Alternative Shelf-Life Labelling and Perceptions of Product Quality, Product Safety and Disposal Likelihood

Designing Alternatives for the "Best-Before Date" in the Fight Against Food Waste

Master Thesis Mike Broeren

Master Marketing Management

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Student:

Mike Broeren

Master:

Master Marketing Management

Department:

Marketing Department

Tilburg School of Economics and Management

Supervision:

Supervisor: Millie Elsen (CentERdata)

Second reader: Elke Schrover

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Tilburg University

Tilburg

Management summary

Worldwide, circa 31% of produced food is wasted somewhere among the food supply chain (FSC) (Gustavsson, Cederberg, Sonesson, van Otterdijk & Meybeck, 2011), which is around 1.3 billion tons of food per year and the incorrect interpretation of the best-before date plays a significant role in this problem. We pose that two main problems exist with the current label; rather focussing on product safety than product quality and not describing a gradual decline. In two experimental studies, alternatives for the current best-before date are investigated. In the first experiment, an online panel was used and small evidence is found for 'optimal until' to deliver the intended message of the BBD better. We conclude that the attention for the text near the expiration date is low and want to research if increasing the attention yields better results for our alternatives. Ironically, as we find in study 2 via a lab experiment, an awareness campaign is merely effective for the original label and not for alternative labelling. Possible explanations of this effect might be found in the familiarity of the original label and the so-called aha-effect. Implementing effective marketing campaigns are advised over revising the label type.

Keywords: food waste, product quality, product safety, date labels, best-before date

Preface

This thesis is the final chapter of my Master Marketing Management at Tilburg University. The initial reason I chose the Master was to learn more theories about marketing. Further, I wanted to provide myself with more knowledge about how to motivate marketing decisions. In both aspects, the Master has really been helpful and a great stepping stone towards my professional career.

I also obtained more knowledge about conducting research and know I want to work as a market researcher for the coming years. This is also the reason my graduation is a bit later than expected, since from August 2014 up to February 2016, I have been working for a market research company.

Nevertheless, I am happy I decided to contact Millie Elsen at the start of 2016 and this thesis would not have been possible in the way as it is without her expertise and help. The feedback helped the thesis largely and it was a pleasure to discuss possible research directions and experimental design.

Further thanks go out to CentERdata for the opportunity for the internship and the facilities to work with. I hope this thesis might be helpful in any matter in the fight against food waste. For me, after writing this thesis, disposing food will never be the same.

Enjoy reading,

Mike Broeren
Tilburg, August 2016

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1.1.Introduction

1.1.1. Problem Indication

Recent years, the attention for food waste has increased. Food waste occurs throughout the whole food supply chain (FSC), 'from farm to fork' (Parfitt, Barthel & MacNaughton, 2010). Worldwide, circa 31% of produced food is wasted somewhere among the food supply chain (FSC) (Gustavsson, Cederberg, Sonesson, van Otterdijk & Meybeck, 2011), which is around 1.3 billion tons of food per year. It is difficult to make accurate estimates of numbers of food waste (e.g. FUSIONS, 2014; Monier, Escalon, O'Connor, 2010; Parfitt et al., 2010; Smil, 2004) in the FSC, but it is mainly acknowledged that it is a significant problem which has large environmental and ecological impacts. Consumer behaviour is a main cause of food waste, mainly in developed countries (Aschemann-Witzel, de Hooghe, Amani, Bech-Larsen & Oostindjer, 2015; Gustavsson et al., 2011). In this research, we will zoom in on one specific aspect of consumer behaviour leading to food waste, namely date labelling.

The current status is that in Europe, since 2011, two date label types exist, namely the best-before date (BBD) (linked to quality aspects) and the use-by date (UBD) (linked to food safety) (EU, 2011). We define shelf life as the period before the product becomes unacceptable for consumption from sensorial, nutritional or safety perspectives (Fu & Labuza, 1993).

The BBD on the one hand, is a quality guarantee of the manufacturer, up to this date the maximum quality is guaranteed. Past this date, lots of foods are still safe to eat. The BBD label is designed to get consumers to use their senses to judge the edibility of the product, after the expiration date (Soethoudt, van der Sluis, Waarts & Tromp, 2012). The BBD thus leaves space for consumer agency (Yngfalk, 2012). On the other hand, consumption of products after the

UBD implies health risks and the UBD thus states the final date of consumption. Manufacturers are responsible for food safety and are thus allowed to choose which label type (BBD or UBD) and which expiration date they apply (EC, 2002; Yngfalk, 2012). Manufacturers take quality and safety parameters into account to decide on which label and date to apply (van Boxstael, Devlieghere, Berkvens, Vermeulen & Uyttendaele, 2014) and further protect their brand equity via the application of date labelling (Harcar & Karakaya, 2005; Theotokis, Pramatari & Tsiros, 2012).

1.1.2. Problem Statement

Often, date labels are not interpreted correctly. Different studies investigated the knowledge about date labels and on average only circa 50%-60% of respondents indicated the correct meaning of the BBD (e.g. Abeliotis, Lasaridi & Chroni, 2014; FSAI, 2011; TNS, 2014; van Boxstael et al., 2014; WRAP, 2008a). For BBD's, a correct interpretation would be that the product may not be at its optimal quality, but is still safe to consume after the expiration date for some (sometimes surprisingly long) time after the BBD.

But, what does the other half of consumers infer? A study across eight different European countries revealed that on average, 37% would say that the 'best-before date' means 'the last day on which the food is safe to eat'. So, instead of product quality, they infer product safety. A consequence of this interpretation is that these consumers would dispose the food immediately after the BBD when it is still safe to consume. Therefore, this interpretation leads to unnecessary disposal and thus food waste. The same study revealed that for consumers, who believed that the 'best before' label represents a 'safe to eat/drink' limit were significantly more likely to claim not to consume food that has past the BBD (TNS, 2014).

The idea that food past the expiration date makes you sick is deeply rooted (especially with younger consumers) and consumers are rather safe than sorry (Holmqvist, 2011). However, products that carry a BBD are safe to consume for a certain period after the BBD (NVWA, 2015). In fact, this period may be surprisingly long. Coffees, dry pastas and canned food can be consumed safely a year after the BBD has passed (NVWA, 2015).

So, incorrect interpretation of date labelling leads to unnecessary food waste (TNS, 2014; WRAP, 2014) which could have been avoided if the food was managed better (WRAP, 2008b). What can we potentially accomplish if consumer understanding of the best-before date improves? A UK study revealed via a kitchen diary study, that of the disposed items carrying a BBD, 5% was disposed on the date of the label and 12% was thrown away the day after the date on the label (WRAP, 2011). Objectively, these products were all well consumable at the day of the BBD, or one day after the BBD (Soethoudt et al., 2012). In the Netherlands, we see that consumers that handle the BBD more leniently dispose less on a yearly basis (30kg versus 56kg) (van Westerhoven & Steenhuisen, 2010). These authors further estimate that a potential reduction of 14kg per person per year could be established if the BBD would be approached more leniently. All in all, we conclude that misinterpretation of date labels is contributing to the food waste problem. In the next paragraph, we will describe and introduce our conceptual model.

1.1.3. Conceptual model

Often, food is disposed too soon due to incorrect inferences made via the BBD: people tend to see this as the date after which consumption is no longer safe. In this study, we will try to improve the understanding by coming up with two alternatives, which we think better reflect the actual meaning of a BBD. We propose our conceptual model in figure 1.

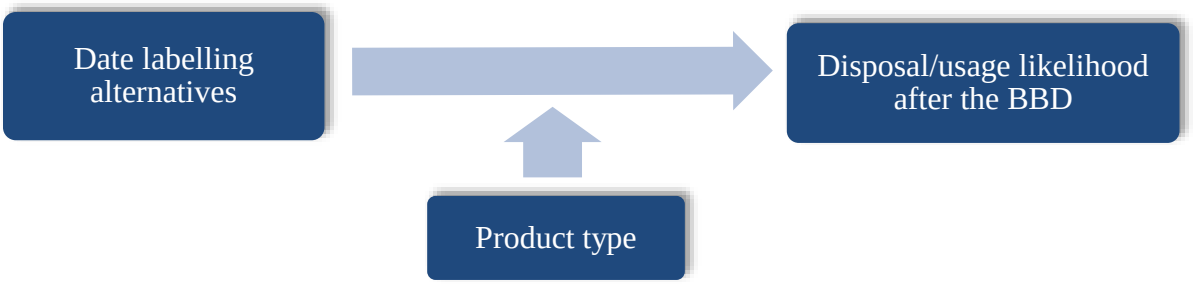

Figure 1. Conceptual model

The alternatives we use in this study are both referring more directly and clearly to **product quality** (instead of safety, which we feel the current Dutch labelling method for the BBD does) and a more **gradual decrease in quality** in comparison to the current labelling for the BBD and are provided below. Dutch translations are provided in brackets.

1. "At least preservable until" (current label) (in Dutch: "Ten minste houdbaar tot")
2. "*100% quality guaranteed until*" (alternative 1) ("100% kwaliteit gegarandeerd tot")
3. *'Optimal until'* (alternative 2) ("Optimaal tot")

1.1.4. Research Questions

In this study we focus on answering the following research questions:

1. How do perceptions of product quality, product risk and, eventually, the disposal likelihood of products past the expiration date, differ for alternative labelling methods in comparison to the original date labelling method?
2. Do these perceptions differ for different product types?

We will start with a review of literature, after which an experimental study is conducted to answer the research questions.

1.2.Theory and predictions

In the second chapter, first, background information on the role of date labelling in food waste is provided. Secondly, we describe routes to food disposal. Thirdly, expectations about the results of alternative labels are elaborated upon. The chapter finalizes with the role of product type.

1.2.1. Household food waste

Consensus in literature exists about the major contribution of consumer behaviour in the food waste problem (e.g. Aschemann-Witzel et al., 2015; Newsome et al., 2014; Parfitt et al., 2010; WRAP, 2007, 2011;). In the Netherlands, consumers waste on average 43.7 kg per person per year (van Westerhoven & Steenhuizen, 2010) and in Europe, a majority (52%) of food waste occurs at the consumption stage, while in the US this percentage is even higher (61%) (Lipinski, Hanson, Lomax, Kitinoja, Waite & Searchinger, 2013). In this study we will focus on household food waste and within this, there are different reasons why consumers waste food. These could be roughly summarized into two categories. Firstly, consumers tend to cook, prepare or serve too much. Secondly, food is not always used in time and therefore disposed. This includes all food that is disposed for being passed the date label, gone mouldy or looking, smelling or tasting bad (WRAP, 2009). We will focus on the latter, with special focus on the passing of date labels. In the next paragraph, we will describe consumer behaviour and food disposal decisions, and expand on the role of perceived risk with regard to products past the expiration date.

1.2.2. Food disposal

The decision to use or to throw away food when it’s past the expiration date is based on the perceived risk of the product. Within the literature of perceived risk, different types of risk

can be identified, varying from for instance social risk (embarrassment for friends and family due to purchasing a product) to functional risk (the product not performing as expected) (Dunn, Murphy, and Skelly, 1986; Jacoby & Kaplan, 1972 & Roselius, 1971). In relation to checking expiration dates, three types of perceived risk can be identified (Tsiros & Heilman, 2005):

- Functional risk (the product not performing as expected),
- Performance risk (the product not meeting the standards of quality) and
- Physical risk (safety in using the product)

However, we propose that functional risk and performance risk may be hard to distinguish for consumers, when it comes to food and we refer to both as aspects of the *quality of the product*. Physical risk is directly linked to *product safety*. So the perceived risk related to the expiration date is based on product quality and product safety (figure 2).

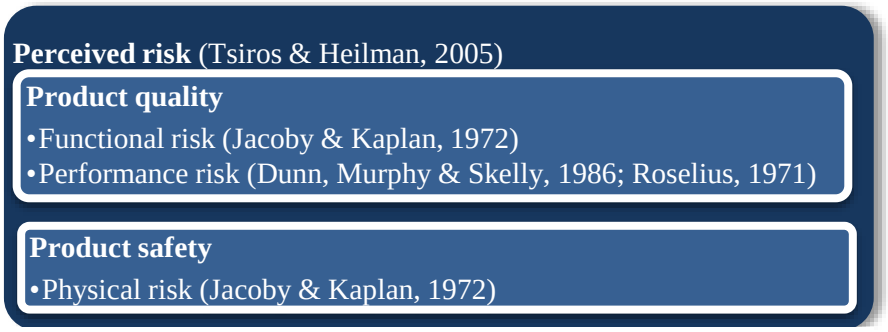

Figure 2. Perceived risk related to food past the expiration date

This is in line with research conducted by WRAP (2008a), who conducted a research with several products that were past the BBD with one to two days. Overall, two main reasons, or routes to disposal were found. Firstly, consumers use the expiration date to tell whether a product is safe to eat. However, although some people assumed some products were safe to eat, they would still choose to dispose the product because it was not of the quality they desire. A product which carries a BBD which is often disposed due to quality concerns is bread, while

BBD-products that are often disposed due to safety concerns are for instance dairy products (WRAP, 2008a; 2008b).

