE 1-9 BUT KEEP 1-4 AND 5-7 TOGETHER. SINGLE CODE FOR EACH.		
	Not confident in judging whether it's still ok to eat	1	
	Wouldn't want to risk it/take the chance	2	
	Unsafe/risk of food poisoning	3	
	Not confident/sure how to use it once it's reached this point	4	
	No longer appealing	5	
	lost its freshness/goodness	6	
	It would taste bad/disgusting	7	
	[SHOW IN DATE LABEL SPLIT SAMPLE] It's gone past the date on the label	8	
	Don't want to touch it/gross	9	
	Some other reason	10	

ASK ALL

Q15	**Please indicate on the scale below how you make decisions about when to eat or throw away the following foods?** RANDOMISE A-H. SINGLE CODE FOR EACH						
		I rely entirely on the date given on the pack	I rely mostly on the date given on the pack	I rely on a mixture of the date and my own judgement	I rely mostly on my own judgement	I rely entirely on my own judgement	Don't know
A	[SHOW IF Q10=1] Fresh milk (dairy)	1	2	3	4	5	6
B	[SHOW IF Q10=2] Yoghurts	1	2	3	4	5	6
C	[SHOW IF Q10=3] Cheddar cheese	1	2	3	4	5	6
D	[SHOW IF Q10=4] Potatoes	1	2	3	4	5	6
E	[SHOW IF Q10=5] Apples	1	2	3	4	5	6
F	[SHOW IF Q10=6] Broccoli	1	2	3	4	5	6
G	[SHOW IF Q10=7] Cucumber	1	2	3	4	5	6
H	[SHOW IF Q10=8] Banana	1	2	3	4	5	6

ASK ALL

Q16	**In the <u>past two weeks</u>, did you eat any of the following when they were past the Best Before date?** RANDOMISE A-F. SINGLE CODE FOR EACH					
		Yes – regularly	Yes – once or twice	No - never	Not sure/don't check dates for this	I purchase this loose so there was no date label
A	[SHOW IF Q10=3] Cheddar cheese	1	2	3	4	5
B	[SHOW IF Q10=4] Potatoes	1	2	3	4	5
C	[SHOW IF Q10=5] Apples	1	2	3	4	5
D	[SHOW IF Q10=6] Broccoli	1	2	3	4	5
E	[SHOW IF Q10=7] Cucumber	1	2	3	4	5
F	[SHOW IF Q10=8] Banana	1	2	3	4	5

ASK ALL

Q17	**In the <u>past two weeks</u>, did you eat or drink any of the following when they were past the Use By date?** RANDOMISE A-B. SINGLE CODE FOR EACH				
		Yes – regularly	Yes – once or twice	No - never	Not sure/don't check dates for this
A	[SHOW IF Q10=1] Fresh milk (dairy)	1	2	3	4
B	[SHOW IF Q10=2] Yoghurts	1	2	3	4

ASK ALL

Q18	**Which of the following – if any – apply to you.** MULTICODE. RANDOMISE 1-7 BUT KEEP 2-3 AND 4-5 TOGETHER		
	Was formally asked by the NHS to shield during the coronavirus pandemic (because you are classified at higher risk)	1	
	Have a food sensitivity or intolerance (e.g. lactose)	2	
	Have a clinically diagnosed food allergy (e.g. gluten, nuts)	3	
	Have experienced a <u>mild to moderate</u> case of food poisoning as an adult (i.e. some vomiting and/or diarrhoea that lasted for less than 12 hours)	4	
	Have experienced a <u>serious case</u> of food poisoning as an adult (i.e. significant vomiting or diarrhoea that lasted for more than 12 hours or required medical treatment in a hospital)	5	
	Currently following a vegetarian or vegan diet	6	
	Currently taking long term control medication (e.g. statins, immunosuppressants)	7	
	None of these [SINGLE CODE ONLY]	8	

B: Reported reliance on date labels versus own judgement.

