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„Nudging as Tool to Reduce Date Label Related Food Waste on Consumer Level"

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Bei der Arbeit an den gefundenen Daten und beim Eintauchen in das Meer an Literatur zu unserem Thema habe ich herausgefunden, welch kreative Ideen Nudging bieten kann zur Etablierung eines nachhaltigeren Konsum- und Wegwerfverhaltens. Die Beschäftigung mit den Themen Nudging und Lebensmittelabfall eröffnete mir eine neue Welt an möglichen Lösungsansätzen und hielt meine Begeisterung und Motivation bis zum Ende des Arbeitsprozesses aufrecht.

ABSTRACT

Food waste is generally accepted to be one of the causes for global undernutrition. The best before date on yogurts is often misunderstood and is one reason for food waste generated by the consumer. In the present study, the intention was to lower the power of the best before date label in the consumers' perception by using nudging methodology. Nudging is a marketing tool to influence individuals without taking away or limiting their options. Several nudging mechanisms are known which are collected in the framework MINDSPACE. In the present work, the cues: salience, norms, messenger and priming were applied. This was done by raising data about the perceptions of a yogurt with exceeded best before date seen as a picture in a questionnaire. The questionnaire contained questions about the participant's willingness to eat the yogurt, the willingness to offer it to guests, and various sensory properties of the product. Furthermore, data were assessed about reasons for individual food waste, knowledge about the definition of the best before date, and personal food waste beliefs.

Results showed that there was no increased acceptance of the yogurts to be observed in the nudged groups compared to the control group (hypothetical consumption control group: 96.5%; nudge group "98% der Österreicher": 95.7%; nudge group "Hygieneexperte": 88.6%; nudge group "Reifer ist besser": 87.9%; nudge group "Priming": 90.1%). In fact, the liking of the nudging group "Hygieneexperte" was lower than the liking of the control group (liking scale from 1 - "not enjoyable at all" to 7 - "very enjoyable"; nudge group "Hygieneexperte": median 5; control group: median 6).

Generally, the participants claim that they still would consume the yogurt to a high percentage (91.8%). However only half of them would also offer the yogurts with exceeded date labels to their guests (46.3%). But again, the nudges applied do not change the willingness to offer the product to guests (willingness to offer to guests control group: 45.9%; nudge group "98% der Österreicher": 46.8%; nudge group "Hygieneexperte": 44.3%; nudge group "Reifer ist besser": 47.3%; nudge group "Priming": 47.3%).

A majority of the participants – 63.3% – claim their personal amount of food waste to be lower than the average. 75.3% of the participants chose the correct definition of the best before date and there is a generally high consent to the food waste beliefs (category 4 or 5 on a scale from 1 "I don't agree at all" to 5 "I totally agree") except for one belief. The consent to the food waste belief "I feel my efforts to decrease food waste can assist in reducing world hunger" shows a lower degree of consent from the participants (mode category 3). Women feel worse when they are disposing food items than men do.

For further research, a laboratory experiment with tasting of yogurts could be an approach to gain more powerful results. With this method, the hypothetical answering of the questions would be replaced by using the senses smell, taste and sight to assess the acceptance of the product which equals to a higher degree the real life situation. Also, the design of the nudges need further thinking in terms of their effect they might have on the target group. If the potential consumers of the yogurt are expected to be well informed about the topics food waste and sustainability this knowledge should be taken into consideration when creating the nudges. The nudging architects could work hand in hand with the consumers to make sure every side – the political players and the sustainable consumer – achieves the desired effect – which is to reduce food waste.

ZUSAMMENFASSUNG

Eine der Ursachen für die weltweite Unterernährung ist die Verschwendung intakter Lebensmittel. Ein Grund, der zu Lebensmittelabfall führt, ist unter anderem das Mindesthaltbarkeitsdatum, das vom Konsumenten oft falsch verstanden wird als Datum, zu dem das Produkt nicht mehr zum Verzehr geeignet ist. In der vorliegenden Arbeit wurde versucht, die starke Wirkung des Mindesthaltbarkeitsdatums auf den Konsumenten zu schwächen.

Das dazu verwendete Instrument ist nudging, eine Marketingstrategie, die den Konsumenten bzw. die Konsumentin beeinflussen soll, ohne dessen/deren Wahlmöglichkeiten einzuschränken. Aus dem Englischen übersetzt bedeutet nudging schubsen, anstupsen oder anstoßen. Die verschiedenen Mechanismen, auf denen nudging basiert, sind im Paper MINDSPACE von Dolan et al. (2012) zusammengefasst. Diese Arbeit bildet die Grundlage für die Planung des vorliegenden Projektes. In meiner Masterarbeit kommen die MINDSPACE Mechanismen Salience (Auffälligkeit), Norms (soziale Normen), Messenger (Wer sendet die Botschaft?) und Priming (Beeinflussung im Vorhinein) zur Anwendung. Dazu wurde ein Online-Fragebogen erstellt mit dem Bild eines Jogurtbechers, dessen Mindesthaltbarkeitsdatum überschritten war. Die Teilnehmer_innen sahen entweder einen Jogurtbecher mit einer nudge-Botschaft vor sich, oder mit leerer Oberfläche, wenn es sich um die Kontrollgruppe handelte. Nun wurde die Akzeptanz des Jogurts erhoben anhand von Fragen zur Bereitschaft zum Verzehr, zum Anbieten an Gäste sowie zu sensorischen Attributen wie Einschätzung des Geruchs, des Geschmacks und der Sicherheit des Produkts. Weiters wurden Fragen gestellt zu persönlichen Gründen, Lebensmittel wegzuwerfen, zum Wissen über die Definition des Mindesthaltbarkeitsdatums und zu persönlichen Einstellungen und Werten in Bezug auf Lebensmittelabfall und Nachhaltigkeit (Food Waste Beliefs).

Die nudge-Gruppen zeigten im Vergleich zur Kontrollgruppe keine gesteigerte Akzeptanz des Jogurts (hypothetischer Verzehr Kontrollgruppe: 96.5%; nudging Gruppe “98% der Österreicher”: 95.7%; nudging Gruppe “Hygieneexperte”: 88.6%; nudging Gruppe “Reifer ist besser”: 87.9%; nudging Gruppe “Priming”: 90.1%). Im Gegenteil war eher ein umgekehrter Trend zu beobachten. So schätzten die Teilnehmer_innen in der nudging Gruppe „Hygieneexperte“, die dem MINDSPACE Mechanismus „messenger“ zugeordnet ist, dass sie das Jogurt weniger mögen würden, als jene der Kontrollgruppe (Einschätzung Geschmack: Skala von 1 überhaupt nicht – 7 sehr gut; nudging Gruppe „Hygieneexperte“ Median 5, Kontrollgruppe Median 6).

91.8% der Befragten geben an, dass das Jogurt noch zum Verzehr geeignet sei. Allerdings würde nur rund die Hälfte (46.3%) das Produkt auch Gästen anbieten. Die

nudging Botschaften änderten jedenfalls nichts an der Bereitschaft, das Jogurt auch Gästen anzubieten (Bereitschaft, das Jogurt Gästen anzubieten Kontrollgruppe: 45.9%; nudging Gruppe “98% der Österreicher”: 46.8%; nudging Gruppe “Hygieneexperte”: 44.3%; nudging Gruppe “Reifer ist besser”: 47.3%; nudging Gruppe “Priming”: 47.3%).

Ein Großteil der Teilnehmer_innen – 63.3 % – gibt an, weniger als der durchschnittliche Bürger an Lebensmittelabfall zu produzieren. 75.3% wählen die richtige Definition des Mindesthaltbarkeitsdatums aus. Ebenfalls ist die Zustimmung zu den Food Waste Beliefs generell hoch (Modus Kategorie 4 oder 5 auf einer Skala von 1 keine Zustimmung – 5 volle Zustimmung). Am skeptischsten zeigten sich die Teilnehmer beim Food Waste Belief „Ich glaube, wenn ich mich bemühe, Lebensmittelabfälle zu reduzieren, kann dies den Welthunger mindern“ (Modus Kategorie 3). Frauen zeigen eine teilweise höhere Zustimmung zu den Food Waste Beliefs als Männer. So fühlen sie sich beispielsweise schlechter, wenn sie Lebensmittel entsorgen.

Eine Vermutung für die geringe Reaktion auf die Nudges ist, dass diese zu offensichtlich gewählt waren. Die Teilnehmer waren eventuell verwirrt davon oder ließen sich einfach nicht beeindrucken. Eventuell waren die Befragten auch schon sensibilisiert auf die Themen Nachhaltigkeit und Lebensmittelabfall und beantworteten den Fragebogen dementsprechend, indem sie eine höhere Akzeptanz für das Produkt angaben. Das Design der Nudges müsste folglich hinsichtlich der Zielgruppe überarbeitet werden, um auf deren Informationsstand einzugehen und so eine tatsächliche Steigerung der Akzeptanz zu erreichen.