With regard to food studies, literature shows that food safety and food quality are the most prevailing and common factors in perceived risk, food choice and consumer demand (Grunert, 2005; van Rijswijk & Frewer, 2006). Both are clearly related, but nevertheless different and we should treat them as distinctive constructs. For consumers a product that is of quality is perceived as safe, although a product that is perceived as safe is not necessarily of high quality (Grunert, 2005; van Rijswijk & Frewer, 2006). For biscuits, for example, over time the perceived quality decreases, while the perceived safety remains approximately constant up to a certain period. The possibility for consumers to judge the quality and safety of a product is often limited – when products deteriorate, this is often not visible in the beginning (Latvala & Kola, 2004). In our study we define perceived risk for food products carrying a BBD as a combination of the risk associated with the quality of a product and the risk associated with the safety of consuming the product.

In the next paragraph, we will zoom in on the role of date labels in disposal decisions. Also, we explain why we expect that the alternatives we test in our study will lead to different perceptions of food quality and safety.

1.2.3. Consumer inferences of product quality and safety and the role of date labels

The previous section revealed that food disposal decisions are based upon inferences of product quality and product safety. In this paragraph we will describe the role of expiration dates in these inferences. The main weaknesses of the current BBD are discussed and we explain why we expect that our alternatives will lead to improved results.

Multiple approaches exist to obtain information about product quality and safety, for instance the look, smell and taste of a product (van Boxstael et al., 2014; WRAP, 2008a), food labels (Grunert & Wills, 2007; Verbeke & Ward, 2006), certain rules of thumb (Green, Draper & Dowler, 2003), but also the type of product, on which we expand later (Tsiros & Heilman, 2005; van Boxstael et al., 2014; WRAP, 2011). Often, these approaches are used in combination with each other (van Boxstael et al., 2014). We will now expand on the role of date labels.

Research of the FSAI (2009) revealed that 95% of respondents felt the expiration date is an import piece of information on the food labels. A recent study done by TNS (2014) reveals that in the EU-28, 58% of respondents indicates *always* to check expiration dates and 32% *often* or *sometime* check expiration dates. 10% *rarely* or *never* checks dates. However, the reported attention is not a predictor of actual attention for date marks (Gaschler, Mata, Störmer, Kühnel, Bilalic, 2010). Date labelling helps in providing information about product quality (Holm & Kildevang, 1996; Verbeke & Ward, 2006), safety (van Rijswijk & Frewer, 2008; WRAP, 2008a; Elsen, van Giesen & Leenheer, 2015) and product freshness (Giménez, Ares & Gambaro, 2008; Wansink & Wright, 2006). When processing a package, for instance to perceive healthfulness, consumers pay relative low attention to the date label (Ares, Giménez, Bruzzone, Vidal, Antúnez & Maiche, 2013). Consumers use the BBD as a quick scan to inform their selves about the product quality or safety (Lagerkvist, 2013; Verbeke & Ward, 2006). Perhaps therefore, the BBD is often interpreted inaccurately and products carrying a BBD are often disposed too soon (Hanssen & Møller, 2013; van Westerhoven & Steenhuizen, 2010; Williams, Wikström, Otterbring, Löfgren & Gustafsson, 2012; WRAP, 2011).

The BBD often is interpreted too strict instead of lenient. As WRAP (2011) indicates, almost one out of five products carrying a BBD is disposed on the expiration date, or one day

after the expiration date. Further, consumers tend to treat the BBD as a use-by date (TNS, 2014; WRAP, 2011). This means they see the date that is displayed as the final date of consumption. Consumers perceive the product to lose its quality and safety, one day after the BBD. Objectively, this is not the case (NVWA, 2015), the product quality declines gradually after the

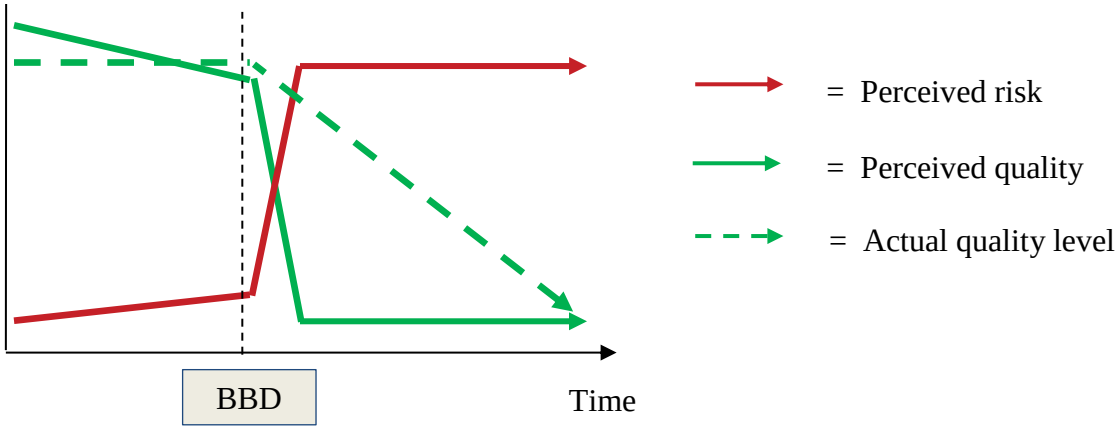

Figure 3. Consumer perceptions of food quality and safety past the BBD and objective safety and quality. Please note we did not display the actual risk, since this the variation between products is large. Consumer interpretation often is strict and dependent on the expiration date (BBD).

BBD, instead of the perceived rapid drop. We visualized the consumer interpretation of products with a BBD versus the 'actual, objective' product state in figure 3.

Now, we will elaborate upon the alternatives we will test in our study and compare with the current BBD. The message the label should deliver, is that when the corresponding expiration date has passed, the maximum quality is no longer guaranteed by the manufacturer. Instead, the quality will decline gradually. We identify two main problems with the current label used for BBD-products – especially in the Netherlands.

1. First, the current labelling method in the Netherlands is still focussing too much on perishability. The Dutch equivalent can be roughly translated as 'at least preservable until' – which relates more to safety than to quality. The English equivalent 'best before' is milder and more accurate with regard to the actual meaning (Soethoudt et al., 2012).

2. Second, the current labelling method does not prescribe a gradual decline in quality (figure 3). We see this as a reason why consumers dispose products, carrying a BBD, a day after the expiration date (WRAP, 2008a).

Therefore, we designed two label texts of which we expect to deliver the intended message better. Can we improve understanding of the current best before date, which as we have seen leads to avoidable food waste? The following labels were compared with the current label:

1. 100% quality guaranteed until ***2. Optimal until***

With regard to the weak points of the current labelling we observed before, we expect both alternatives to focus more on quality (rather than safety) in comparison to the original label. Also, both alternatives relate to a gradual decline (figure 3) via "100%" and "Optimal". Differences between the two alternatives are not predicted. One might expect the '*100% quality guaranteed until'* to achieve better results since it is clearly referring to *product quality* with the actual word "quality" in the label. Further, mentioning "100%" indicates a *gradual decline of quality*, rather than a sudden decline, one day after the passing of the BBD (figure 3).

'Optimal until' conveys the same message and, on top of that, it is shorter to process. This might be a huge advantage since date labels are processed on a heuristic base – as quickly as possible with low attention. (Lagerkvist, 2013; Verbeke & Ward, 2006; WRAP, 2011). WRAP (2011, p. 120) states the following: "Food labels are used by most people in the majority of situations as quick short cuts, heuristics or rules of thumb". Therefore a shorter claim may be more beneficial. As is found by Wansink, Sonka and Hasler (2004) short label claims help communicate (beneficial) aspects of a product and provide people with more understanding. We state the following two hypotheses with regard to our alternatives.

H1. A while after the BBD, both *'100% quality guaranteed'* as *'optimal until'* yield a higher perceived quality and less perceived risk compared to the "original labelling", up to a certain moment in time at which quality and risk is low regardless of the label type.

H2. A while after the BBD, both *'100% quality guaranteed'* as *'optimal until'* yield a lower disposal likelihood compared to the "original labelling", up to a certain moment in time at which usage is low regardless of the label type.

We expect to find no differences on the best-before date itself, since a lot of consumers would still use the product on the date itself. Further, a large period past the BBD, we expect that the perceived decline of quality and increase of risk will and should be too big, regardless of the label type. Therefore, almost all consumers would dispose the product, despite the label stated on the product. In the next and final section of the theory section, we will elaborate on the effects of product type. We will see that certain products entail more risk than others, which will lead to more frequent checking of date labels.

1.2.4. Effects depend on product type

Date labels are not uniformly interpreted for each product, but interpretations are based upon risk the nature of a product implies (WRAP, 2008a, 2011). Literature describes that product type, rather than label type, is even more important in the interpretation of date labelling and determining consumer behaviour (Verbeke & Ward, 2006; WRAP, 2011). Consumers rely more on date labels for products where there is a higher perceived safety risk (Ares et al., 2013; Tsiros & Heilman, 2005; WRAP, 2011).

An example of a product where people experience high levels of perceived risk is yoghurt. A Norwegian study showed that for yoghurts with BBD's, for 70% of respondents

expiration dates would be the main reason of disposal. Objectively, yoghurts with BBD's all last well beyond the date placed on the package (Hanssen & Moller, 2013). A UK study found that 41% of respondents would dispose yoghurt one or two days out of date (BBD) – again, these yoghurts would still be safe to consume. In the same study, a large amount of respondents indicated they would dispose the yoghurt due to safety concerns (which do not come in one or two days after the expiration date). Just a small amount of consumers would rely on the own senses, which is advised when the BBD is applied. In contrast, e.g. potatoes (BBD) were judged 'okay to eat' in 88% of the cases, tomatoes with a BBD were judged okay in 85% of the cases and also cheese (BBD) were in three out of four times judged 'okay to eat' (WRAP, 2008a). All of these products were a couple of days out of date. A different UK study showed the same result, and 40% of consumers indicated to fully rely on the date for yoghurt and for milk. For potatoes in the same study, 7% relies entirely on the label and 70% indicates to use their own senses (WRAP, 2011). The rarity of cases where yoghurt is disposed due to the look or smell being off indicates that consumers may have difficulties judging for their selves whether the product is unsafe and consumers trust on date labelling more. For products that do not imply safety risks, as bakery products or cereal, the date is of less importance to consumers (WRAP, 2011). The nature of a product thus seems to play an important role in food safety perceptions and disposal decisions. Some products are by nature perceived as more risky than others (although their actual shelf-lives are objectively comparable).

When risk increases, consumers seek to relieve this risk (Derbaix, 1982; Roselius, 1971; Taylor, 1974) and the date label helps consumers to reduce perceived risk when making a decision whether to use or dispose a product (Tsiros & Heilman, 2005). Therefore, the attention for the date label is likely to be greater for products with higher levels of perceived risk. We pose

that, then, the proposed label alternatives will be more effective in delivering the intended message (see section 2.3) and lead to less perceived risk and a higher perceived quality and a lower disposal likelihood. We expect that this effect will be stronger for products that are perceived as more (as compared to less) risky, since the reliance on date marks is larger when perceived risk increases (Tsiros & Heilman, 2005). We state the following hypotheses:

> **H3.** A while after the BBD, differences in perceived quality and risk between the *'100% quality guaranteed'* and *'optimal until'* labelling versus the "original labelling" are larger for products that are perceived as more risky in nature as compared to products that are perceived less risky in nature.
>
> **H4.** A while after the BBD, differences in disposal likelihood between the *'100% quality guaranteed'* and *'optimal until'* compared to the "original labelling" are larger for products that are perceived as more risky in nature as compared to products that are perceived less risky in nature.

1.3.Method study 1

In this chapter, we will describe the method we applied to test hypotheses 1 to 4. The chapter starts with describing the experimental design and the sample. An online experiment was conducted via a large Dutch household sample, which is described first. Secondly, the manipulation of our independent variables is described and the chapter concludes with the procedure for respondents and the measures of our dependent variables.

1.3.1. Design and participants

In order to test the hypotheses, we used a 2 (perceived product risk: high versus low) x 3 (label type: original versus '*100% quality guaranteed*' versus '*optimal until*') x 4 (time) mixed

design, yielding twenty-four conditions (table 1). 'Product type' was manipulated within-subjects. , meaning that each participant evaluated both yoghurt and breakfast cake. 'Label type' was manipulated between-subjects, each respondent saw only one type of label for both products. Finally, our time conditions were manipulated between-subjects, but rotated such that each participant evaluated each product on a single time point. For each product and participant, this time point was selected randomly.

Product	Label type	Condition 1 (t1)	Condition 2 (t2)	Condition 3 (t3)	Condition 4 (t4)
Risky (yoghurt)	BBD	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days
Risky (yoghurt)	100%	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days
Risky (yoghurt)	Optimal	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days
Safe (breakfast cake)	BBD	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days
Safe (breakfast cake)	100%	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days
Safe (breakfast cake)	Optimal	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days

Table 1. Conditions used in the experiment

For our data collection, we made use of a representative panel of Dutch households[1]. In total, 2.197 respondents filled in the questionnaire (M_{age} = 55.2, SD_{age} = 16.7; gender: 52.5% male, 47.5% female). A sample description can be found in table 2. In our next paragraph, we will describe the manipulation of our independent variables (product type, label type and time) and the pre-test we conducted.