The following tables detail the reported reliance on date labels versus own judgement for each product. Data are split by WRAP segments alongside the UK population which is highlighted in bold. Sample bases are also shown in brackets. Asterisks denote values that over-index against the UK population.

Table 20. Reported reliance on date labels and own judgement for apples.

	Aspirational Discoverers (360)	Functional Fuellers (745)	Spontaneous Creatives (1084)	Ideal Advocates (1165)	Pressure Providers (651)	UK population (4005)
I rely entirely on the date given on the pack	16%*	2%	3%	2%	2%	**4%**
I rely mostly on the date given on the pack	15%*	5%	6%	3%	6%	**6%**
I rely on a mixture of the date and my own judgement	25%	24%	21%	17%	24%	**22%**
I rely mostly on my own judgement	21%	31%	32%*	29%	27%	**21%**
I rely entirely on my own judgement	21%	37%	35%	48%*	39%	**39%**
Don't know	2%*	---	2%*	---	1%	**1%**

Table 21. Reported reliance on date labels and own judgement for bananas.

	Aspirational Discoverers (370)	Functional Fuellers (770)	Spontaneous Creatives (1098)	Ideal Advocates (1177)	Pressure Providers (643)	UK population (4058)
I rely entirely on the date given on the pack	15%*	2%	3%	2%	2%	**4%**
I rely mostly on the date given on the pack	16%*	3%	6%	3%	4%	**5%**
I rely on a mixture of the date and my own judgement	23%	20%	21%	15%	22%	**19%**
I rely mostly on my own judgement	22%	31%	31%	28%	29%	**29%**
I rely entirely on my own judgement	22%	42%	38%	50%*	41%	**41%**
Don't know	2%	1%	2%*	---	1%	**1%**

Table 22. Reported reliance on date labels and own judgement for broccoli.

	Aspirational Discoverers (306)	Functional Fuellers (625)	Spontaneous Creatives (942)	Ideal Advocates (1122)	Pressure Providers (575)	UK population (3570)
I rely entirely on the date given on the pack	14%*	2%	3%	3%	2%	**4%**
I rely mostly on the date given on the pack	15%*	5%	6%	4%	6%	**6%**
I rely on a mixture of the date and my own judgement	26%	24%	23%	21%	23%	**23%**
I rely mostly on my own judgement	21%	32%	34%*	27%	30%	**29%**
I rely entirely on my own judgement	23%	36%	33%	45%*	38%	**37%**
Don't know	2%	1%	1%	---	1%	**1%**

Table 23. Reported reliance on date labels and own judgement for cucumber.

	Aspirational Discoverers (330)	Functional Fuellers (650)	Spontaneous Creatives (973)	Ideal Advocates (1089)	Pressure Providers (565)	UK population (3607)
I rely entirely on the date given on the pack	14%*	3%	3%	2%	3%	**4%**
I rely mostly on the date given on the pack	18%*	6%	7%	3%	6%	**7%**
I rely on a mixture of the date and my own judgement	25%	24%	22%	19%	23%	**22%**
I rely mostly on my own judgement	21%	31%	33%*	28%	30%	**30%**
I rely entirely on my own judgement	19%	36%	32%	47%*	36%	**37%**
Don't know	3%*	1%	2%	---	1%	**1%**

Table 24. Reported reliance on date labels and own judgement for potatoes.

	Aspirational Discoverers (366)	Functional Fuellers (813)	Spontaneous Creatives (1152)	Ideal Advocates (1272)	Pressure Providers (675)	UK population (4278)
I rely entirely on the date given on the pack	11%*	2%	3%	2%	2%	**3%**
I rely mostly on the date given on the pack	15%*	4%	5%	3%	5%	**5%**
I rely on a mixture of the date and my own judgement	29%*	22%	22%	18%	23%	**22%**
I rely mostly on my own judgement	21%	33%*	32%	28%	30%	**30%**
I rely entirely on my own judgement	22%	38%	36%	48%*	39%	**39%**
Don't know	2%	1%	1%	---	1%	**1%**

Table 25. Reported reliance on date labels and own judgement for cheddar cheese.