In einem weiteren Schritt empfiehlt sich eine tatsächliche Verkostung von Jogurts mit Nudges und einer Kontrollgruppe im sensorischen Labor. Dadurch könnten aussagekräftigere Ergebnisse erzielt werden, als wenn die Attribute von den Teilnehmern, wie in der vorliegenden Arbeit, nur hypothetisch eingestuft werden.

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1 INTRODUCTION

1.1 THEORETICAL BACKGROUND

1.1.1 FOOD WASTE AND DATE LABELLING

Food waste does have negative impacts on the environment, society and economy. (EPRS European Parliamentary Research Service 2014).

For the total amount of 89 million tons of food waste in the European Union per year 170 million tons CO_2 are emitted. For 2020 the Bio Intelligence Service of the European Commission forecasts an emission of CO_2 of 240 million tons related to food waste. These emissions contribute to the greenhouse effect and climate change (BIOIS 2011).

In economic terms food waste is an investment for nothing – it increases the prices for food and lowers the farmers' income (EPRS 2014).

Food waste stands for resources such as labor, land, water and energy that have been used for no reason. Reducing food waste means saving these resources for the actual production of food to feed the growing population.

By 2050, the world population will increase to an estimated 9.6 billion people. Currently 1 billion people worldwide are malnourished (Global Nutrition Report 2016). In the years 2014-2016 795 million people suffered from undernourishment worldwide. This equals one in nine persons being undernourished (FAO 2015). It is a tremendous challenge to provide the growing world population with sufficient calories. According to experts, one of the strategies to improve food security could be to reduce food waste. By this measure the increase of food production could be held on a lower level which saves resources and emissions (EPRS 2014).

There is no consistent definition of food waste. The Food and Agriculture Organization defines food which is lost during sowing, cultivation, harvesting, processing, preserving, and the first agricultural transformation stages as "food losses". Food that is disposed by the retailer or consumer is defined as "food waste" (FAO 2011).

Of the 4 billion tons of food that are annually produced worldwide 30% (FAO 2011) to 50% (EPRS 2014) is wasted.

In EU, the average amount of food waste per capita is 179 kg per year based on data of EUROSTAT from 2006. Varying widely among the member states of the EU, in Austria the average amount of food waste per capita is about 209 kg per year (Kretschmer et al. 2013).

In industrialized countries, the largest part – 42% – of the disposal of edible food items is caused by the consumer (EPRS 2014, BIOIS 2011).

According to Lucifero (2016), the overall reasons for consumer caused food waste in industrialized countries are based on sociological factors (such as family structures and lifestyle) and consumer behavior related to societal wealth in general. Factors that influence the quantity of food waste on the consumer level are household size and composition (smaller households tend to cause more food waste), household income (higher income leads to more food waste), household demographics (more young members cause more food waste), and household culture (lifestyle) (Parfitt et al. 2010, HLPE 2014).

The detailed causes for food losses and food waste on the consumer level are (WRAP 2012, HLPE 2014, BIOIS 2011):

- lack of awareness of the amount of food waste produced by the individual, the environmental impact of food waste, personal financial benefit of saving food waste
- consumer do not value food high enough
- unplanned purchases that lead to surpluses
- poor stock management in the household
- poor food preparation – preparing too large portions, that are not eaten; preparing meals that do not meet the taste of the family members; lack of knowledge about leftover management, throwing away too much of the edible parts like skins of fruits
- **confusion and misinterpretation of best before date and use by date.**

In this thesis, the emphasis is put on date labelling as cause for consumer based food waste. This factor will be discussed in detail.

Lucifero (2016) claims the legislation and the food producing companies to be responsible for food waste in terms of special quality requirements and appearance standards for food items.

Waarts et al. (2011) suggest the following adaptations in the legislation to reduce food waste: The date labels on food items are often set for a too narrow time span. There are products with a long shelf life for which the expiration dates could be prolonged by the government. Also, there is the suggestion to abolish date labels for non-perishable products like salt or spices.

Grocery stores tend to remove products earlier than necessary from the shelves because of product liability (Waarts et al. 2011).

In July 2017, Greenpeace Austria published the results of the microbiological and sensory testing of several food items with exceeded date labels. Their tests included both dairy yogurt and soy yogurt. The products were stored under the recommended

storage conditions and then analyzed by a food research laboratory two weeks after the best before date. The soy yogurt and the yogurt were still in the same condition as before the date labelled, so the products were tested again every two weeks. The soy yogurt was edible until five months after the best before date and the dairy yogurt was still edible six months after that date (Greenpeace 2017).

Bio Intelligence Service suggests standardizing food date labelling as a measure to minimize food waste in Europe (BIOIS 2011).

For the consumers, food items close to the expiry date (Tsiros and Heilman 2005) and deformed food items are not attractive for purchase (Aschemann-Witzel et al. 2015). In terms of shelf life, the willingness to pay is lower for suboptimal food items (Tsiros and Heilman 2005). Also, if products with different best before dates are arranged in the same shelf by the grocery stores, the consumers prefer the ‘freshest’ product to the ‘oldest’ (HLPE 2014).

A relevant point concerning food labelling is the consumers’ difficulty to distinguish the terms “best before date” (minimum durability date) and “use by date” (expiry date).

According to the EU regulation 1169/2011 the definition of the best before date or minimum durability date (Mindesthaltbarkeitsdatum) is “the date until which the food retains its specific properties when properly stored”. This EU regulation includes the following passage about the use by date:

“In the case of foods which, from a microbiological point of view, are highly perishable and are therefore likely after a short period to constitute an immediate danger to human health, the date of minimum durability shall be replaced by the ‘use by’ date. After the ‘use by’ date a food shall be deemed to be unsafe.” (EU regulation 1169/2011).

Food items labeled with a “use by” date should not be consumed beyond this date since they could be hazardous to health. The best before date however does not label the product to be a risk for health once this date is exceeded (Lucifero 2016). Consumers seem to confuse these two terms and so, food which is still edible is often disposed and contributes to the consumer caused food waste.

In the U.S., this problem seems to have even larger dimensions since there exists a multitude of date labels such as the “production” or “pack” date, “sell by” date, “best if used by” date, “use by” date, “last date recommended for the use of the product while at peak quality”, “freeze by” date and the “enjoy by” date. These date labels are not defined clearly. Their regulations vary among the states. Also, the use of these dates can differ from product to product and from manufacturer to manufacturer. The manufacturers and retailers choose the kind of date labelling and define the actual date they print on their

products. This happens according to their marketing standards and is meant to ensure the brand integrity which often leads to earlier date labels than necessary (NRDC 2013).

In the UK, research showed that 45-49% of the consumers misunderstood the meaning of the labels “sell by” and “use by”. In this study, it is estimated that 20% of avoidable food waste in the UK is related to the confusion of the date labels (BIOIS 2011).

In the waste report of the Bio Intelligence Service of the EU date labelling is also stated as a reason for consumer related food waste. The report claims that consumers often do not distinguish between the terms “best before”, “sell by”, “use by” or “display by”. Eventually the different labels are treated the same and in many cases food which is still suitable for consumption is thrown away. The paper implies that the consumers’ sensory judgement is used in combination with the date label to decide whether the food item is discarded or not. The lack of transparency in date labelling is seen as a cause for food wasted which was actually still edible (BIOIS 2011).

As demonstrated by the summarized facts above, consumer based food waste is strongly related to date labelling. More precisely the consumers’ misunderstanding of date labels leads to the disposal of food items which are actually still edible. Thus, the goal for the present project is to reduce unnecessary food waste by slight changes in the way date labels are perceived by the consumer.

1.1.2 NUDGING

The target of reducing consumer related food waste calls for a change of behavior. Usually when it comes to influence the behavior of consumers, tools like information, incentives, or taxes come into action.

Research has shown that there is another possible approach to influence consumer behavior. The key is to change the environments in which consumers act rather than appealing to their conscious minds. Mostly automatic and unconscious processes are influenced by small adaptations of the consumers’ surroundings (Dolan et al. 2012).

Thaler and Sunstein (2008) have worked on the topic of the so called “libertarian paternalism”. This is a form of paternalism to influence peoples’ choices. Other than in “traditional” paternalist approaches, there are no constraints or compulsions. Thaler and Sunstein call their approach “nudging” and describe it as a way to influence peoples’ behavior without limiting their freedom. People tend not to make rational and well considered decisions all the time. Many decisions are made automatically, impulsively and unreflectedly. Due to these systematic “failures”, the planners have the chance to influence the peoples’ behavior without the nudged people even realizing it most of the time (Leonard et al. 2008).