Table 2. *Study 1 - Sample descriptions*

Gender	Absolute	Percentage
Male	1.154	52.5%
Female	1.043	47.5%
Age	Absolute	Percentage
16 until 21	31	1.4%
22 until 30	144	6.6%
31 until 45	506	23.0%
46 until 55	345	15.7%
56 until 65	443	20.2%
66 until 75	500	22.8%
Older than 75	228	10.4%
Education	Absolute	Percentage
Primary/elementary education	87	4.0%
vmbo	532	24.2%
havo/vwo	238	10.8%
mbo	483	22.0%
hbo	544	24.8%
wo	313	14.2%

[1] The CentERpanel contains more than 2.000 households, which fill in questionnaires every week at home via internet. The CentERpanel is a representative sample of the Dutch population

1.3.2. Manipulation of the independent variables

Although label type is the most important independent variable, first it is described how product type was manipulated. In order to come up with two products that are objectively comparable, we conducted a pre-test. After describing results of the pre-tests, the chosen products are displayed, which makes it easier to explain how label type is manipulated.

Product type. Our goal is to come up with two products which objectively are comparable in terms of shelf life, but which are interpreted differently by consumers. A pre-test with a convenience sample (n=27; M_{age} = 32.7; 48% male) was conducted. In appendix B results of the pre-test are described in more detail. First, based on prescriptions of the Dutch Food and Consumer Product Safety Authority (Nederlandse Voedsel- en warenautoriteit (NVWA)) fifteen products were chosen in the pre-test, containing three type of products: i) products with a very long shelf life (up to 1 year and longer), ii) products with a long shelf life (up to 2 months and longer) and iii) products with a limited shelf life (consume within 3-4 weeks)[2].

Firstly, we checked whether these categories were perceived differently in terms of perceived safety. An ANOVA showed this was the case (F, (2,52) = 39.53, $p < 0.001$). The products with limited shelf-life were indeed perceived as least safe (M=5.0) in comparison to long shelf-life products (M=6.5) and the very long shelf-life products (M=5.8)

After concluding the short shelf life products indeed were perceived as riskier, we checked which products (within this category) were perceived as *most risky*. Follow-up analysis reveals that the nine limited durable products which were tested in this category differed

[2] For a full list of the tested products, see appendix A.

significantly on perceived risk (F (8,208) = 16.35, $p < 0.001$). Milk, bread and yoghurt were perceived as risky and differed significantly from gingerbread/breakfast cake and butter ($p<0.05$) (results of the pre-test are presented in figure 4). As risky food product, yoghurt is chosen. The 'safe' food product is chosen to be gingerbread/breakfast cake, since this is also a breakfast product.[3] Both have a comparable shelf life: a study revealed that yoghurt did not show decay in quality or safety four weeks after the BBD (Cammelbeeck, 2013) whereas for breakfast cake, consumption is recommended three weeks after the BBD (NVWA, 2015).

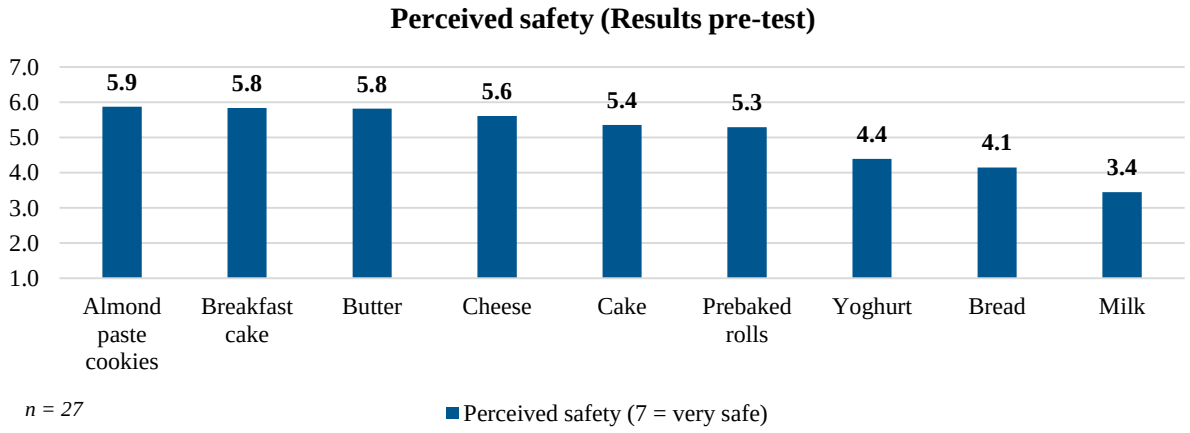

Figure 4. Results pre-test perceived safety limited shelf-life products

Label type. Each product was accompanied with a date label. Per respondent, both products were represented with the same label type to avoid learning effects and demand characteristics (Leary, 2001). Presenting multiple labels (including one label which might already be familiar) may emphasize the manipulation for respondents as well as the aim of the study, and was therefore avoided.

[3] `Breakfast cake often is used in the Netherlands as breakfast supplement or as a snack

Time. Time conditions were randomized per stimulus. Thus, for example, a certain respondent could have faced yoghurt with a label containing where the BBD expired with 24 days and the breakfast cake with a label where the BBD expired with 3 days. Via this manner, we aimed to make the 'fridge/pantry' situation as natural as possible.

Brand. We wanted to exclude any brand-associated inferences, thus used a fictious brand. In figure 5a and 5b, visual representations of the used stimuli are provided.

Label 1. Original label

Label 2. 100% quality guaranteed until

Label 3. Optimal until

Figure 5a. Stimuli used breakfast cake

Label 1. Original label

Label 2. 100% quality guaranteed until

Label 3. Optimal until

Figure 5b. Stimuli used yoghurt

1.3.3. Procedure and measures

Procedure. Respondents filled in the questionnaire via internet. Respondents were asked to imagine they came home the previous evening from holidays and they had no time to do grocery

shopping and didn't feel like it due to tiredness. A breakfast situation was simulated and respondents further were asked to imagine to open their fridge or pantry and check for leftovers. For each of the products, perceived quality, perceived safety and usage likelihood were measured. Questions were inspired on the study conducted by Elsen, van Giesen & Leenheer (2015). The order of product types was counterbalanced, meaning that half of the respondents first saw the yoghurt and secondly the gingerbread/ breakfast cake and vice versa.

Perceived quality. We measured perceived quality via one item; 'the quality of this product at the moment is…' (1=very poor, 7=very good).

Perceived safety. We measured perceived safety via two items;

- The chance of getting ill: 'if I eat this product today, the chance I get ill is…' (1=very small, 7=very large).
- The amount of risk; 'if I eat this product today, I face…' (1=no risk at all, 7=a large risk).

Disposal/usage likelihood. We measured disposal/usage likelihood via one item; 'if you could choose between consuming and disposing the product today, what would you do?' (1=definitely dispose, 2=probably dispose, 3=equally likely dispose or consume, 4=probably consume, 5=definitely consume).

1.4.Results study 1

In order to test our hypotheses, multiple three-way ANOVA's were conducted with perceived quality, perceived safety and usage likelihood as dependent variables, using time, label

type and product type as independent variables. Table 3 and figure 6-9 provide descriptive statistics and table 4 provides the estimation results.

Table 3. Descriptive results study 1		**Yoghurt**			**Breakfast cake**		
		Original label	**100% Quality**	**Optimal until**	**Original label**	**100% Quality**	**Optimal until**
Perceived quality (1-7)	**BBD**	4.82	4.89	5.16	5.62	5.62	5.68
	BBD + 3 days	4.16	4.12	4.29	5.10	5.09	5.19
	BBD + 14 days	3.67	3.81	3.78	4.88	4.69	4.70
	BBD + 24 days	3.76	3.54	3.67	4.75	4.89	4.68
		Original label	**100% Quality**	**Optimal until**	**Original label**	**100% Quality**	**Optimal until**
Perceived safety – amount of risk (1-7)	**BBD**	2.41	2.14	2.29	1.40	1.43	1.39
	BBD + 3 days	2.63	2.75	2.75	1.69	1.75	1.69
	BBD + 14 days	3.56	3.35	3.07	1.92	2.04	1.80
	BBD + 24 days	3.48	3.75	3.39	2.01	1.89	2.03
		Original label	**100% Quality**	**Optimal until**	**Original label**	**100% Quality**	**Optimal until**
Perceived safety – chance of getting ill (1-7)	**BBD**	2.55	2.28	2.47	1.52	1.56	1.55
	BBD + 3 days	2.88	3.03	2.95	1.94	1.95	1.88
	BBD + 14 days	3.63	3.56	3.43	2.18	2.28	2.12
	BBD + 24 days	3.72	3.94	3.70	2.29	2.15	2.22
		Original label	**100% Quality**	**Optimal until**	**Original label**	**100% Quality**	**Optimal until**
Usage likelihood (1-5)	**BBD**	3.63	3.94	3.88	4.53	4.46	4.53
	BBD + 3 days	3.44	3.30	3.34	4.36	4.36	4.34
	BBD + 14 days	2.73	2.81	2.87	4.01	3.94	4.13
	BBD + 24 days	2.67	2.51	2.71	3.94	3.99	3.90