	Aspirational Discoverers (351)	Functional Fuellers (809)	Spontaneous Creatives (1120)	Ideal Advocates (1234)	Pressure Providers (666)	UK population (4180)
I rely entirely on the date given on the pack	21%*	5%	8%	7%	9%	**8%**
I rely mostly on the date given on the pack	22%*	10%	14%	10%	13%	**12%**
I rely on a mixture of the date and my own judgement	29%	30%	33%*	25%	32%	**29%**
I rely mostly on my own judgement	12%	29%*	24%	26%	25%	**25%**
I rely entirely on my own judgement	13%	26%	20%	32%*	21%	**24%**
Don't know	2%	1%	2%*	---	1%	**1%**

Table 26. Reported reliance on date labels and own judgement for milk.

	Aspirational Discoverers (365)	Functional Fuellers (816)	Spontaneous Creatives (1112)	Ideal Advocates (1214)	Pressure Providers (656)	UK population (4163)
I rely entirely on the date given on the pack	31%*	11%	17%	14%	19%	**17%**
I rely mostly on the date given on the pack	25%*	18%	22%*	16%	22%	**20%**
I rely on a mixture of the date and my own judgement	24%	30%	32%	29%	30%	**30%**
I rely mostly on my own judgement	8%	19%*	14%	18%*	15%	**16%**
I rely entirely on my own judgement	10%	21%*	14%	23%*	13%	**17%**
Don't know	2%*	---	2%*	---	1%	**1%**

Table 27. Reported reliance on date labels and own judgement for yogurt.

	Aspirational Discoverers (355)	Functional Fuellers (692)	Spontaneous Creatives (1057)	Ideal Advocates (1118)	Pressure Providers (627)	UK population (3849)
I rely entirely on the date given on the pack	31%*	15%	18%	14%	19%	**18%**
I rely mostly on the date given on the pack	25%	20%	24%	18%	26%*	**22%**
I rely on a mixture of the date and my own judgement	25%	32%	33%	32%	31%	**31%**
I rely mostly on my own judgement	9%	17%*	12%	17%*	13%	**14%**
I rely entirely on my own judgement	8%	16%	11%	19%*	11%	**14%**
Don't know	2%	1%	2%*	---	1%	**1%**

C: Explicit responses for 'Dispose'.

Table 28. Percentage of participants that chose 'Dispose' for each image in the IATs.

Image	Unpackaged	Packaged	Packaged with date
Apple 1	3%	4%	4%
Apple 2	7%	7%	7%
Apple 3	30%	27%	27%
Apple 4	87%	82%	82%
Banana 1	1%	4%	3%
Banana 2	1%	2%	29%
Banana 3	11%	14%	48%
Banana 4	58%	56%	78%
Banana 5	76%	73%	88%
Broccoli 1	3%	6%	6%
Broccoli 2	19%	36%	69%
Broccoli 3	60%	83%	91%
Broccoli 4	82%	89%	94%
Cucumber 1	4%	3%	5%
Cucumber 2	27%	63%	82%
Cucumber 3	69%	84%	92%
Cucumber 4	89%	95%	96%
Potato 1	0%	10%	5%
Potato 2	2%	7%	30%
Potato 3	16%	17%	44%
Potato 4	28%	40%	61%
Potato 5	59%	73%	84%
Cheese 1	2%	2%	2%
Cheese 2	28%	2%	2%
Cheese 3	67%	54%	76%
Cheese 4	89%	76%	87%
Milk 1a	---	2%	---
Milk 1b	---	---	4%
Milk 1c	---	---	13%
Milk 1d	---	---	53%
Milk 2a	---	49%	---
Milk 2b	---	---	76%
Yogurt 1a	---	13%	---
Yogurt 1b	---	---	10%
Yogurt 1c	---	---	54%
Yogurt 2a	---	38%	---
Yogurt 2b	---	---	14%
Yogurt 2c	---	---	25%
Yogurt 2d	---	---	62%
Yogurt 3	---	78%	86%
Yogurt 4	---	86%	92%