This is also part of the definition of nudging by Hausman and Welch (2010):

„Nudges are ways of influencing choice without limiting the choice set or making alternatives appreciably costlier in terms of time, trouble, social sanctions and so forth. They are called for because of flaws in individual decision-making, and they work by making use of those flaws. “

Thaler and Sunstein (2008) explain that in all undertakings regarding the health, economy or sustainability sectors, planners must be choice architects. They emphasize that nudging is not nannying:

„A nudge, as we will use the term, is any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid.”

There are several attempts at categorizing and ordering the functions of nudging and architecture of choice. The most relevant papers presenting categorized nudging mechanisms for the present thesis are Lehner et al. (2016) (see Table 1) and the framework MINDSPACE by Dolan et al. (2012) (see Table 2).

Table 1: Nudging Mechanisms (Lehner et al. 2016)

Nudging Mechanism	Application
Simplification and framing of information	Presenting information straightforward and so that it meets the information processing ability of the consumer; phrasing the information in way that attracts the desires and values of the consumers
Changes to the physical environment	Product placement in shelves and in the shops (Goldberg and Gunasti 2007); reduced plate size reduces calorie intake and food waste (Freedman and Brochado 2010)
Changes to the default option	People tend to take the easiest and fastest way, they do not act if it is not necessary, e.g. if the default at printers is double sided, people do not make the effort to change it and there is less paper wasted (Egebark and Ekstrom 2013)
Use of social norms	People are influenced by want the “norm” is; what other people do; they tend to go with the crowd

Dolan et al. (2012) developed a framework on the different ways that influence behavior – The MINDSPACE way. It is both a summary and an attempt to categorize the various mechanisms behavior change and choice architecture are built on.

This framework is also used as an important base for the present thesis. The planning of the investigation was in fact built up around the MINDSPACE framework.

Table 2: MINDSPACE cues (Dolan et al. 2012)

MINDSPACE	Behavior
Messenger	We are heavily influenced by who communicates information to us; e.g. experts' opinions are highly esteemed; information communicated by individuals who are alike the recipient is more easily processed
Incentives	Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses; financial rewards encourage healthy lifestyles (Marteau et al. 2009)
Norms	We are strongly influenced by what others do; social customs and standards are followed by the members of the certain group
Defaults	We "go with the flow" of pre-set options; people avoid active choice making if possible which leads them to the default option
Salience	Our attention is drawn to what is novel and seems relevant to us; in todays' lives people are inundated with information, therefore strategies to filter out what seems relevant became necessary
Priming	Our acts are often influenced by sub-conscious cues; activation of memories has influence on present experiences, often subconsciously
Affect	Our emotional associations can powerfully shape our actions; automatic emotional responses to words or sights influence the behavior before the rational thinking has a chance to work
Commitments	We seek to be consistent with our public promises and reciprocate acts; commitments are more effective the higher the costs for failure are
Ego	We act in ways that make us feel better about ourselves

1.1.3 NUDGING AND FOOD WASTE

Date labelling is a factor that contributes to food waste. The most meaningful and probably the most successful solution to come by this problem would probably be to rethink the regulations for date labelling (Waarts et al. 2011).

Since this is unlikely to happen in the near future, nudging could be a new approach. As reported by Sunstein (2014), nudging can be a possibility to encourage pro-environmental and sustainable consumption. It can be utilized to promote policy successes by either weakening counteracting forces (like media or marketing strategies) or raising environmentally positive behavior (Thaler and Sunstein 2008).

Nudging has been applied in the field of sustainable consumption and has in parts shown positive effects. For the present thesis, I want to concentrate on the examples of reducing food waste through nudging.

Wansink et al. (2013) investigated the sales and the waste of apples in school cafeterias when they are sliced before being sold. They found out that by simply slicing apples instead of selling the whole fruit the percentage of students eating only half or less of the fruit decreased by 48% compared to the control group. The control group consisted of students of schools which were still offered whole apples. This measure can be classified as default according to the MINDSPACE cues. The physical environment changed; the students were offered sliced fruit which they accepted.

The mechanism of default seems to work particularly well in terms of reducing food waste. Several research groups tried experimenting with reduced plate size or portion size.

Freedman and Brochado (2010) determined various effects of reduced portion size of French fries in a five-week nonlaboratory environment. The setting was a university all you can eat dining with the subjects being mainly students who regularly eat at the dining. Diners (students) could choose bags of French fries of 88g each. After the first week, the content of the bags decreased weekly by 15g for four weeks to 44g in the 5th week. It was reported how many bags were taken by the students and how much of the French fries was left on the tray and returned to the kitchen. This was done without the diners knowing about the procedure. The results were a reduction in the grams consumed per diner (from 74.3 ± 2.2g at portion size 88g to 52.2 ± 6.0g at portion size 44g) and a reduction in the total grams wasted (grams wasted from 6g at portion size 88g to 4g at portion size 44g).

Motivated by the existing literature about reduced plate and portion size, Kallbecken and Saelen (2013) conducted a study testing the nudging tools of default and social norms to motivate guests of a hotel chain towards a more sustainable consumption behavior.

For the investigation, restaurant buffets of seven hotels belonging to the hotel chain were assigned to treatment number one, further seven hotels of the chain were in treatment number two. A total of 38 hotels were in the control group.

In treatment one, the guests were offered smaller plates at the buffet. The assumption was that the food waste would reduce through this measure, which complies the nudging mechanism of default.

The second treatment was a sign at the buffet in the hotel restaurant with the following words: ‘‘Welcome back! Again! And again! Visit our buffet many times. That’s better than taking a lot once’’. By this measure social cues should be activated and the guests of the buffet were encouraged to serve themselves smaller portions and thus causing less food waste. Because of the explicit invitation, guests are meant to feel good about going to the buffet several times and should feel like it is a “normal” thing to do. In addition, if some guests are following this invitation it is more likely that other guests will do the same – this is the way social norms are working (Herman and Polivy 2005).

The result of using smaller plates is a reduction in food waste of 19.5%. Treatment number two – the sign at the buffet – led to a reduction in food waste of 20.5%. Guest satisfaction did not change through the intervention and the hotels had a financial benefit through reducing food waste. Therefore, the authors are talking of a win-win situation for the hotels on the one hand and the environment on the other (Kallbecken and Saelen 2013).

Because choices in food, eating habits, and therefore the production of food waste, are especially linked to emotion-driven and irrational ways of human decision-making, nudging seems an ideal tool to influence consumers’ decisions.

1.1.4 NUDGING AND DATE LABELLING

As demonstrated by various studies, nudging can work to reduce food waste. Most of the results are due to the tool of default and social norms.

So far there is no research on the usage of nudging for reducing food waste by specifically addressing the issue of date labelling.

The Department for Environment Food and Rural Affairs (DEFRA 2011) suggests making the “display until” and “sell by” date less visible in order not to influence the consumers, since this date is only meant for the retailer. This is already an approach which is similar to the nudging idea.

Especially for the present thesis the focus lies on the date label as a reason for food waste. Through analyzing the MINDSPACE framework, several different slogans were worked out as nudges that address the date label on the yogurt. By this measure, the

power of the date label should be weakened. The participants should put more trust in the taste and the safety of the yogurt despite its best before date being exceeded.

1.2 RATIONALE AND RESEARCH QUESTIONS

1.2.1 ACCEPTANCE OF A YOGURT WITH EXCEEDED BEST BEFORE DATE

The overarching goal is to reduce consumer based food waste caused by date labels that indicate a too short shelf life. The basic idea is to give the consumer a positive overall perception of a yogurt with an exceeded minimum durability and to make the consumer more willing to consume the yogurt longer.

The aim of the whole project is to investigate whether nudging can be a tool to make a yogurt with exceeded best before date more acceptable among the consumers in comparison to a plain yogurt which has no nudge. In regard to this question it is of interest which MINDSPACE mechanism i.e. which nudge works most efficiently

This higher acceptance of nudged yogurts compared to yogurts without a nudge means that a higher willingness to eat the yogurt, to offer it to guests and to consume the yogurt longer is expected in the nudged groups. Furthermore, the estimated food safety and sensory properties like taste and smell and the overall liking are expected to be better in the nudged groups compared to the control group. These evaluations are also tested for sex differences.

Another part of the study is to test the connection between the estimated personal amount of food waste and the edibility and offering the yogurt to guests.

1.2.2 KNOWLEDGE BEST BEFORE DATE

Another part of the questionnaire was designed to test whether the knowledge about the difference between the “best before” date and the “use by” date influences the rated edibility and acceptance of the yogurt with exceeded date label in the nudged groups and in the control group. Also, the answer to this question is brought into connection with the willingness to offer the yogurt to guests.

In the questionnaire reasons for disposing food were raised. It is of interest whether the chosen reasons have any connections with the chosen definition of the best before date. In this context, the hypothesis is that if the participants choose the reason “best before date exceeded” to dispose of food, they tend to choose the wrong definition of the best before date over the right definition.