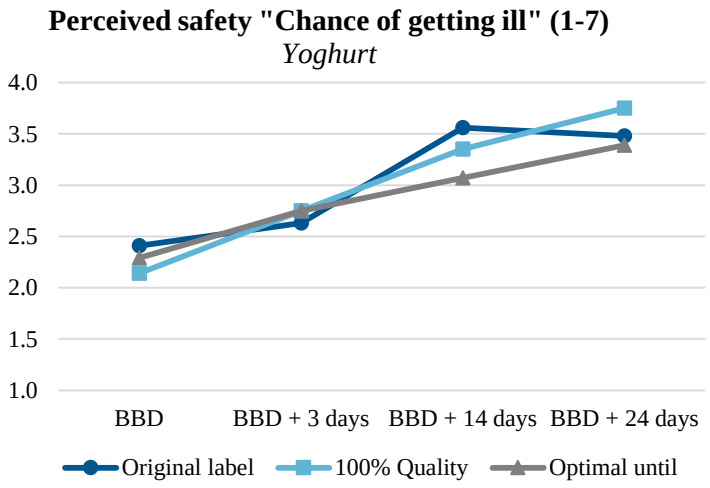

Figure 6a. Perceived chance of getting ill yoghurt

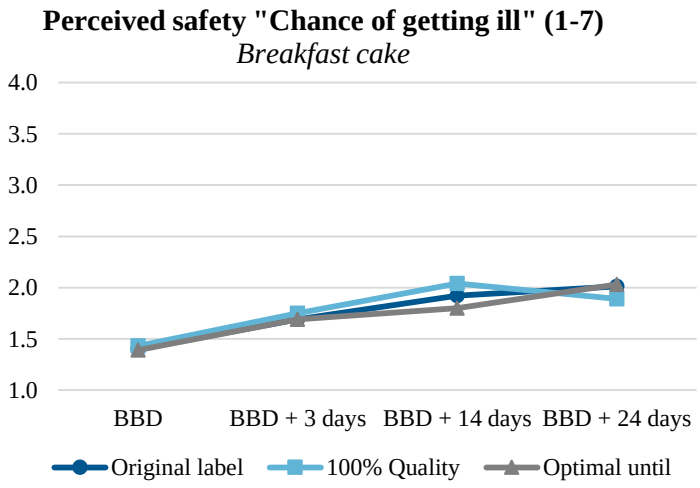

Figure 6b. Perceived chance of getting ill breakfast cake

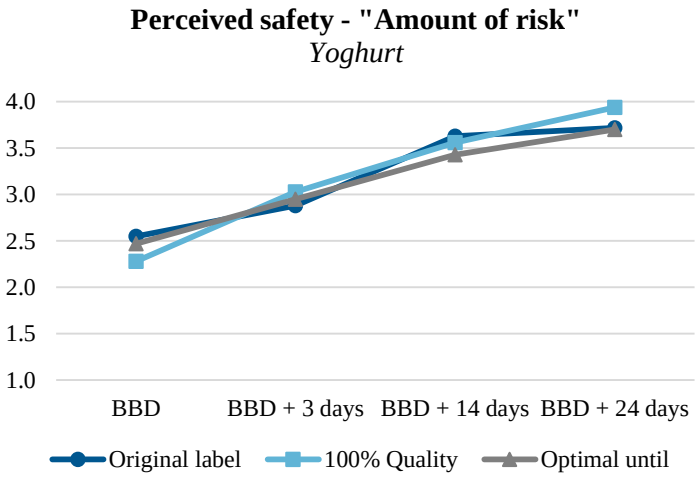

Figure 7a. Perceived amount of risk yoghurt

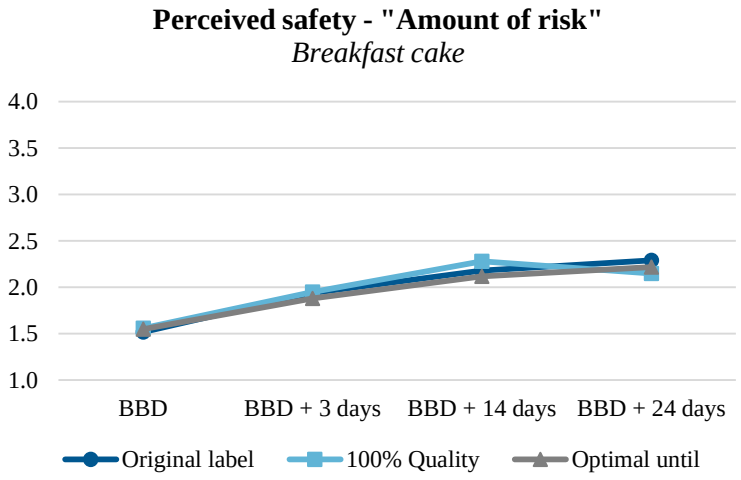

Figure 7b. Perceived amount of risk breakfast cake

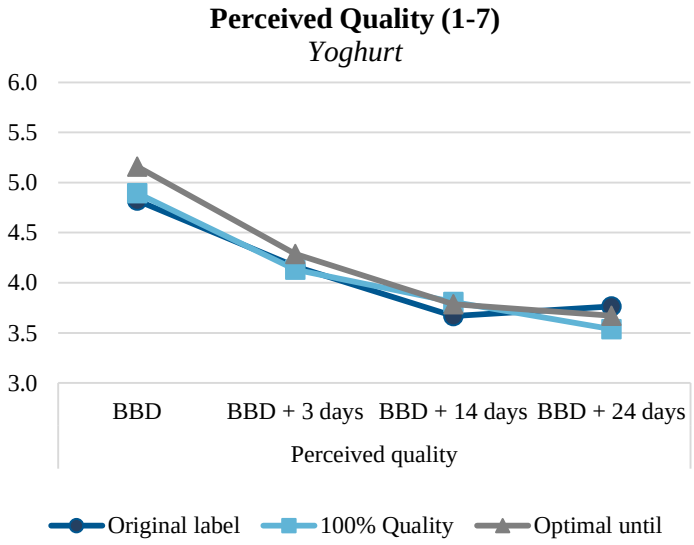

Figure 8a. Perceived quality yoghurt

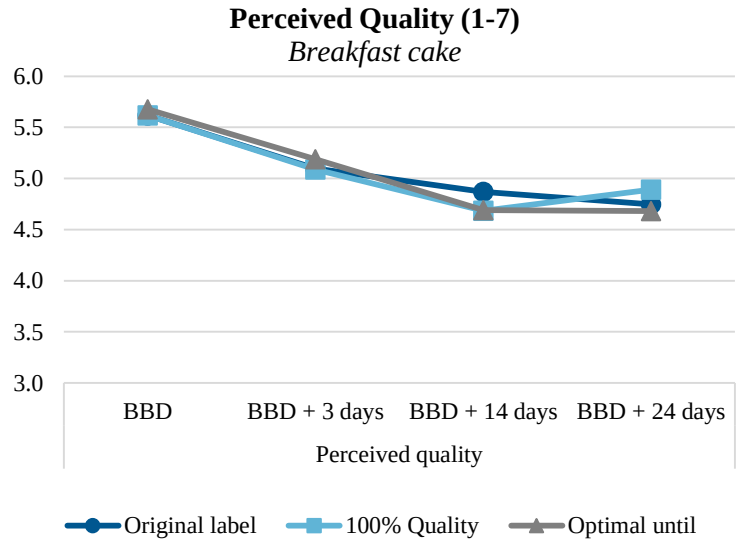

Figure 8b. Perceived quality breakfast cake

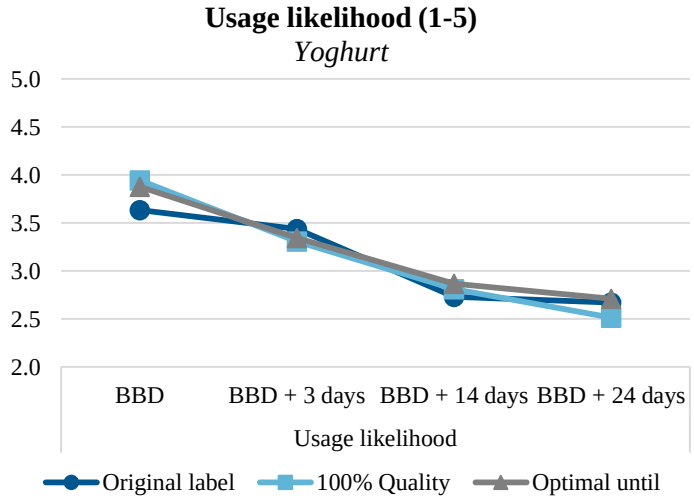

Figure 9a. Usage likelihood yoghurt

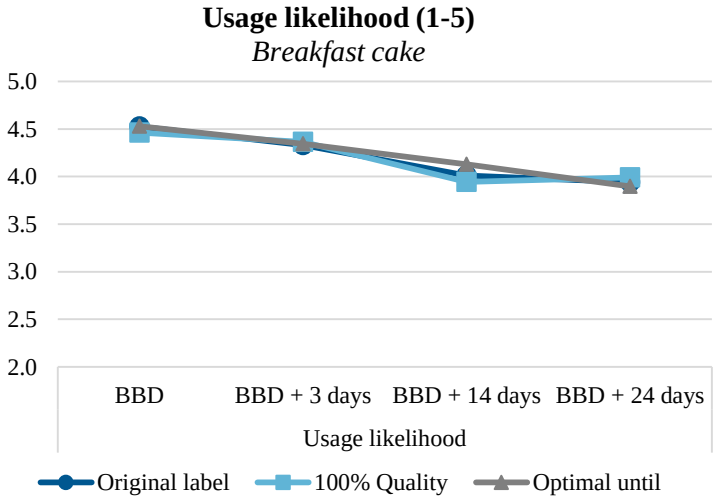

Figure 9b. Usage likelihood breakfast cake

As can be found in table 4, for each of our variables, both product type and time showed a significant main effect on all dependent variables (all p-values < 0.001). Label type did not reveal a significant main effect for the dependent variables (all p-values >0.05).

Table 4. Test results ANOVA study 1

	Perceived quality		Perceived safety – amount of risk		Perceived safety – chance of getting ill		Usage likelihood	
	F	p	F	p	F	p	F	p
Label type	0.58	0.563	1.39	0.249	0.53	0.587	0.69	0.500
Time	106.29**	<0.001	77.78**	<0.001	93.16**	<0.001	106.18**	<0.001
Product type	355.63**	<0.001	650.30**	<0.001	636.47**	<0.001	717.84**	<0.001
Label type * time	0.62	0.713	1.33	0.239	0.51	0.798	0.63	0.703
Product * label type	0.95	0.388	0.55	0.580	0.01	0.986	0.19	0.827
Product type * time	3.51	0.015*	11.90	<0.001**	10.10	<0.001**	12.82**	<0.001
Product type * label type * time	0.80	0.574	1.53	0.166	0.95	0.462	1.21	0.299

** = Significant at p<0.05 level; ** = Significant at p<0.001 level*

Firstly, we predicted that the alternative labelling method would lead to higher perceived safety and a higher perceived quality in comparison to the original label. More specifically, we expected this effect to occur "a while after the BBD", and not on the expiration date itself, nor for a large period of time after the expiration date. Therefore, we check the interaction effect of label type and time. Since this interaction effect is insignificant for neither perceived quality (F (6,4358) = 0.62, p = 0.713), nor for the amount of risk (F (6,4358) = 1.33, p = 0.239) or the chance of getting ill (F (6,4358) = .51, p = 0.798), we should reject the first hypothesis.

Despite the insignificant interaction effect, follow-up analyses are conducted for time conditions 2 (3 days after the BBD) and 3 (14 days after the BBD) ("a while after the BBD"). Since for half of the tested conditions null effects are predicted, the statistical power decreases largely (Cohen, Cohen, West & Aiken, 2003). The first hypothesis predicted no effects of label type on the expiration date itself, since almost all consumers would likely use the product. Also for a large period of time beyond the expiration date (t4), no effects of label type are predicted, since almost all consumers are likely to dispose the product.

A second ANOVA was conducted, with just using the time condition BBD + 3 days and the BBD + 14 days. In this analysis, a significant main effect of label type is predicted, since the time periods in which no variation is expected were removed. However, for none of our variables of interest, label type showed a significant effect (all *p*-values > 0.05). This time, a significant interaction effect between time and label type was found for the chance of getting ill (F (2,2181) = 0.30, p = 0.739). Follow-up analyses reveal a significant effect of label type 14 days after the BBD (F (2,2181) = 4.212, p = 0.15). Two weeks after the BBD, the '*optimal until*' label (M=2.44) leads to less perceived risk compared to the original label (M= 2.74) as well as the '*100% quality guaranteed until label*' (M=2.70). So, the first hypothesis can be partially accepted.

The second hypothesis state that the alternative labels would lead to less disposal likelihood, a while after the BBD, in comparison to the original labelling. Again, the interaction effect of time and label type for usage likelihood is analysed via an ANOVA. However, no significant effect for the interaction of time and label type (F (4,4358) = 0.63, p = 0.703) is found. However, as explained before, a large part of statistical power is lost due to the use of time condition with the BBD itself and the time condition with a large period of time beyond the BBD (+ 24 days). Therefore, a follow-up test was conducted with merely time condition 2 (BBD + 3 days) and time condition 3 (BBD + 14 days), analysing the main effect of label type for usage likelihood. No significant effect of label type on usage likelihood was found (F (2,2181) = 0.469, p = 0.626).

The third and fourth hypothesis that the effect of labelling would be larger for products that imply more risk. The interaction of product type and label is neither significant for perceived quality (F (2,4358) = 0.95, p = 0.388) nor for the amount of risk (F (2,4358) = 0.55, p = 0.580) or the chance of getting ill (F (2,4358) = 0.01, p = 0.986). Also for disposal likelihood, no significant interaction was found (F (2,4358) = 0.19, p = 0.827). We therefore reject hypotheses 3 and 4.

Table 5. Follow up tests time versus product type	**Perceived safety "Amount of risk" (1-7)**					
	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days	F	p
Yoghurt	2.28[a]	2.71[a] *(+0.43)*	3.33[a] *(+0.62)*	3.53[a] *(+0.20)*	75.062[*]	p<0.001
Breakfast cake	1.41[a]	1.71[a] *(+0.30)*	1.92[a] *(+0.21)*	1.98[b] *(+0.06)*	15.112[*]	p<0.001
	Perceived safety "Chance of getting ill" (1-7)					
	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days	F	p
Yoghurt	2.43[a]	2.96[a] *(+0.53)*	3.54[a] *(+0.58)*	3.79[a] *(+0.25)*	81.673[*]	p<0.001
Breakfast cake	1.54[a]	1.93[a] *(+0.39)*	2.19[a] *(+0.26)*	2.22[b] *(+0.03)*	22.172[*]	p<0.001
	Perceived quality (1-7)					
	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days	F	p
Yoghurt	4.95[a]	4.19[a] *(-0.76)*	3.75[a] *(-0.44)*	3.66[b] *(-0.09)*	73.707[*]	p<0.001
Breakfast cake	5.64[a]	5.13[a] *(-0.49)*	4.75[a] *(-0.38)*	4.77[b] *(+0.02)*	36.289[*]	p<0.001
	Usage likelihood (1-5)					
	BBD	BBD + 3 days	BBD + 14 days	BBD + 24 days	F	p
Yoghurt	3.81[a]	3.36[a] *(-0.45)*	2.80[a] *(-0.44)*	2.63[a] *(-0.17)*	96.625[*]	p<0.001
Breakfast cake	4.51[a]	4.35[a] *(-0.16)*	4.03[a] *(-0.32)*	3.94[b] *(-0.09)*	22.79[*]	p<0.001

[*] *= Significant at p<0.001 level;*
[a,b] *= the same superscripts indicate significant row-wise comparisons between time slots*

Table 5. Follow-up tests time versus product type (relative difference with previous timeslot in brackets)

In addition, the analyses reveal a product type versus time interaction for perceived quality (F (6,4358) = 5.53, p = 0.015), the amount of risk (F (6,4358) = 11.90, p < 0.001), the chance of getting ill (F (6,4358) = 10.10, p < 0.001) and disposal likelihood (F(6,4358) = 12.82, p <0.001). As can be seen in table 5, the largest differences can be found between time condition 1 and 2 as well as between time condition 2 and 3. So, where the first two weeks after the BBD a large decrease in quality, safety and usage likelihood can be found, this effect declines over time.

The differences between the time slots are larger for yoghurt than for breakfast cake. This implies that when a product that is riskier in nature, the decrease in perceived quality, safety and usage likelihood occurs faster in comparison to a safer product does.

1.5.Preliminary conclusion

In the first part of this study, no strong evidence was found that using alternative labels will lead to less perceived risk, lower disposal intentions and higher perceived quality of products after the BBD when they are still safe to consume. Significant differences were found between the '*optimal until*' label and the other labels used in the study when we looked at the perceived chance of getting ill; 14 days after the BBD. In this case, consumers perceived the chance of getting ill to be smaller when the '*optimal until*' label was applied in comparison to the original labelling method and the '*100% quality until label*'. We found no evidence for the alternatives to lead to a higher perceived quality in comparison to the original label. Also for disposal likelihood, we found no evidence for the alternatives to lead to less disposal in comparison to the original labelling. Comparing these effects per product type did not lead to significant results either.