D: Reasons for 'Dispose'

Table 29. Reasons given by participants for choosing 'Dispose' in each IAT for apples.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Apple 1	Unpackaged (37)	11%	22%	16%	43%	8%	-
	Packaged (54)	14%	28%	10%	33%	15%	-
	Packaged+Date (54)	11%	8%	10%	40%	27%	5%
Apple 2	Unpackaged (91)	9%	11%	16%	59%	6%	-
	Packaged (94)	12%	25%	9%	42%	13%	-
	Packaged+Date (539)	13%	11%	11%	43%	1%	21%
Apple 3	Unpackaged (407)	11%	12%	16%	59%	2%	-
	Packaged (355)	17%	16%	12%	53%	2%	-
	Packaged+Date (540)	14%	9%	18%	44%	2%	12%
Apple 4	Unpackaged (920)	25%	7%	34%	32%	1%	-
	Packaged (692)	25%	8%	35%	31%	1%	-
	Packaged+Date (542)	21%	4%	39%	31%	-	5%

Table 30. Reasons given by participants for choosing 'Dispose' in each IAT for bananas.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Banana 1	Unpacked (13)	6%	14%	7%	24%	48%	-
	Packaged (49)	6%	34%	10%	18%	32%	-
	Packaged+Date (45)	21%	22%	4%	16%	31%	7%
Banana 2	Unpacked (17)	12%	14%	16%	29%	30%	-
	Packaged (29)	15%	24%	-	29%	32%	-
	Packaged+Date (299)	13%	11%	8%	36%	2%	30%
Banana 3	Unpacked (155)	8%	9%	17%	65%	1%	-
	Packaged (190)	9%	10%	10%	64%	7%	-
	Packaged+Date (538)	14%	10%	12%	45%	2%	17%
Banana 4	Unpacked (788)	9%	10%	28%	51%	2%	-
	Packaged (688)	11%	10%	23%	54%	2%	-
	Packaged+Date (541)	14%	8%	26%	43%	1%	9%
Banana 5	Unpacked (916)	11%	9%	33%	45%	2%	-
	Packaged (692)	16%	10%	30%	43%	1%	-
	Packaged+Date (538)	14%	8%	40%	31%	1%	6%

Table 31. Reasons given by participants for choosing 'Dispose' in each IAT for broccoli.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Broccoli 1	Unpackaged (32)	16%	21%	7%	42%	14%	-
	Packaged (72)	12%	16%	5%	51%	16%	-
	Packaged+Date (74)	9%	16%	8%	43%	12%	12%
Broccoli 2	Unpackaged (227)	11%	14%	7%	66%	2%	-
	Packaged (420)	16%	12%	14%	57%	1%	-
	Packaged+Date (538)	10%	7%	17%	56%	-	9%
Broccoli 3	Unpackaged (720)	15%	12%	16%	57%	1%	-
	Packaged (698)	23%	7%	30%	40%	-	-
	Packaged+Date (539)	14%	4%	38%	40%	-	4%
Broccoli 4	Unpackaged (918)	34%	9%	27%	30%	-	-
	Packaged (697)	26%	6%	39%	29%	-	-
	Packaged+Date (543)	21%	3%	43%	29%	-	4%

Table 32. Reasons given by participants for choosing 'Dispose' in each IAT for cucumber.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Cucumber 1	Unpackaged (44)	12%	22%	9%	41%	16%	-
	Packaged (31)	9%	30%	10%	37%	13%	-
	Packaged+Date (56)	9%	11%	13%	32%	23%	11%
Cucumber 2	Unpackaged (335)	10%	16%	15%	57%	2%	-
	Packaged (696)	17%	12%	24%	47%	1%	-
	Packaged+Date (542)	13%	7%	29%	44%	1%	7%
Cucumber 3	Unpackaged (335)	10%	16%	15%	57%	2%	-
	Packaged (696)	17%	12%	24%	47%	1%	-
	Packaged+Date (542)	13%	7%	29%	44%	1%	7%
Cucumber 4	Unpackaged (927)	27%	9%	32%	31%	1%	-
	Packaged (702)	37%	4%	43%	16%	-	-
	Packaged+Date (537)	27%	3%	52%	15%	1%	2%