1.2.3 FOOD WASTE BELIEFS

Farr-Wharton et al. (2014) claim that behavior that leads to food waste is an environmentally significant behavior. In general, environmental awareness tends to grow

among customers. However, food waste has not been a policy priority in recent years. Thus, a sort of mindlessness has led to a wasteful handling of food. People tend to buy, consume, and waste food carelessly. This behavior and its impact can be completely unconscious (BIOIS 2011).

The third big part of the data collection in the questionnaire therefore concentrates on personal food waste beliefs. These are questions about participants' personal opinions and beliefs regarding food waste and its environmental, ethical, and social impacts.

First, the consent to each of the food waste belief is raised and tested for sex differences.

It is tested whether there is a stronger consent to the food waste beliefs among the people who rate the yogurt edible. Another hypothesis is that people with a high consent to the food waste beliefs use the yogurt longer.

It is of special interest to analyze if a low amount of estimated individual food waste goes along with a high consent to the belief of sustainability.

The food waste belief of sustainability is also brought into connection with the definitions of the best before date.

Finally, correlations between the singular food waste beliefs are examined.

With this measure, I want to analyze the participants' personal values concerning food waste, the environment, and society, and to which degree they see their own responsibility in such questions.

2 MATERIALS AND METHODS

2.1 STUDY DESIGN OVERVIEW

An online questionnaire was created to collect data for answering the research questions stated above. The following chart provides an overview about the principle structure of the questionnaire (see Figure 1).

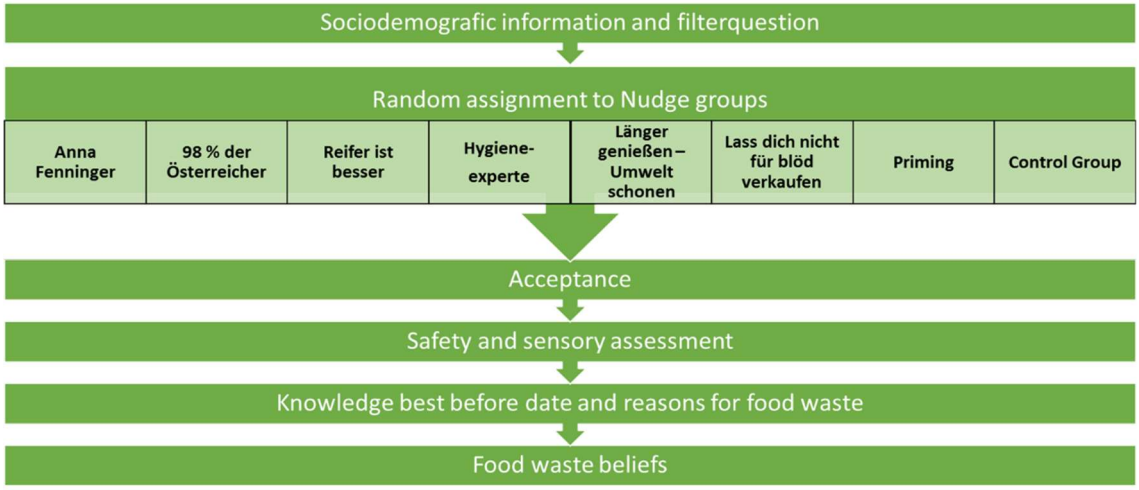


Figure 1: Intervention Concept (Erbschwendtner 2017)

According to the description of Dolans' (2012) MINDSPACE cues, seven nudges were designed (see Table 3). These nudges are applied on the picture of a neutral yogurt bucket, which is presented to the participants in the questionnaire (see chapter 2.2).

Table 3: Nudges Applied in the Questionnaire

Short description german	Short description english	MINDSPACE cue
Anna Fenninger	Austrian Skiing star	Messenger
98% der Österreicher	98% of the Austrians	Norms
Reifer ist besser	Mellower is better	Salience
Hygieneexperte	Hygiene expert	Messenger
Länger genießen – Umwelt schonen	Enjoying longer is environment friendly	Commitment, Norms
Lass dich nicht für blöd verkaufen	Don't let others take you for a fool	Salience, Norms, Affect
Priming	In the course of our master thesis we want to counteract	Priming

Short description german	Short description english	MINDSPACE cue
	unnecessary food wasting. Help us to reduce food waste together!	

In the present thesis, just four of these nudges are discussed, since the others are discussed in the thesis written by Lisa Erbschwendtner (2017).

The nudges that are analyzed detailed in the present study are:

- Reifer ist besser (Mellower is better)
- 98% der Österreicher (98% of Austrians)
- Hygieneexperte (Hygiene expert)
- Priming

2.2 NUDGES

2.2.1 SALIENCE: REIFER IST BESSER

In an environment that holds a lot of stimuli all the time and everywhere people filter information in order to make decisions. Information that passes these filters is usually the one that is easy to understand, flashy, and catchy. In the MINDSPACE model, this process is met by the cue *salience* (cf. Dolan et al., 2012). According to this work, *salience* influences behavior through novelty, accessibility and simplicity to make people most likely to recognize information.

Lehner et al. (2016) phrase four types of nudging tools, one of which is called “simplification and framing of information”. Similar to *salience* as a MINDSPACE cue, simplification is meant to present the information in a more straightforward way to support people’s decision-making processes as best as possible. Framing is explained as the phrasing of information that appeals to the values and attitudes of consumers.

In a systematic review, Wilson et al. (2016) try to show the evidence of the nudging categories salience and priming for a healthier eating behavior. They conclude that the combination of salience and priming nudges has a positive effect on a healthier eating behavior. An example in this review for salience nudges are labelling food items with the calorie content of food items and beverages. In a study by Wisdom et al. (2010), this measure leads to a reduction of calorie intake of almost 100 calories per meal. Olstad et al. (2014) use descriptive labels to promote healthier snacks and beverages at a café. Here, fun labelling of the food was applied such as “wacky watermelon slushie” and

“funky chicken teriyaki wrap”. However, there are no significant differences in the sale of healthy and unhealthy food items.

The nudge “Reifer ist besser” (Mellower is better) is designed according to *salience* characteristics. It is a short and catchy phrase referring to e.g. wine, where there is the famous saying that wine gets better with age or cheese for which maturity is often a hallmark of quality.

In the yogurt package design for the present study, the phrase’s yellow highlighting should be eye-catching in contrast to the blue background.

The intention is to give the consumer the quick and easy hint that the yogurt gets better aged so that it is not thrown away so carelessly.

Figure 2: Yogurt „Reifer ist besser“

2.2.2 NORMS: 98% DER ÖSTERREICHER

Social norms are unwritten rules that regulate interactions in a society. Once a certain behavior or attitude is established, the members of the group tend to adjust to the norm. Social norms can vary widely among different groups. They can influence the members of a group or a society based on what the other members within that group do. This is because we tend to strive for conformity (Young 2007). Burke and Young even state that the more closely a social rule is followed the more likely it is that even more people will follow (Burke and Young 2009).

A vivid example of the application of social norms as nudging tool is the “Most of us wear seatbelts campaign”. Here citizens were asked to report their use of seatbelts and guess the percentage of citizens using seatbelts. They guessed that 60% were using seatbelts. However, 85% of the participants claimed to use seatbelts in a car themselves. By implementing the campaign “Most of us wear seatbelts” the self-reported usage of seatbelts could be significantly increased (Linkenbach und Perkins 2003).

Another example is one of which the aim is to alter the behavior of hotel guests towards more environmental friendly use of towels. Here in the rooms of one group of hotel guests a descriptive norm was applied which said: “JOIN YOUR FELLOW GUESTS IN HELPING TO SAVE THE ENVIRONMENT. Almost 75% of guests who are asked to participate in our new resource savings program do help by using their towels more than once. You can join your fellow guests in this program to help save the environment by reusing your towels during your stay.” Another group of hotel guests could read a standard environment message which was: “HELP SAVE THE ENVIRONMENT. You can show your respect for nature and help save the environment by reusing your towels during your stay.” Here the descriptive social norm turned out to be significantly more successful (Goldstein et al. 2008).

Drawing on these examples, focusing on social norms for the present study goal seemed to be a good idea. The high percentage value shown on the picture is consciously chosen and entirely fictional. The participants should want to feel like belonging to “the 98% of Austrians”, who would eat the yogurt also after the date labeled. The social norm should convince the participants to do the same as 98% of Austrians.

Figure 3: Yogurt „98% der Österreicher“

2.2.3 MESSENGER: EXPERT OPINION

Whether a piece of information is regarded as trustworthy or valuable depends to a great degree on the person communicating it. If the messenger is a person of authority, the receivers are more likely to comply, even if the information itself may not make sense. Both the value and the perceived truth of an information rise if the messenger appears credible.

People also tend to accept information more easily if the messenger is more alike them and they can relate to the messenger.