On the other hand, evidence was found that over time, perceived quality decreases, whereas perceived risk increases as well as disposal likelihood, as expected. Also, as expected, the objective shelf life was not necessarily an indicator for subjective, perceived shelf life of a product. Yoghurt was perceived as a product which is more risky in nature than breakfast cake. So, when the time increases past the BBD, so does the perceived risk and disposal likelihood. This increase is larger for yoghurt then for breakfast cake. The perceived quality decreases when the time increases past the BBD. Further, the significant effects of time imply that consumers do look at the date label, which is good. However, little evidence is found that the type of label that

is used is affecting these inferences. So do consumers merely look at the expiration date that is applied? We state two possible explanations:

1. Consumers only paid attention to the expiration date. They did not pay attention to the text that is stated near the date. Therefore we do find significant effects of time, but not of label type. This is in accordance with the fact that date labels are processed on a heuristic based with limited attention (Lagerkvist, 2013; Verbeke & Ward, 2006).

2. Consumers paid attention to both the expiration date and the text stated near the date – but did not comprehend the text. So, the alternatives lead to the same inferences as the original labelling (which is understood poorly; TNS, 2014). Therefore, we only see a significant effect of time. In figure 10, we show the different interpretation of the text stated near the date and the expiration date itself.

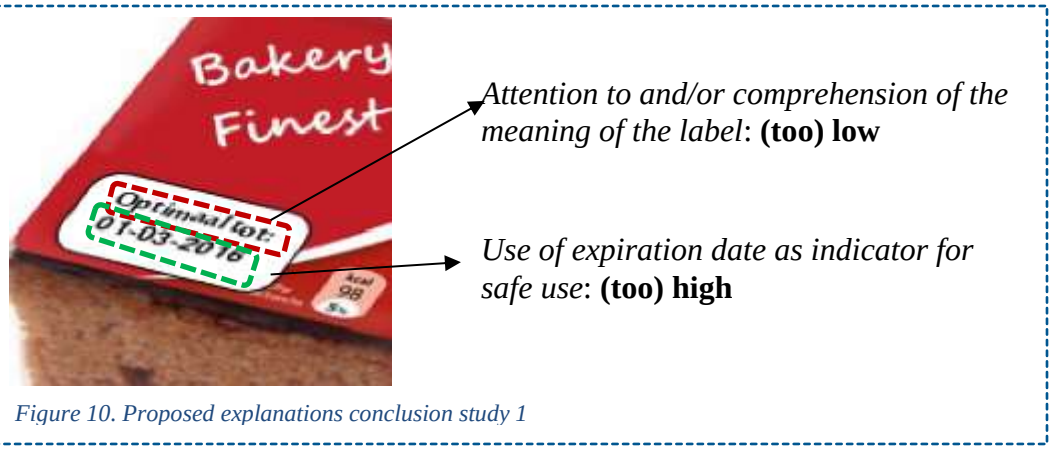

Figure 10. Proposed explanations conclusion study 1

The second study investigated these two stated explanations. If the first explanation is true, so a lack of attention to the label text, then increasing the attention could be a requirement for our new labelling to be successful at all. An awareness campaign might then be useful. If the second explanation is true, so a lack of comprehension, then a more elaborated information/ education campaign is probably needed, where we also explain the meaning of expiration dates.

Study 2.

The first study found no strong evidence that changing the label type leads to different disposal decisions and inferences about product quality and safety. We concluded this might be due to a lack of attention and/or a lack of comprehension of the meaning of the text accompanying the expiration date (section 1.4.4.). Study 2 tested the effects of two intervention types in a controlled lab experiment. A campaign is found useful in increasing the attention to food labels (Verbeke, Ward & Avermaete, 2002; Verbeke & Ward, 2006). We created two campaigns. The first campaign stimulated consumers to look on the package for the meaning of the expiration date. If consumers indeed merely look at the expiration date (and not at the stated meaning of the date; see section 1.4.4.), then it might be useful to stimulate them to look for the meaning on the package. Therefore, a campaign was designed which motivated consumers to pay more attention to the date label and informed them that there are different types of expiration dates ("*They look alike, but sure do not mean the same! Do not only look at the expiration date, but also what this date means. You can find this information on the package of your products*"). The main goal of the campaign was to increase the attention for the meaning of the date (i.e. the text on the date label). This campaign is referred to as the '**attention focused campaign**' (figure 11).

The second campaign deals with the 'lack of comprehension' problem, as stated in section 1.4.4. In this case, lack of attention text on the label is not the problem, but rather the stated meaning is (still) not interpreted and/or comprehended correctly. So, besides communicating there different expiration dates, the second campaign explains the potential meanings of the expiration date which exist. On top of the information of the 'attention focused campaign', the second campaign explains that one label type is used to state the finale date that

consumption of a product is safe, while the other label type is meant to state the last date where optimal quality is guaranteed. The main goal of the campaign is a better interpretation of the date label. In this campaign we will increase the attention, but also explain the potential different meanings of the expiration date. We will refer to this campaign as the '**interpretation focused campaign**' (figure 12; a larger version is also displayed in appendix C – 'used materials').

Figure 11. "Attention focused campaign"

Figure 12. "Interpretation focused campaign"

Note that, the "interpretation focused campaign", does not tell respondents which *specific text* refers to product quality and which refers to product safety. Goal of the study is to see which

of the labels *in nature* refers more to product safety – the original label or the '*optimal until*' label. If we do not mention these labels in the campaign, the effectiveness of the labels could be tested in equal conditions.

Further, in comparison to study 1, in study 2 we will only compare the '*optimal until*' label with the original label. The '*optimal until*' led to a smaller perceived chance of getting ill in comparison to both the original labelling method and the '*100% quality guaranteed*' variant. Our other alternative, *'100% quality guaranteed'* did not lead to significant differences with the original label.

2.1.Hypotheses

What is expected with regard to the two campaigns? Firstly, when no campaign is used, one would expect the same results as before – so without a campaign, the new labels will not lead to different inferences of product safety, product quality and eventually disposal likelihood. However, the study setting was different in the study 2 (lab setting) in comparison to study 1 (online panel). We expect respondents in the second study were likely to be less distracted while filling in the questionnaire. Therefore in the second study, the 'natural attention' was higher when filling in the questionnaire. When respondents fill in the questionnaire with more attention, it is more likely the alternative label will be noticed. So, in the control condition, we expect the *'optimal until'* label to lead to lower perceived risk, higher perceived quality and lower disposal intentions in comparison to the '*original label*', based on the evidence found in study 1.

Second, we predict that if we increase the awareness for the potential meanings of the label via the "attention focused campaign", consumers are more likely to pay more attention to both the 'original label' as the '*optimal until*' label. We expect that, compared to the condition

where we do not provide this information, the likelihood that both the 'original label' and the '*optimal until*' label will lead to less disposal is larger. In the "interpretation campaign" we stimulate consumers to pay attention to the meaning of the expiration date on the package, but in addition explain which potential meanings of the expiration date types exist ("…one refers to safety […], the other refers to quality"). We expect that this explanation will help in comprehending both the '*optimal until*' label as the 'original label' better compared to a condition where we do not provide this explanation. So, any campaign is expected to work better than no campaign and hypothesize the following:

> **H5.** When consumers see the 'attention focused campaign', both labels will lead to a higher perceived quality, a lower perceived risk and a lower disposal likelihood in comparison to seeing no campaign.
>
> **H6.** When consumers see the 'interpretation focused campaign', both labels will lead to a higher perceived quality, a lower perceived risk and a lower disposal likelihood in comparison to seeing no campaign.

Thus, we expect any of the campaigns to work better in comparison to no campaign. However, the reason that two campaigns are designed is to provide more insight in which of the two problems as posed in section 1.4.4. are occurring. If the "attention focused campaign" is used and the '*optimal until*' indeed leads to less disposal in comparison to the original label, the, **attention** for the text near the expiration seems to be the problem. However, if the "interpretation focused campaign" is used and the '*optimal until*' leads to less disposal in comparison to the original label, more is needed for the alternative labelling to work than just increasing the attention for the text: the meaning of the text near the expiration date needs to be explained as well in that case.

Thirdly, we predict that when the attention for date labelling increases, consumers are less likely to overlook the stated meaning of the expiration date– which might have occurred at study 1. As seen in study 1, we find some evidence for the '*optimal until*' label to lead to less perceived risk in comparison to the original label. We therefore expect that if stimulate the consumers to look for the meaning of an expiration date, the *optimal until* label will lead to less disposal in comparison to the original label. We thus hypothesize:

> **H7.** When consumers first see the 'attention focused campaign', the '*optimal until*' label will lead to a higher perceived quality, less perceived risk and eventually a lower disposal likelihood compared to the original label.

In the "interpretation focused campaign", the explanation that one of the labels refers to safety and the other refers to product quality makes both the '*optimal until*' and the original label easier to interpret. However, the campaign does not state which text refers to product safety and which text refers to product quality. We expect that the '*optimal until*' in nature refers more to quality (instead of safety) in comparison to the original labelling. It is thus easier for respondents to identify the correct meaning of the '*optimal until*' label in comparison to the original labelling.

> **H8.** When consumers see the 'interpretation focused campaign', the '*optimal until*' label will lead to a higher perceived quality, less perceived risk and eventually a lower disposal likelihood compared to the original label.

We summarize our expectations and hypotheses in figure 13. Please note that if we refer to working of the label, we refer to delivering the intended message of the BBD. This message is that after the BBD, products are still safe to consume, although quality may decline. In this study, a label that 'works better', leads to less disposal a while after the BBD.

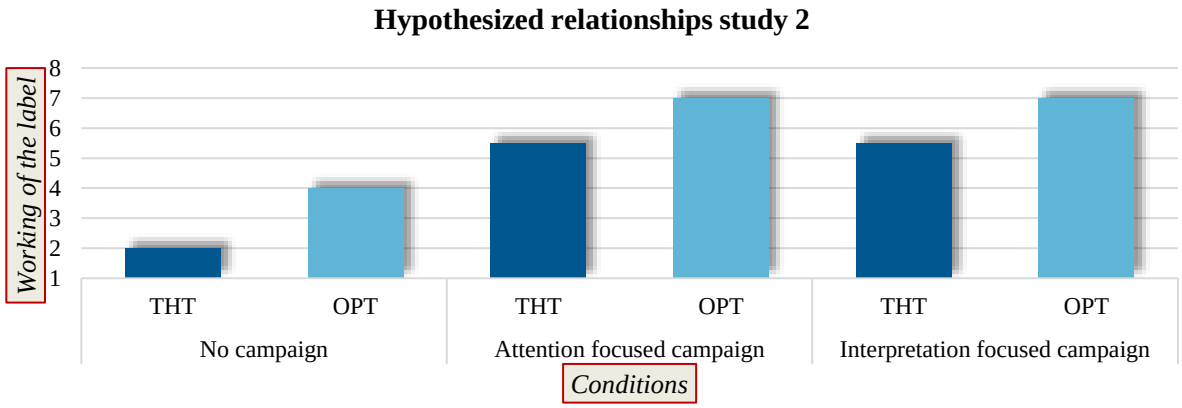

Figure 13. Hypothesized relationships second study

2.2. Method study 2

2.2.1. Design and participants

The second study used a 3 (campaign type (no campaign versus 'attention focused' versus 'interpretation focused' x 2 (label type (original versus *optimal until*) x 2 (product (milk and yoghurt)) mixed design, yielding twelve conditions (table 6). Product type was manipulated within respondents, whereas label type and campaign type were manipulated between respondents.

Product	"Attention focused campaign"	"Interpretation focused campaign"	No campaign
Yoghurt	BBD	BBD	BBD
Yoghurt	Optimal	Optimal	Optimal
Milk	BBD	BBD	BBD
Milk	Optimal	Optimal	Optimal

Table 6. Design study 2

In comparison to the first study, study 2 was conducted in a more controlled setting; respondents filled in the questionnaire in the lab in individual cubicles. Tilburg University students were invited to the lab, where they filled in the questionnaires. In total, 130 respondents completed the questionnaire (M_{age} = 22.8, SD_{age} = 3.1; gender: 50% male, 50% female)

2.2.2. Manipulation of the independent variables

Attention for date labels. We manipulated the attention for date labels between-respondents via the different campaigns as described in the previous section (figure 11 and 12and appendix C).

Label type. In study 2 only the '*optimal until*' label is compared with the original label.

Product. As seen with study 1, per product type different disposal decisions are made. We wanted to examine in our research if alternative labels can serve as a solution for products that are disposed too soon. Therefore, we will only use products that often are perceived as risky in nature. In our pre-test, we saw that yoghurt, milk and bread were perceived as such. Therefore yoghurt and milk were used as products in this second study. We expect these two products to be interpreted comparable and use two product types to increase the generalizability of results.

Time. We used one time point: 7 days after the BBD. This is based on our previous data which revealed that 7 days after the BBD about half of the consumers would consume yoghurt and half would dispose the yoghurt. Thus, a week after the BBD, the doubt about usage/disposal seems to be the largest. We aimed to select a point in time where on the one hand not all consumers would **dispose** the product, and on the other hand, not all consumers would **use** the product. Therefore, a week after the BBD seemed to be best suited for the study.