Table 33. Reasons given by participants for choosing 'Dispose' in each IAT for potatoes.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Potato 1	Unpackaged (6)	17%	36%	-	32%	15%	-
	Packaged (139)	18%	27%	12%	36%	7%	-
	Packaged+Date (73)	11%	12%	11%	41%	19%	6%
Potato 2	Unpackaged (32)	12%	25%	11%	42%	10%	-
	Packaged (100)	18%	23%	10%	38%	12%	-
	Packaged+Date (426)	16%	16%	7%	34%	1%	25%
Potato 3	Unpackaged (231)	20%	18%	7%	53%	2%	-
	Packaged (242)	17%	22%	12%	47%	2%	-
	Packaged+Date (540)	18%	15%	11%	38%	1%	17%
Potato 4	Unpackaged (408)	19%	23%	9%	49%	1%	-
	Packaged (551)	24%	18%	19%	39%	1%	-
	Packaged+Date (537)	19%	12%	19%	36%	1%	13%
Potato 5	Unpackaged (831)	24%	15%	15%	45%	1%	-
	Packaged (700)	30%	10%	27%	33%	1%	-
	Packaged+Date (539)	26%	7%	32%	27%	1%	8%

Table 34. Reasons given by participants for choosing 'Dispose' in each IAT for cheese.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Cheese 1	Unpackaged (31)	19%	30%	11%	26%	14%	-
	Packaged (22)	9%	19%	4%	38%	30%	-
	Packaged+Date (34)	14%	21%	3%	23%	37%	3%
Cheese 2	Unpackaged (385)	37%	20%	12%	30%	2%	-
	Packaged (31)	23%	20%	7%	27%	23%	-
	Packaged+Date (33)	13%	9%	5%	24%	43%	5%
Cheese 3	Unpackaged (898)	52%	12%	15%	21%	-	-
	Packaged (685)	52%	11%	15%	22%	1%	-
	Packaged+Date (541)	43%	10%	21%	16%	1%	9%
Cheese 4	Unpackaged (927)	58%	6%	19%	15%	1%	-
	Packaged (694)	58%	9%	18%	15%	-	-
	Packaged+Date (542)	50%	6%	26%	15%	1%	4%

Table 35. Reasons given by participants for choosing 'Dispose' in each IAT for milk.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Milk 1	No date (30)	19%	29%	-	29%	23%	-
	Before UB (62)	18%	21%	11%	5%	42%	4%
	On UB (179)	27%	20%	11%	25%	8%	9%
	After UB (530)	30%	12%	17%	11%	2%	28%
Milk 2	No date (655)	46%	9%	32%	13%	-	-
	With date (545)	40%	8%	25%	13%	1%	13%

Table 36. Reasons given by participants for choosing 'Dispose' in each IAT for yogurt.

	IAT	Risk	Lack of confidence	Disgust	Personal Preference	Other reason	Past date
Yogurt 1	No date 169)	18%	29%	10%	19%	24%	-
	Before UB (131)	19%	10%	7%	19%	42%	3%
	After UB (538)	30%	18%	9%	10%	2%	31%
Yogurt 2	No date (477)	44%	16%	16%	20%	4%	-
	Before UB (187)	34%	15%	10%	20%	18%	2%
	On UB (326)	36%	22%	10%	20%	6%	6%
	After UB (541)	38%	15%	13%	11%	2%	21%
Yogurt 3	No date (692)	67%	4%	19%	9%	-	-
	With date (538)	54%	4%	26%	7%	1%	8%
Yogurt 4	No date (691)	67%	3%	25%	5%	-	-
	With date (538)	56%	2%	30%	6%	1%	6%