If the messenger is considered an expert in the respective field, changes in behavior are more likely to follow (Dolan et al. 2012).

This is demonstrated in a study by Webb and Sheeran (2006) that showed that health interventions are more effective when explained by research assistants and health educators than when communicated by trained facilitators or teachers.

Based on these findings, the nudge “Hygieneexperte” is constructed. It says: “Tipp: Hygieneexperte Dr. Manafi empfiehlt: Auch nach Ablauf unbedenklich!” It includes the reference to a “hygiene expert” which should suggest that the messenger is an expert in the field of microbiology and therefore surely can make serious statements to a yogurt with exceeded best before date. This expert recommends to not worry about consuming the expired product. According to literature, the idea is that the participants react to the

messenger nudge and, due to their trust in the expert's information, will rate the yogurt better and safer.

Figure 4: Yogurt „Hygieneexperte"

2.2.4 PRIMING

Another way of influencing consumer's choices is by activating subconscious cues before introducing the actual choice. This method is called *priming*. The actual decisions are altered through words, sights or smells that the consumer is exposed to (Bargh 2006). In the present thesis, words were applied for the nudging tool of *priming*.

Studies show that people who have been exposed to words that remind them of elderly people make them walk slower and have a poorer memory afterwards (Dijksterhuis and Bargh 2001). When people were requested to form a sentence including words such as *fit*, *active* or *athletic*, they started to use the stairs instead of the elevator significantly more often (Wryobeck and Chen 2003).

In the present work, the participants were primed by being presented a sentence before they got to the picture of a neutral yogurt cup without any further nudge labelling.

The participants read a short introduction about the intention of the questionnaire – "In the course of our master thesis we want to counteract unnecessary food wastage. Help us to reduce food waste together!". Then they go on with filling out the questionnaire. The idea is that because of the "reminder" the participants are going to state that they would use the expired yogurt longer, offer it to guests more readily, etc.

The “communitarian” character of the priming introduction could interact with the MINDSPACE cue *norms* which suggests that the feeling of belonging to a group influences the choice architecture (Dolan et al. 2012).

Also, the MINDSPACE tool e*go* may play a role in this case because one wants to feel self-consistency. This means that people want to act in accordance with their beliefs and values. If their sense for environmental protection is touched by the priming words, they might be less inclined to dispose of the yogurt too quickly.

„Im Rahmen unserer Masterarbeit wollen wir einen Weg finden, unnötiger Lebensmittelverschwendung entgegenzuwirken. Helfen Sie mit, reduzieren wir gemeinsam Lebensmittelabfälle!“

Figure 5: Yogurt Control Group and Priming

2.3 CALCULATION SAMPLE SIZE

The required sample size was calculated with the software G*Power which was developed by Heinrich Heine University Düsseldorf. The effect size chosen was 0.15. It is an F-test and the type of power analysis is a priori which includes a given alpha (0.05), power (0.95) and effect size.

The study (including the co-study by Erbschwendtner 2017) includes 8 groups. G*Power accounted for a total sample size of $N = 984$ which makes $N = 123$ for each group. With 123 participants in each group a power of 0.95 can be reached.

For the five groups, that are analyzed in the present study, that accounts for *N* = 615 total sample size.

2.4 PARTICIPANT RECRUITEMENT

The link to the questionnaire was placed mainly on Facebook and through e-mails.

Via e-mail probably the greatest variety of people was reached – relatives of all ages, co-workers and ex-co-workers of different companies of different sectors. All of them were asked to spread the link generously.

Most of the participants found the link to the questionnaire on Facebook. There, friends and friends of friends participated. A big group are probably also the participants who saw the link in one of the numerous “groups” on Facebook that were used to spread the link.

2.5 QUESTIONNAIRE STRUCTURE

After agreeing to the declaration of consent, the participant is guided to the questionnaire, which consists of three blocks. The middle block of which differs depending on the nudging group the participant is randomly assigned to.

2.5.1 BLOCK 1: SOCIODEMOGRAPHIC DATA

First, socio-demographic data like age, degree of education, profession as well as income is raised. These questions are either single choice or open questions (age). For filtering out subjects, which never consume yogurt, section one ends with the question to the frequency of consuming yogurt.

2.5.2 BLOCK 2: YOGURT PICTURE AND ACCEPTANCE

In the second block, the participants are randomly directed to the picture of either one of the 4 nudged yogurts or the control group with a blank surface on the yogurt bucket.

The picture is followed by questions to investigate the acceptance of the yogurt. This is achieved by several sub-aspects (see Figure 6).

Most importantly the edibility of the yogurt – here the participants can choose whether they think the yogurt is still edible or not.

Next, the time span as to how long the yogurt would still be consumed by the participant is investigated. Participants can choose a date via click into a calendar to determine the last day of consumption.

Another point to assess the acceptance of the yogurt is the willingness to offer the yogurt to guests (yes/no question).

Furthermore, the estimated safety of the yogurt and the estimated intensity of the sour taste of the yogurt are raised (scaled questions). The participants could rate the safety they would state for the yogurt in the questionnaire on a bar with 7 categories. On the bar, 1 stands for the lowest and 7 for the highest safety class. The variable taste is scaled from 1-7, with 1 as the least noticeable intensity for sour taste and 7 the most noticeable intensity of the sour taste of the yogurt.

Then it is researched what the participant thinks the smell is like and how much they would like the yogurt with scaled questions. Smell is scaled from category 1 which stands for “doesn’t smell good at all” to category 7 which stands for “smells very good”. The “liking” could be rated from 1 “not enjoyable at all” to 7 “very enjoyable” (Oberrauter 2016).

The second block is finished with raising information about the sum of money people would spend for the product they see on the picture. Participants are asked to write a number for the amount of money by themselves.

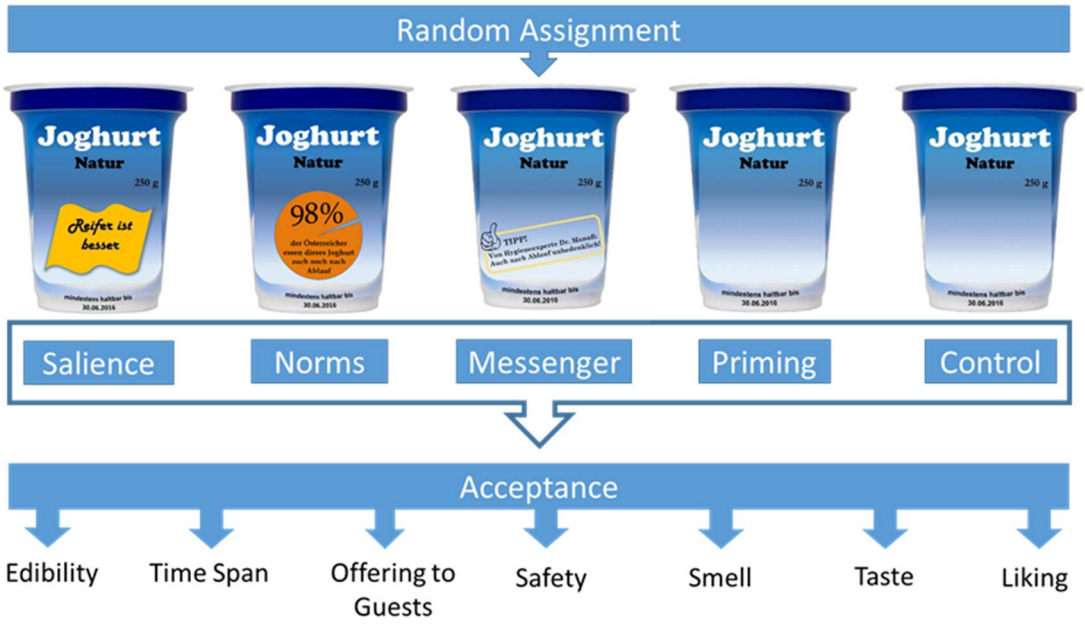


Figure 6: Scheme of Assessing the Acceptance of the Yogurts

2.5.3 BLOCK 3: REASONS FOR FOOD WASTE AND FOOD WASTE BELIEFS

By comparing the average amount of food waste an Austrian household produces weekly (0.8kg, see Figure 7) to the personal amount of food waste, the participants are asked to guess whether they produce less, the same or more by themselves (Stadt Wien).

Figure 7: Average Amount of Food Waste per Capita per Week (Corina Scherrer)

Furthermore, personal reasons for producing food waste are raised. This is a question where participants can choose one or more from multiple options.

The knowledge about the best before date is raised with the next question – a single option question to investigate whether the participant knows the exact definition of the best before date. The answer options for this question are the following with the first option as the correct definition:

- Producers' guarantee for the quality of the product
- Expiry date of the product
- Expiry date for sale
- I don't know

These options are shown to the participants in a random order.