2.2.3. Procedure and measures

Again, three constructs of interest were measured; perceived quality, perceived safety and disposal/usage likelihood. In addition to study 1, two items were added which provide more insights in the constructs of interest. One measured perceived quality, 'I think this products at this moment is…' (7=delicious), the other measured perceived safety, 'It's a wise decision to use this product today' (7=fully agree). Consumers first were randomly assigned to either the

'attention focused campaign', the 'interpretation focused campaign' or a control condition where no campaign was shown. When they participated in the survey, respondents were asked to imagine they would cook for their families tonight and were looking for a recipe on the website of a large supermarket in the Netherlands (Albert Heijn[4]). They would then face an informative webpage of Albert Heijn, explaining more about date labelling – which was either the 'attention focused campaign' or the 'interpretation focused campaign'. Secondly, respondents went through the same procedure as in study 1. Again, respondents were asked to imagine they came home from holidays the day before and had no time do grocery shopping (see section 1.3.3.).

2.3. Results study 2

To test the second set of hypotheses, multiple two-way ANOVA's for our constructs of interest (perceived quality, perceived safety and usage likelihood), using campaign type and label type as independent variables were conducted. Descriptive statistics are provided in table 7.

Table 7. Descriptive statistics study 2		**Yoghurt**			**Milk**		
		Attention	**Interpretation**	**No campaign**	**Attention**	**Interpretation**	**No campaign**
Perceived safety – chance of getting ill (1-7)	**THT**	3.56	3.44	4.40	2.39	3.28	3.80
	OPT	4.12	3.80	3.29	3.00	2.84	2.29
		Attention	**Interpretation**	**No campaign**	**Attention**	**Interpretation**	**No campaign**
Perceived safety – amount of risk (1-7)	**THT**	3.89	3.67	4.77	2.67	3.50	4.03
	OPT	4.20	4.20	3.86	3.28	2.92	2.79
		Attention	**Interpretation**	**No campaign**	**Attention**	**Interpretation**	**No campaign**
Perceived safety – wise decision (1-7)	**THT**	3.28	2.61	2.63	4.56	3.61	3.37
	OPT	2.68	3.24	3.07	3.84	4.00	4.21
		Attention	**Interpretation**	**No campaign**	**Attention**	**Interpretation**	**No campaign**
Perceived quality – deliciousness (1-7)	**THT**	3.11	3.44	2.43	4.06	3.39	3.20
	OPT	2.72	2.68	3.00	3.44	3.32	3.43
		Attention	**Interpretation**	**No campaign**	**Attention**	**Interpretation**	**No campaign**
Perceived quality (1-7)	**THT**	3.28	3.39	2.67	4.61	3.56	3.33
	OPT	2.60	2.96	3.07	3.56	3.52	3.50
		Attention	**Interpretation**	**No campaign**	**Attention**	**Interpretation**	**No campaign**
Usage likelihood (1-5)	**THT**	2.44	2.56	2.13	3.22	2.94	2.70
	OPT	2.40	2.20	2.71	2.76	3.08	3.29

[4] The website of Albert Heijn contains more than 14.000 recipes online. It is commonly used to look up recipes in the Netherlands.

Analysis results are provided in table 8 and 9 and follow-up analyses in table 11. A summary of the findings where hypotheses were simplified and results are displayed can be found in table 10.

Table 8. Test results ANOVA study 2

	Perceived safety – chance of getting ill		Perceived safety – amount of risk		Perceived safety – wise decision	
	F	p	F	p	F	p
Label type	1.49	0.224	1.21	0.273	0.62	0.433
Campaign	0.23	0.792	1.21	0.299	0.62	0.538
Product	15.85***	<0.001	21.48***	<0.001	23.18***	<0.001
Label type * campaign	6.94**	0.001	5.37**	0.005	3.89**	0.022
Label type * product	0.83	0.363	0.98	0.324	0.00	0.967
Campaign * product	0.66	0.516	0.28	0.759	0.25	0.776
Label type * campaign * product	0.35	0.709	1.15	0.319	0.22	0.804

Table 9. Test results ANOVA study 2

	Perceived quality – deliciousness		Perceived quality		Usage likelihood	
	F	p	F	p	F	p
Label type	0.59	0.444	1.72	0.190	0.19	0.660
Campaign	0.64	0.527	1.06	0.348	0.00	0.997
Product	6.38**	0.012	11.09**	0.001	12.57***	<0.001
Label type * campaign	1.55	0.215	2.58*	0.078	2.34*	0.099
Label type * product	0.01	0.922	0.03	0.860	0.01	0.938
Campaign * product	0.49	0.614	1.35	0.260	0.02	0.983
Label type * campaign * product	0.52	0.593	0.34	0.714	0.64	0.528

Hypothesis (simplified)		Accepted?	What did we find?
5.	"Attention focused campaign" works better than no campaign	Partially	- The effectiveness of the campaign depend on label type. When the "attention focused campaign" is used, the original label leads to higher perceived product safety and perceived product quality, whereas this is not (or barely) the case for the alternative label 'optimal until'.
6.	"Interpretation focused campaign" works better than no campaign	Partially	- The effectiveness of the campaign depend on label type. When the "interpretation focused campaign" is used, the original label leads to smaller perceived chance of getting ill, whereas this is not (or barely) the case for the alternative label 'optimal until'.
7.	After seeing the "attention focused campaign", OPT works better than THT	No	- Significant interaction effect of label type and campaign. - Follow-up analyses reveal that when the 'attention focused campaign' is applied, THT leads to higher perceived quality than OPT.
8.	After seeing the "interpretation focused campaign", OPT works better than THT	No	- Significant interaction effect of label type and campaign. - No significant follow-up analyses when we check for simple effects at the "interpretation focused campaign."

Table 10. Hypothesis testing study 2

Firstly, hypothesis 5 and 6 predicted that each of the campaigns would work better in comparison to a condition without a campaign. This means that using a campaign would lead to less higher perceived safety and quality and eventually lower disposal intentions. However, we find for no variable of interest a significant main effect of campaign (all *p*-values > 0.05). This could be explained by the finding that the effect of the campaign is depending on the label type, since we do see significant interaction effects of label type and campaign (table 8 and 9). Follow-up test show that the "attention focused campaign" works better than no campaign, when the original label is applied (table 12). We see that for the original label, the 'attention focused campaign" leads to higher perceived safety and quality ($p<0.05$) than when no campaign is applied (table 12 and figure 14 to 16). This is not the case for the 'optimal until' label, where sometimes even the reverse effect is found. We partially accept hypothesis 5, since the results are in line with our expectations when the original label is applied and, in that case, indeed a campaign has beneficial effects. Further, for the 'interpretation focused campaign', this is the case for the perceived chance of getting ill (F (2,248) = 5.828, $p<0.05$) and we could therefore also partially accept hypothesis 6. Especially the 'attention focused campaign' leads to less disposal in comparison to a condition without a campaign, when the original label is used.

Hypothesis 7 and 8 predicted for both campaigns that the optimal until label would lead to a higher perceived safety, quality and a lower disposal likelihood. The interaction effect of label type and campaign type is (marginally) significant for each variable of interest (except 'deliciousness') (table 8 and 9). However, follow-up tests reveal different results than expected (table 11). When the "attention focused campaign" is used, consumers perceive it a wiser decision to consume products which carry the original label (M=3.92*)* in comparison to the '*optimal until*' label (M=3.26), a week after the BBD (F (1,248) = 3.36, p = 0.068). Further,

when consumers see the 'attention focused campaign', they perceive products carrying the original label (*M*=3.94*)* of a higher quality a week after the BBD, than the '*optimal until*' label (*M*=3.08) (F (1,248) = 6.063, *p* = 0.014). When the "interpretation focused campaign" is used, no differences are found between the original label and the '*optimal until*' label (all *p*-values > 0.05). All in all, the above section reveals different results as expected and hypothesis 7 and 8 are rejected. So, when a campaign is applied, the 'optimal until label' does not lead to higher perceived quality, safety and a higher usage likelihood.

Table 11. Follow-up tests label type*campaign

	No campaign				"Attention focused campaign"				"Interpretation focused campaign"			
	OPT	THT	F	p	OPT	THT	F	p	OPT	THT	F	p
Chance of getting ill *(7 = large chance)*	**2.79^{a}**	**4.10^{b}**	12.307	0.001	3.56^{a}	2.97^{a}	2.699	0.102	3.32^{a}	3.36^{a}	0.013	0.909
Amount of risk *(7 = high risk)*	**3.32^{a}**	**4.40^{b}**	9.704	0.002	3.74^{a}	3.28^{a}	1.954	0.163	3.56^{a}	3.58^{a}	0.005	0.944
Wise decision *(7 = wise decision)*	*3.64^{a}*	*3.00^{b}*	2.933	0.088	*3.26^{a}*	*3.92^{c}*	3.355	0.068	3.62^{a}	3.11^{a}	2.015	0.157
Deliciousness *(7 = delicious)*	3.21^{a}	2.82^{a}	0.961	0.328	3.08^{a}	3.58^{a}	1.688	0.192	3.00^{a}	3.42^{a}	1.157	0.283
Quality *(7 = high quality)*	3.29^{a}	3.00^{a}	0.604	0.438	**3.08^{a}**	**3.94^{b}**	6.063	0.014	3.24^{a}	3.47^{a}	0.438	0.509
Usage likelihood *(5 = very likely)*	*3.00^{a}*	*2.42^{b}*	3.847	0.051	2.58^{a}	2.83^{a}	0.795	0.373	2.64^{a}	2.75^{a}	0.150	0.699

^{a,b} = bold + different superscripts indicate significant differences; a and b differ at p < 0.05; italic + different superscripts differ at p < 0.1

In accordance with expectations, in the condition without a campaign, the 'optimal until' label leads to lower perceived risk than original label (table 11). Also, for usage likelihood, a marginally significant interaction effect of label type and campaign (*F* (2,248) = 2.34, *p* = 0.099) is found and a follow-up test reveals that for the no campaign condition the *'optimal until'* label (*M*=3.00) leads to a higher usage likelihood than the '*original label*' (*M*=2.42) (*F* (1,248) = 3.847, *p* = 0.051). The follow-up tests of table 11 are also displayed in figure 14 to 16.

Table 12. Follow-up tests campaign* label type

	'Optimal until'					'Original label'				
	No campaign	Attention focused	Interpretation focused	F	p	No campaign	Attention focused	Interpretation focused	F	p
Chance of getting ill *(7 = large chance)*	2.79[a]	3.56[b]	3.32[a]	2.016	0.135	4.10[a]	2.97[b]	3.36[b]	5.828	0.003
Amount of risk *(7 = high risk)*	3.32[a]	3.74[a]	3.56[a]	0.693	0.501	4.40[a]	3.28[b]	3.58[a,b]	7.087	0.001
Wise decision *(7 = wise decision)*	3.64[a]	3.26[a]	3.62[a]	0.769	0.404	3.00[a]	3.92[b]	3.11[a]	3.777	0.024
Deliciousness *(7 = delicious)*	3.21[a]	3.08[a]	3.00[a]	0.131	0.877	2.82[a]	3.58[b]	3.42[a,b]	2.512	0.083
Quality *(7 = high quality)*	3.29[a]	3.08[a]	3.24[a]	0.191	0.826	3.00[a]	3.94[b]	3.47[a]	3.961	0.020
Usage likelihood *(5 = very likely)*	3.00[a]	2.58[a]	2.64[a]	1.012	0.365	2.42[a]	2.83[a]	2.75[a]	1.400	0.249

[a,b] = different superscripts indicate significant differences; a and b differ at $p < 0.05$

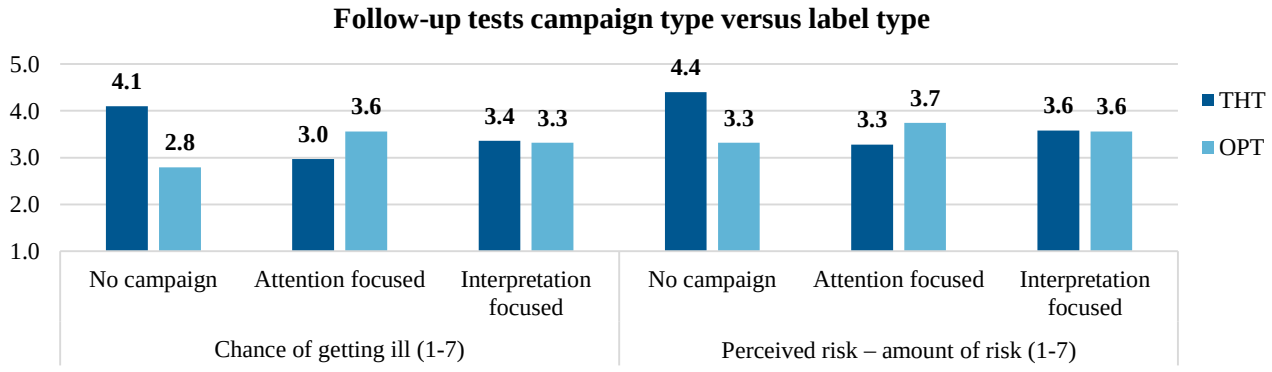

Figure 14. Follow up tests campaign versus label type – 'chance of getting ill' and 'amount of risk'