Finally, there are questions about personal food waste beliefs. With the tool of the food waste beliefs the participants determine to which degree they agree to beliefs concerning food waste. These beliefs touch, for example, the impact personal food waste has on the environment, on the global food distribution, or what the main sources of food waste are. These food waste beliefs are taken from a Master thesis by Gundlach (2015) and from Whitehair et al. (2013). The food waste beliefs are elevated by ranging on a scale from 1-5, with 1 for no consent to the beliefs to 5 for full consent.

2.6 DATE LABEL ON THE YOGURT

The expiry date on the pictures of the yogurts is 30.06.2016. This date never changes during the running time of the investigation which started on 04.07.2016 and lasted until 13.07.2016. So, for the participants who filled out the questionnaire on 04.07.2016 the

yogurt had been expired only 4 days ago. For the ones who participated on 13.07.2016 it had already expired 13 days ago.

Thus, there is a span of 9 days. Of course, this can influence the number of days until which the yogurt would still be consumed. Someone who sees a yogurt which has expired 4 days before might estimate the quality as better than somebody who sees a yogurt which has already been expired for 13 days.

In the questionnaire, the participants were asked to choose a date up to which they would consume the yogurt the latest. With this measure, the effect of the different expiration spans were meant to minimize, since this date could technically also be set in the past. It refers to the timespan in which the yogurt would still be consumed by the participant starting from the minimum durability date.

2.7 STATISTICS

To analyze the research questions, hypotheses were formulated and tested using SPSS with a probability level of <= .05.

2.7.1 ACCEPTANCE OF A YOGURT WITH EXCEEDED BEST BEFORE DATE

Hypotheses:

- Yogurts with an exceeded minimum durability date are more often considered edible if nudged than without a nudge.
- Yogurts with a nudge are more often offered to guests than yogurts without a nudge.
- Yogurts with a nudge are consumed longer than yogurts without a nudge.
- If the participant would not consume the yogurt, they rate the liking lower.
- If the participant would not consume the yogurt, they rate the smelling, taste and safety worse.
- Nudged participants rate the liking higher than the control group.
- Nudged participants rate the sour taste less intense than the control group.
- Nudged participants rate the safety of the product higher than the control group.
- People who think they produce less food waste than the average Austrian are more likely to consume the yogurt with an exceeded best before date compared to people who think they produce the same or more than the average.

- People who think they produce less food waste than the average are more likely to offer the yogurt to their guests compared to people who think they produce the same amount or more than the average.

2.7.2 KNOWLEDGE BEST BEFORE DATE

Hypotheses:

- Participants who do not know the correct definition of the best before date choose the reason “best before date exceeded” to dispose food to a higher percentage.
- Participants who know the right definition of the best before date are more likely to consume the yogurt.
- Participants who know the right definition of the best before date are more likely to offer the yogurt to their guests.
- Participants who do not know the right definition of the best before date are more likely to consume the nudged yogurts than the yogurts without a nudge.

2.7.3 FOOD WASTE BELIEFS

The food waste beliefs evaluated through the questionnaire are:

- ‘Sustainability’: Environmental sustainability is very important to me.
- ‘Environmental impact’: Food waste has a negative effect on the environment.
- ‘Society impact’: I feel one person’s food waste can have a negative impact on society (widening the gap between over- and undernutrition).
- ‘One person environment’: I feel one person’s food waste can have a negative effect on the environment.
- ‘Reducing world hunger’: I feel my efforts to decrease food waste can assist in reducing world hunger.
- ‘Consumer’: I feel the consumer contributes to the total amount of food waste on a large scale.
- ‘Conscience’: I feel bad when I throw away food.

Hypotheses tested regarding the food waste beliefs:

- Participants who rate the yogurt edible have a stronger consent to the food waste beliefs.
- Participants who estimate their produced amount of food waste lower than average consent stronger to the food waste belief ‘sustainability’.

- Participants with a strong consent to the food waste belief ‘sustainability’ know the right definition of the best before date.
- Participants with a strong consent to the food waste beliefs consume the yogurt for longer.

Correlations among single food waste beliefs with each other:

- ‘Environmental impact’ and ‘One person impact’
- ‘Society impact’ and ‘One person impact’
- ‘Society impact’ and ‘Environmental impact’
- ‘Environmental impact’ and ‘Reducing world hunger’
- ‘Consumer’ and ‘Conscience’
- ‘Conscience’ and ‘Reducing world hunger’

3 RESULTS

3.1 DESCRIPTIVE STATISTICS

741 participants could be achieved in total. After the filter question and minus the number of participants who were assigned to the nudge groups of the co-study by Lisa Erbschwendtner, 449 participants remained as sample for the present thesis. This number is divided into the five groups as seen in Figure 8.

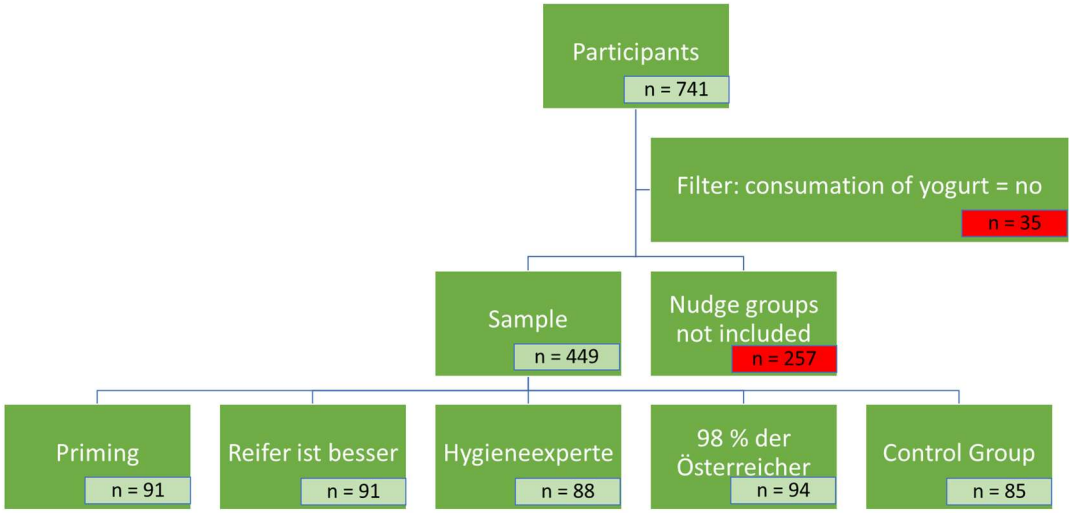


Figure 8: Sample Diagram

The biggest group of the participants have graduated from high school – they account for 33.6%. 21.4% hold a Bachelor's degree and 6.2% hold a Master's degree. The Austrian academic titles Magister and Diploma account for 17.6% together. 7.3% have finished a vocational school.

The income distribution shows that the highest proportion (44.5%) are provided with less than EUR 1000.- per month. 20.9% have an income of between EUR 1000.- and EUR 1500.-, 18.1% of the participants have EUR 1500.- and EUR 2000.-, and 16.5% have an income of more than 2000.- a month (see Figure 9).

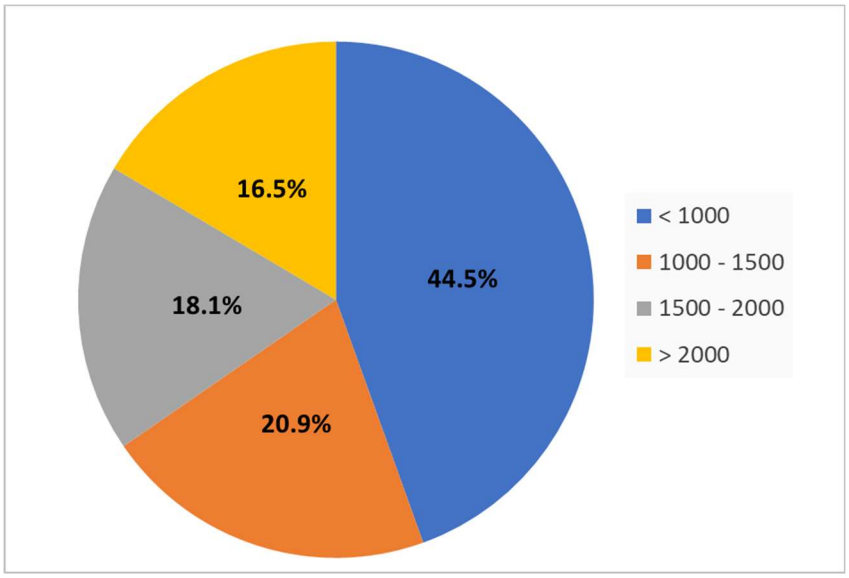


Figure 9: Income Distribution in EUR

More than three quarters - 78.6% of the participants are female, 21.4% are male.