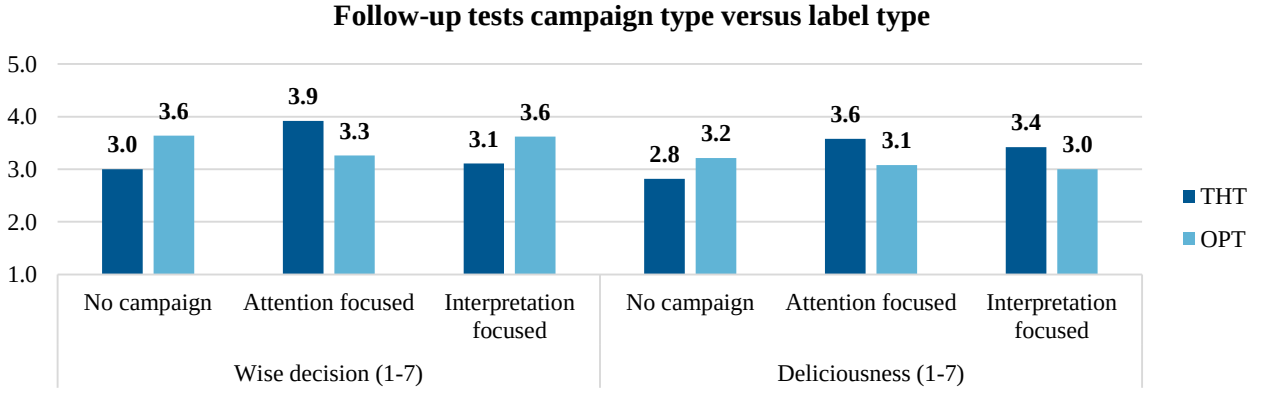

Figure 15. Follow up tests campaign versus label type – 'wise decision' and 'deliciousness'

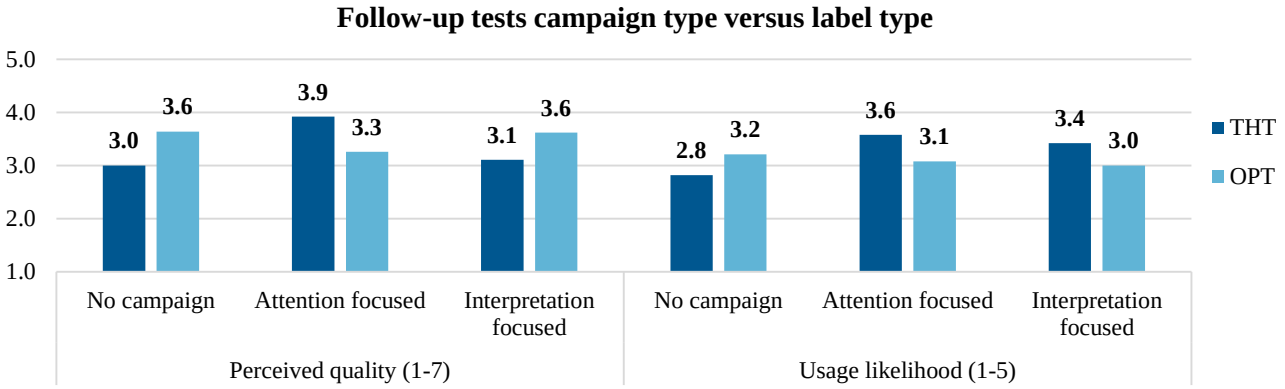

Figure 16. Follow up tests campaign versus label type – 'perceived quality' and 'usage likelihood'

2.4. Conclusion study 2

In study 2, evidence is found for the '*optimal until*' label to work better than the 'original label' in a condition without using a campaign. In study 1, we only found small evidence for this effect. A possible explanation for the stronger effectiveness of the 'optimal until' label in study 2 in comparison to study 1 is the study setting. In study 2 we used a lab setting whereas in study 1 respondents were able to fill in the questionnaire at home. So, in a setting where the natural attention is higher, the '*optimal until*' label appears to be a better label than the original label. However, surprisingly, when we stimulate the attention for date labels, the effectiveness of the 'optimal until' label is comparable to the original label. For most of our variables of interest the 'original label' works as good as the '*optimal until*' label, and for some variables, we even find the 'original label' to work better. In appendix D, we see that the effect of the campaigns is depending on the label type and seems to only effect the original label.

3. Discussion

3.1.General conclusion and discussion

The two experiments researched if alternative date labels would better deliver the intended message of the BBD. The intended message would be that the date indicates the final date where

the manufacturer would guarantee the optimal quality of the product and after this date, consumers should rely on their senses to judge if the product is still desirable for consumption. The problem of the current label namely is that it focusses rather on safety aspects than on quality aspects and no gradual decline is described explicitly. Two alternatives were tested of which we felt satisfied these two conditions better.

Overall, we conclude that, if the natural attention (as seen in study 2 with our lab setting opposed to the setting of study 1) would be high for date labelling, our alternative label '*optimal until*' would better deliver the intended message instead of the original label. However, since this is often not the case and food labels are processed on a heuristic base with selective attention (Lagerkvist, 2013; Verbeke & Ward, 2006; WRAP, 2011) – this scenario has low ecological validity. Ironically however, when we then stimulate the attention and awareness for date labels, we see that the difference between the '*optimal until label*' and the 'original label' is not present (for most of our variables of interest). In fact, for perceived quality we see that if we stimulate consumers to pay more attention to the meaning of the expiration date, the original label works better than the '*optimal until label*'. Further when we increase the attention, consumers perceive it a wiser decision to consume the product after the BBD if it comes with the 'original label' than if it comes with the '*optimal until label*'. So, if the natural attention is high the alternative '*optimal until*' works better, but if we increase the attention ourselves via a campaign, this is not the case and in some cases the original label works better. These results seem rather contradicting and might need elaboration.

A potential explanation can be found in the 'newness' of the '*optimal until label*'. After finalizing the experiment, respondents were asked which label they saw in the experiment (results are displayed in appendix D). More respondents are able to recall and recognize the

original label in comparison to the '*optimal until label*'. As can be expected, consumers might be more familiar the original label, which might be part of explanation. When consumers face a campaign in which they are stimulated to search for the meaning of the expiration date, such a campaign might raise expectations. When they then face a date label they are familiar with – the original label – a sort of "aha-experience" may occur. Consumers might recognize the meaning of the original label, and the campaign thus helps in delivering the intended message of the BBD. The other way around, when consumers see a label that is not in accordance with what they know and expect, a feeling of distrust may be evoked. Further, since the new label is not familiar, the campaign cannot help in *recognition*, nor in an aha-experience.

3.2. Recommendations

What does this imply? Changing the text of the original into '*optimal until*' is not a solution solely, since it only seems to be more effective under the condition of high and active attention. In reality, this condition is unlikely to occur. The results also show that the effectiveness of the original label can be improved, if we stimulate consumers to look for the meaning of the expiration date. The familiarity of the original label might play a key role, and, if policy makers should however decide to change the label type, the new label type should first be introduced thoroughly and consumers should get familiar with the new label. Therefore, we do not recommend changing the label type. It will take a large period of time before consumers get aware with an alternative and this familiarity is needed in order for the label to work, as we could have seen when applying the "attention campaign". The perceived chance of getting ill was higher for the 'optimal until' label in comparison to the original label, when the "attention campaign" was used. Further, a campaign showed to be effective for the original label as well. Awareness campaigns show to be useful in increasing the awareness for food labels (Verbeke,

Ward & Avermaete, 2002; Verbeke & Ward, 2006), but also in the battle against food waste (Quested, Marsh, Stunell, Parry, 2013). A campaign to improve the understanding of the original label text is therefore recommended in favour of changing the label text.

3.3. Limitations and suggestions for further research

In this study, we designed new alternatives which might be more effective to deliver the intended message of the BBD. We found that the '*optimal until label*' could be a suited alternative for the current label. Also, we increased the attention for the date mark via a campaign. We posed that the (natural) attention for the date mark was low and stated that our campaigns would improve the attention. We did find evidence for the effectiveness of the campaign for the original label. So, in some manner, raising awareness and attention does influence the way consumer respond to date labels. However, we still have no statistical proof for how attention works in relation to product information on a package, since we did not measure attention. A future research might use eye-tracking technology to improve this research in the following ways:

1. Is the (natural) attention indeed as low as proposed and how is information on product packaging processed in general?
2. Did a campaign indeed improve the attention and thus lead to different processing compared to a condition without a campaign? How do consumers perceive information on a products packaging when they would (first) see a campaign?

Eye-tracking research are becoming more common in the field of food labelling research (Graham, Orquin & Visschers, 2012). Although it will not answer questions about the

comprehension of date labels, it is useful in determining the attention and the way date labels are processed as part of the whole information displayed on packaging.

Secondly, one of the limitations of the research was the fact we were unable to see if consumers would rely on their own senses, as the BBD describes. A suggestion for future research would be to use a different experiment in which the researchers makes use of controlled observation. Products that are a few days past the expiration date which contain a BBD could be used in the experiment and one could observe what behaviour respondents would show when judging the edibility of the product. Researchers could then see if consumers would open a package, smell the product, see how it looks visually or taste a bit of the product. In other words, would consumers actually use their senses? In accordance to the current study, researchers could check whether alternative labelling would stimulate reliance on the senses. Also, the role of a campaign could be tested in a more natural way.

Appendix A. – Stimuli Used in Pre-test

Stimulus	Durability category (NVWA)	Product group
Orange juice (not freshly made)	Very long durability (up to 1 year and possibly longer)	UHT packed and bottles of soda and fruit juices
Multi-vitamine juice (not freshly made)	Very long durability (up to 1 year and possibly longer)	UHT packed and bottles of soda and fruit juices
Can of orange soda	Very long durability (up to 1 year and possibly longer)	UHT packed and bottles of soda and fruit juices
Pure chocolate bar	Long durability (up to 2 months and possibly longer)	Chocolate
Paprika crisps	Long durability (up to 2 months and possibly longer)	Crisps, pretzels, peanuts
Chocolate sprinkles (sandwich topping)*	Long durability (up to 2 months and possibly longer)	Sandwich toppings (sweet)
Yogurt	Limited durability (BBD date recommended, hereafter own judgement)	Dairy
Buttery spread	Limited durability (BBD date recommended, hereafter own judgement)	Dairy, margarine, butter
Milk	Limited durability (BBD date recommended, hereafter own judgement)	Dairy
Cheese (piece, not slices)	Limited durability (BBD date recommended, hereafter own judgement)	Cheese
Par-baked bread rolls**	Limited durability (BBD date recommended, hereafter own judgement)	Bread, rye bread, par-baked bread
Brown bread	Limited durability (BBD date recommended, hereafter own judgement)	Bread, rye bread, par-baked bread
Breakfast cake***	Limited durability (BBD date recommended, hereafter own judgement)	Cake, cookies with filling, soft cookies, gingerbread
Cake	Limited durability (BBD date recommended, hereafter own judgement)	Cake, cookies with filling, soft cookies, gingerbread
Almond paste cookies******	Limited durability (BBD date recommended, hereafter own judgement)	Cake, cookies with filling, soft cookies, gingerbread

Table 13. Stimuli pretest

NB: starred products in this list are typically Dutch and might need some explanation:

- (*) Chocolate sprinkles *(in Dutch: Hagelslag)*; sweet chocolate sprinkles typically used on sandwiches.
- (**) Par-baked bread rolls *(in Dutch: Afbakbroodjes)*; bread rolls which that are sealed and need to be heated in the oven for approximately 10 minutes.
- (***) Breakfast cake *(in Dutch: Ontbijtkoek / Peperkoek)*; typical Dutch spiced cake, mainly made out of rye. Used as either breakfast supplement or a snack.
- (****) Almond paste cookies *(in Dutch: Gevulde koeken)*; the almond cookie is a typical Dutch baking, it is a round cookie made of dough and butter with a sweet filling.