Table 4 Sex Distribution

Sex	Frequency	Percent
female	353	78.6
male	96	21.4
Total	449	100.0

There is an accumulation of 20- to 30-year-old participants who took part in the study. This is probably due to the university surroundings in which the questionnaire was most present. The youngest participants' age is 17, the oldest is 78. The mean age is 31 (±11.5) years (see Figure 10).

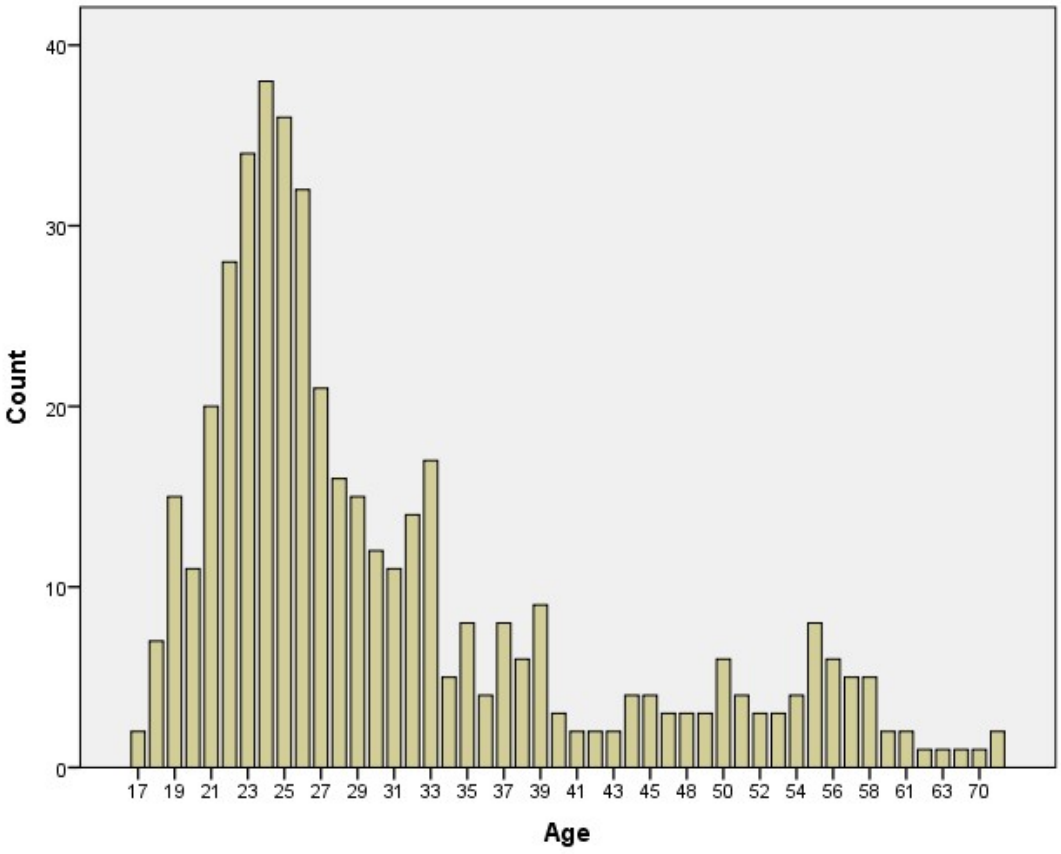


Figure 10: Distribution of Age

The Kolmogorov-Smirnov-test shows no normal distribution for the variable age (p = <.001).

As to the responsibility for food purchases in their respective households, the data are distributed as follows:

Table 5: Responsibility for Food Purchase in the Household

		Frequency	Percent
Responsibility for Food Purchases	always	213	47.4
	often	168	37.4
	seldom	60	13.4
	never	8	1.8
	Total	449	100.0

86.7% of the women are always or often responsible for food purchases. Men take this responsibility to 78.1% always or often. These differences between men and women are not significant (X^2 (1, N = 449) = 6.18, p = .103).

3.2 ACCEPTANCE OF A YOGURT WITH EXCEEDED BEST BEFORE DATE

91.8% of all the participants rate the yogurt edible (see Table 6).

Table 6: Overall Edibility

Edibility	Frequency	Percent
Yes	412	91.8
No	37	8.2
Total	449	100.0

Hypothesis: Yogurts with an exceeded minimum durability date are more often considered edible if nudged than without a nudge.

A cross tabulation was done with the variables group (4 nudged groups and the control group) and edibility. Pearson Chi-Square Test shows no significant difference between the five groups. None of the groups differ significantly from the others. (X^2 (4, N = 449) = 7.71, p = .103) (see Table 7 and Figure 11).

*Table 7: Cross Tabulation Group * Edibility*

			Edibility		Total
			yes	no	
Group	Control Group	Count	82	3	85
		% within Group	96.5%	3.5%	100.0%
	98% der Österreicher	Count	90	4	94
		% within Group	95.7%	4.3%	100.0%
	Hygieneexperte	Count	78	10	88
		% within Group	88.6%	11.4%	100.0%
	Reifer ist besser	Count	80	11	91
		% within Group	87.9%	12.1%	100.0%
	Priming	Count	82	9	91
		% within Group	90.1%	9.9%	100.0%
Total		Count	412	37	449
		% within Group	91,8%	8,2%	100,0%

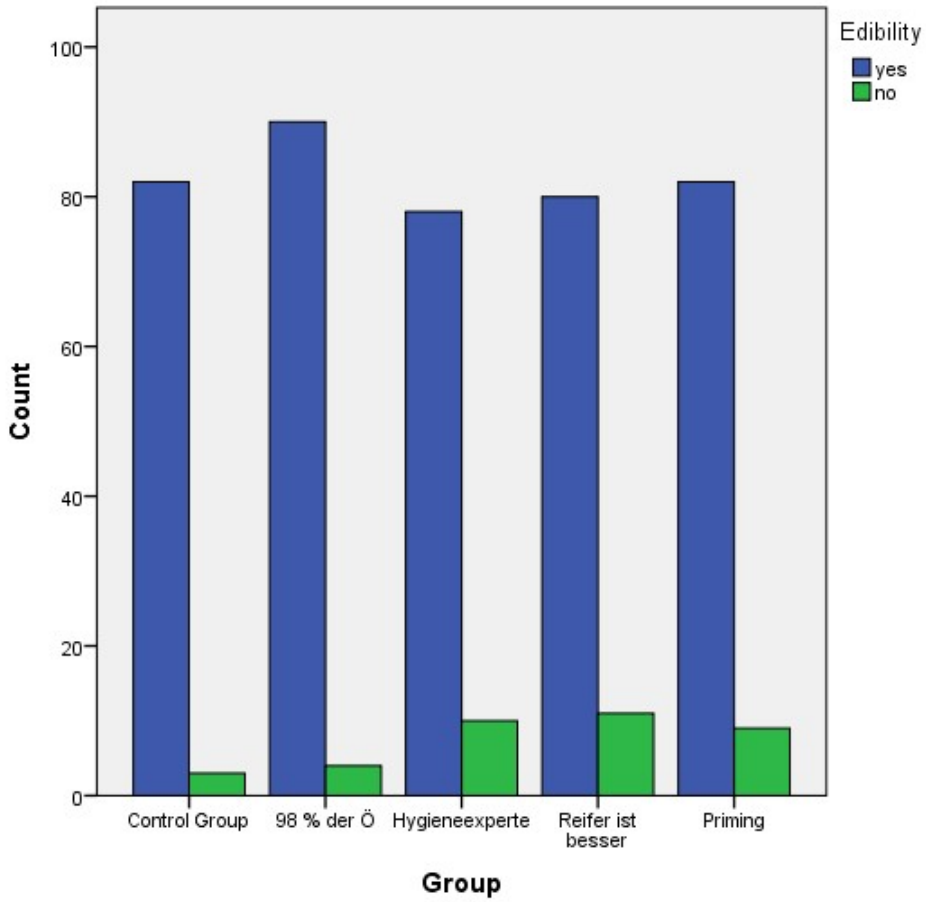


Figure 11: Edibility Assessment in the Nudged Groups and the Control Group

The distribution of the male and female participants' answers regarding edibility are shown in Table 8 and Figure 12.

Chi Square showed no significant sex differences in the variable edibility (X^2 (1, N = 449) = .145, p = .703).