Appendix B. – Results Pre-test

1. Is there a difference between very long shelf life products, long shelf life products and short-shelf life products?

Perceived safety

Descriptive Statistics

	Mean	Std. Deviation	N
Very long	5.7531	1.21807	27
Long	6.4938	.61582	27
Short	5.0041	1.10101	27

Tests of Within-Subjects Effects

Measure: Safety

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
safety	Sphericity Assumed	29.960	2	14.980	39.953	.000
	Greenhouse-Geisser	29.960	1.855	16.150	39.953	.000
	Huynh-Feldt	29.960	1.992	15.043	39.953	.000
	Lower-bound	29.960	1.000	29.960	39.953	.000
Error(safety)	Sphericity Assumed	19.497	52	.375		
	Greenhouse-Geisser	19.497	48.233	.404		
	Huynh-Feldt	19.497	51.783	.377		
	Lower-bound	19.497	26.000	.750		

Tests of Within-Subjects Contrasts

Measure: Safety

Source	safety	Type III Sum of Squares	df	Mean Square	F	Sig.
safety	Linear	7.573	1	7.573	27.189	.000
	Quadratic	22.387	1	22.387	47.497	.000
Error(safety)	Linear	7.242	26	.279		
	Quadratic	12.255	26	.471		

Pairwise Comparisons

Measure: Safety

(I) safety	(J) safety	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Very long	Long	-.741*	.184	.001	-1.212	-.269
	Short	.749*	.144	.000	.381	1.117
Long	Very long	.741*	.184	.001	.269	1.212
	Short	1.490*	.169	.000	1.056	1.923
Short	Very long	-.749*	.144	.000	-1.117	-.381
	Long	-1.490*	.169	.000	-1.923	-1.056

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Perceived risk of illness (reverse scaled, meaning a higher score is more perceived safety)

Descriptive Statistics

	Mean	Std. Deviation	N
Short	5.1646	1.16059	27
Long	6.6790	.50197	27
Very long	5.9012	1.25342	27

Tests of Within-Subjects Effects

Measure: Perceived risk of illness

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
illness	Sphericity Assumed	30.969	2	15.484	38.360	.000
	Greenhouse-Geisser	30.969	1.821	17.003	38.360	.000
	Huynh-Feldt	30.969	1.951	15.872	38.360	.000
	Lower-bound	30.969	1.000	30.969	38.360	.000
Error(illness)	Sphericity Assumed	20.990	52	.404		
	Greenhouse-Geisser	20.990	47.355	.443		
	Huynh-Feldt	20.990	50.730	.414		
	Lower-bound	20.990	26.000	.807		

Tests of Within-Subjects Contrasts

Measure: Perceived risk of illness

Source	Illness	Type III Sum of Squares	df	Mean Square	F	Sig.
illness	Level 1 vs. Level 2	61.922	1	61.922	71.563	.000
	Level 2 vs. Level 3	16.333	1	16.333	16.474	.000
Error(illness)	Level 1 vs. Level 2	22.497	26	.865		
	Level 2 vs. Level 3	25.778	26	.991		

Pairwise Comparisons

Measure Perceived risk of illness

(I) illness	(J) illness	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Short	Long	-1.514*	.179	.000	-1.973	-1.056
	Very long	-.737*	.145	.000	-1.107	-.366
Long	Short	1.514*	.179	.000	1.056	1.973
	Very long	.778*	.192	.001	.287	1.268
Very long	Short	.737*	.145	.000	.366	1.107
	Long	-.778*	.192	.001	-1.268	-.287

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

2. Do the question measure the same construct?

Cronbach's alpha per product

Product	Cronbach's Alpha	Product	Cronbach's Alpha
Orange juice	.965	**Bread**	.969
Sinas	.973	**Milk**	.909
Multivitamine juice	.984	**Chocolate sprinkles**	.514
Cake	.951	**Yogurt**	.989
Gevulde koeken	.951	**Butter**	.962
Chocolate bar	.852	**Cheese**	.962
Gingerbread	.984	**Prebaked bread rolls**	.928
Paprika crisps	.906		

Appendix C. – Used materials

Breakfast cake

Label 1. Original label

Label 2. "100% quality guaranteed until"

Label 3. 'Optimal until'

Figure 17. Breakfast cake and the used labels

Yoghurt

Label 1. Original label

Label 2. "100% quality guaranteed until"

Label 3. 'Optimal until'

Figure 18. Yoghurt and the used labels

Milk

Figure 19. Milk and the used labels

Attention focused campaign

Figure 20. Visual of the attention focused campaign

Interpretation focused campaign

Figure 21. Visual of the interpretation focused campaign

Questionnaire

Questions in italics were merely used in study 2.

Perceived risk

1. If I eat this yoghurt/breakfast cake today, the chance I get ill is… (1=very small, 7=very large)
2. If I eat this yoghurt/breakfast cake today, I face… (1=no risk at all, 7=a large risk)
3. *To what extent do you agree to the following statement? It is a wise decision to consume this yoghurt/milk today. (1=fully disagree, 7=fully agree)*

Perceived quality

4. The quality of this yoghurt/breakfast cake at the moment is… (1=very poor, 7=very good)
5. *How delicious is this yoghurt/milk today? (1=not delicious, 7=delicious)*

Disposal/usage likelihood

6. If you could choose between consuming and disposing the yoghurt/breakfast cake today, what would you do?'
    a. 1=definitely dispose
    b. 2=probably dispose
    c. 3=equally likely dispose or consume
    d. 4=probably consume
    e. 5=definitely consume

Appendix D. – Knowledge labelling study 2.

In our second study, we asked three questions to measure attitude towards and the knowledge about date labels. Via an open question, we checked whether respondents could recall which text was displayed together with the expiration date. Second, we asked via a closed question if respondents could recognize the text which was displayed together with the expiration date. Finally, we asked respondents, again via a multiple choice question the correct meaning of the best before date.

On average, 60% of respondents was able to recall the text which was displayed together with the expiration date. 37% of respondents was able to correctly recall the original labelling, while 23% was able to correctly recall the '*optimal until label*'. Thus 40% of respondents falsely recalled something different than the label which was displayed. 9% of respondents falsely stated the original labelling, while the *'optimal until label*' was displayed. 9% merely stated the date (without the label type) and 10% stated they did not know which label type was displayed. Finally, 12% of respondents stated a text which does not exist in real life, or gave an incorrect interpretation (figure 22).

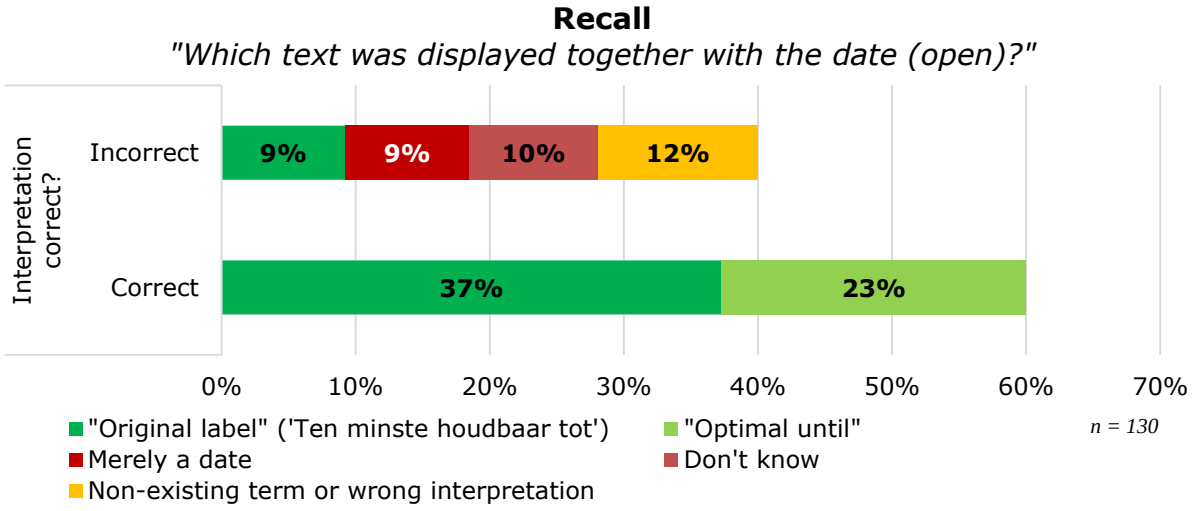

Figure 22. Recall date label study 2

A global view of the answers we labelled as 'non-existing terms' or 'wrong interpretations' are shown together with an English explanation in table 14.

Non-existing terms		**Wrong interpretation**	
Dutch	**English translation**	**Dutch**	**English translation**
Ten minste houdbaar tot en te gebruiken tot beide genoemd	*Respondent mentioned both BBD as UBD*	**Ik kan me alleen de datum herinneren, niet de tekst**	*I can only remember the date, not the tekst.*
Beste van smaak	*Best flavour*	**Dat je nadat de houdbaarheidsdatum verstreken is, de melk niet meer kunt drinken**	*You cannot drink the milk anymore, once the expiration date has passed*
Optimaal te gebruiken tot	*Optimal usable until*		
Te houden tot	*To hold until*		
Optimale kwaliteit	*Optimal quality*	**Ik kan me de tekst niet meer herinneren**	*I cannot remember the text*
Het best te gebruiken voor	*Best used before*	**Ik heb de tekst niet gezien, maar ik denk dat er stond: "ongeopend houdbaar tot…"**	*I have not seen the text, but I think it said: "If not opened, preservable until…"*
Best consumed before 1/6, of zoiets	*Best consumed before 1/6, or something like that*	**02/06 geeft aan dat het product na deze datum over tijd is.**	*02/06 indicates that the product after this date is 'over time'*
Ten minste houdbaar tot en met	*At least preservable up to and including*		
U.H.T.	*U.H.T. (Ultra-Heat Treated)*[5]		

Table 14. Wrong interpretation expiration dates study 2

When we look at the results for recognition, not surprisingly, the amount of 'correct' answers increases. Circa 4 out of 5 respondents correctly recognized the label which they saw in the questionnaire. 47% of respondents correctly recognized the original label and 32% recognized the *'optimal until label*'. 13% of respondents incorrectly stated they saw the original label, while in fact they saw the '*optimal until label*'. Also, 3% stated to have seen a use-by date, which was not used at all. 4% respondents stated they did not know which label they saw.

[5] U.H.T.: A way to make milk longer preservable. The milk stimulus we used contained a 'U.H.T.-label on the package. The milk stimulus can be found in appendix C as well.

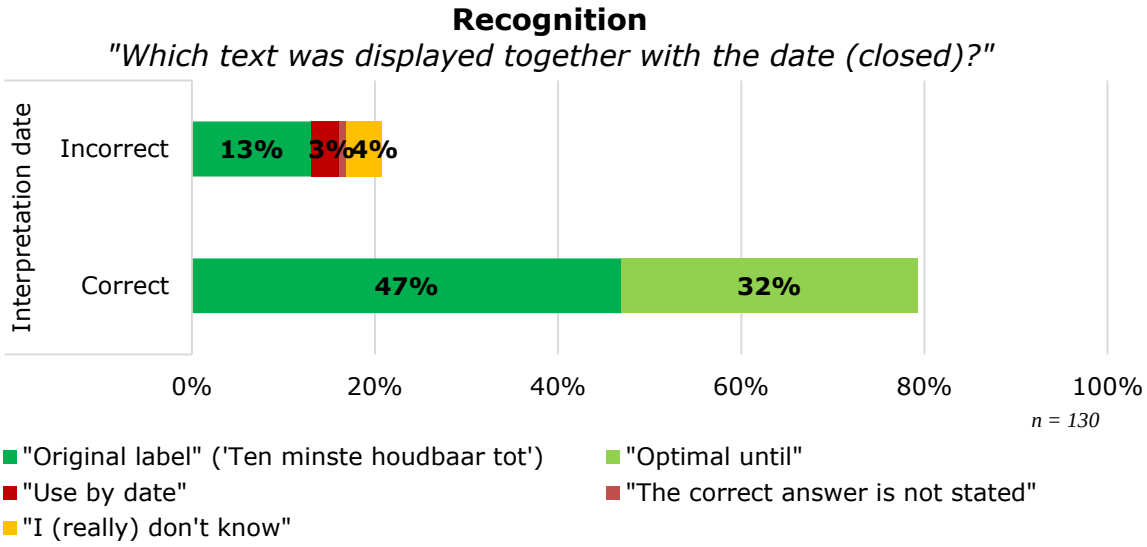

Figure 23. Recognition date label study 2

Finally, we asked respondents to pick the correct answer with regard to the meaning of the BBD. 60% correctly stated that the BBD refers to the manufacturer's guarantee of optimal quality. However, 17% stated the BBD refers to product safety, and 22% stated the final date a store is allowed to sell the product.

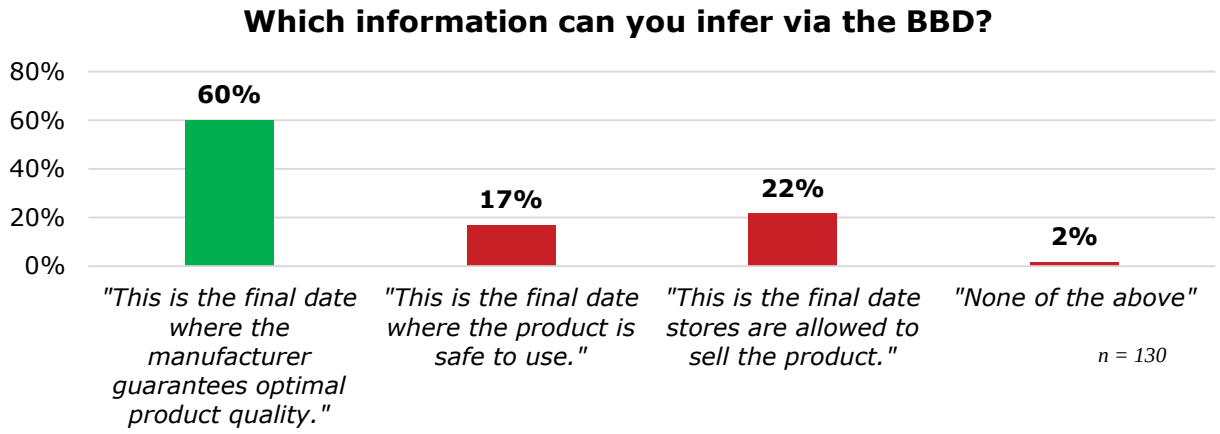

Figure 24. Knowledge meaning BBD study 2

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