*Table 8: Cross Tabulation Sex * Edibility*

			Edibility		Total
			yes	no	
Sex	female	Count	323	30	353
		% within Sex	91.5%	8.5%	100.0%
	male	Count	89	7	96
		% within Sex	92.7%	7.3%	100.0%
Total		Count	412	37	449
		% within Sex	91.8%	8.2%	100.0%

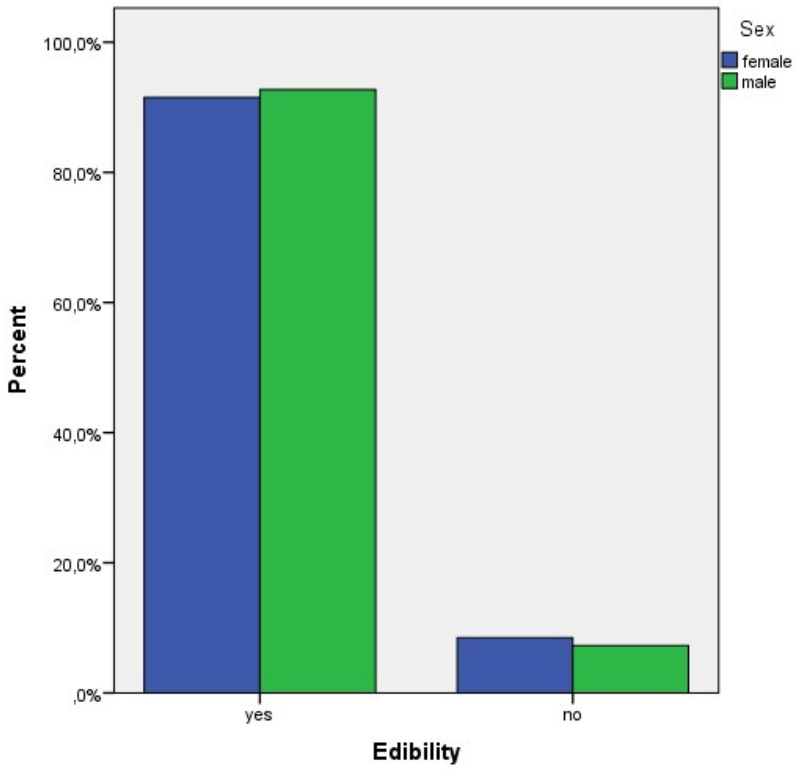


Figure 12: Edibility Assessment by Men and Women

Hypothesis: Yogurts with a nudge are more often offered to guests than yogurts without a nudge.

In all the groups, there are more participants who would not offer the yogurt to guests than participants who would. On average 46.3% would offer the product to guests whereas 53.7% would not offer it to guests (see Table 9 and Figure 13).

Pearson Chi Square Test shows no significant difference between the five groups regarding the variable guests (X^2 (4, N = 449) = 0.23, p = .994).

On these grounds, the hypotheses that one or more of the nudged groups show an increased willingness to either eat the yogurt or offer it to guests can be rejected.

*Table 9: Cross Tabulation Group * Guests*

			Guests		Total
			yes	no	
Group	Control Group	Count	39	46	85
		% within Group	45,9%	54,1%	100,0%
	98% der Österreicher	Count	44	50	94
		% within Group	46,8%	53,2%	100,0%
	Hygieneexperte	Count	39	49	88
		% within Group	44,3%	55,7%	100,0%
	Reifer ist besser	Count	43	48	91
		% within Group	47,3%	52,7%	100,0%
	Priming	Count	43	48	91
		% within Group	47,3%	52,7%	100,0%
Total		Count	208	241	449
		% within Group	46,3%	53,7%	100,0%

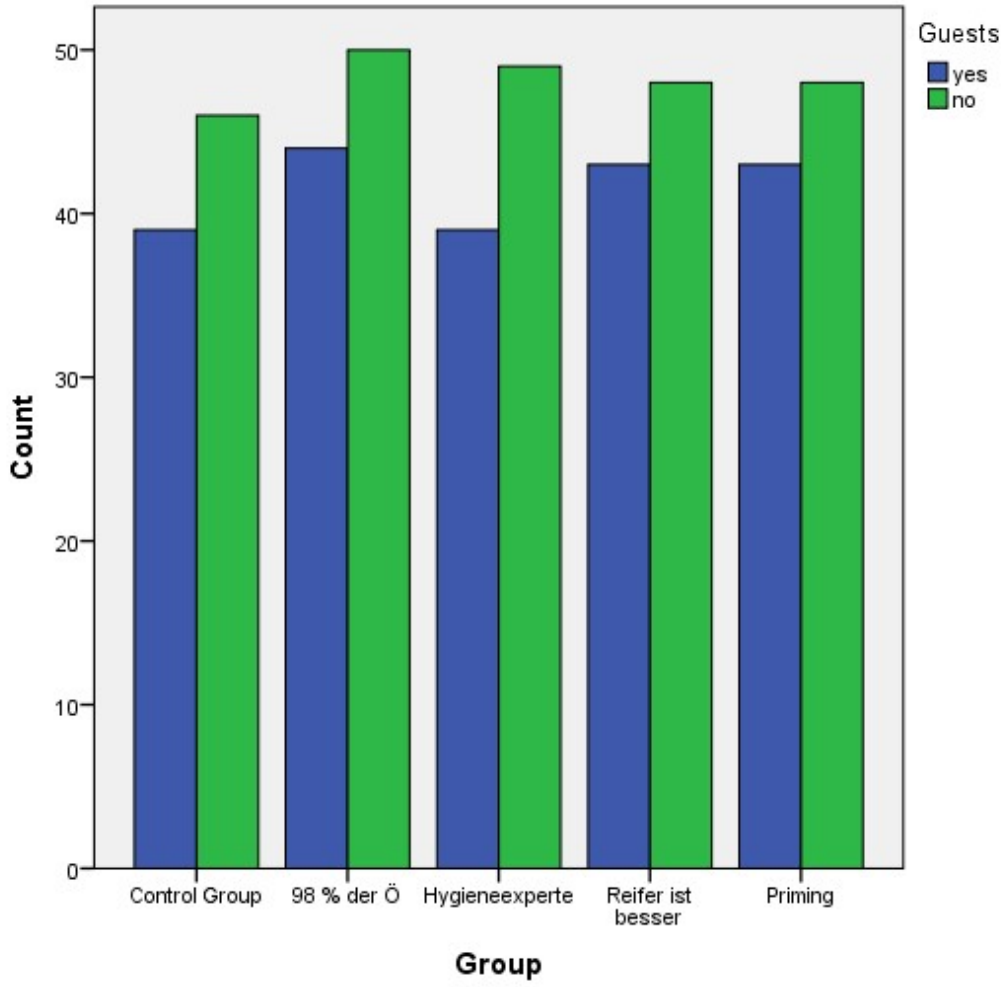


Figure 13: Offering to Guests in the tested Groups

An obvious observation can be made by looking at the percentages of people who would state the yogurt still edible and the percentage of offering the yogurt to guests. While 91.8% of the total participants rate the yogurt as edible, only 46.3% would offer the yogurt to their guests. In detail: of the 91.8% saying the yogurt is edible, 50.2% would also offer it to their guests. The other 49.8% would not offer the expired yogurt to guests, even if they think it still edible. Of the 8.2% of the total participants that did not rate the yogurt edible 97.3% also would not offer it to guests.

These differences are significant according to Pearson Chi-Square test (X^2 (1, N = 449) = 30.86, p < .001). If the participants do not rate the yogurt edible they would also not offer it to their guests.

Regarding the willingness to offer the yogurt to guests, there are no differences between the sexes (X^2 (1, N = 449) = .015, p = .903) (see Table 10).

*Table 10: Cross Tabulation Sex * Guests*

			Guests		Total
			yes	no	
Sex	female	Count	163	190	353
		% within Sex	46,2%	53,8%	100,0%
	male	Count	45	51	96
		% within Sex	46,9%	53,1%	100,0%
Total		Count	208	241	449
		% within Sex	46,3%	53,7%	100,0%

Hypothesis: Yogurts with a nudge are consumed for longer than yogurts without a nudge.

In order to test this hypothesis a new variable was generated: time span. The participants of the questionnaire could choose a date in a calendar as the last day to consume the yogurt in the picture. By calculating the days between the printed best before date (30.06.2016) and the date chosen by the participant the variable time span was created. This was done by the excel function TAGE360.

Statistical outliers are identified as all the values outside the area mean - 2**SD*. This area is 99.11 ± 2*1699.55 = [3498.21; -3299.99]. Values in the past – i.e. before the best before date is exceeded – are also excluded.

Without the statistical outliers, there are 446 values left for the further statistical calculations.

The variable time span is not normally distributed according to Kolmogorov-Smirnov.

The mean and median number of days of the variable time span in each group is shown in Table 11 and Figure 14.

Table 11: Time Span in Days in each Group

Group	Mean	N	Std. Deviation	Median
Control Group	18,80	85	37,183	10,0
98% der Österreicher	19,86	94	25,425	10,0
Hygieneexperte	24,02	87	32,027	10,0
Reifer ist besser	18,19	91	23,556	10,0
Priming	18,15	89	21,584	10,0
Total	19,79	446	28,345	10,0

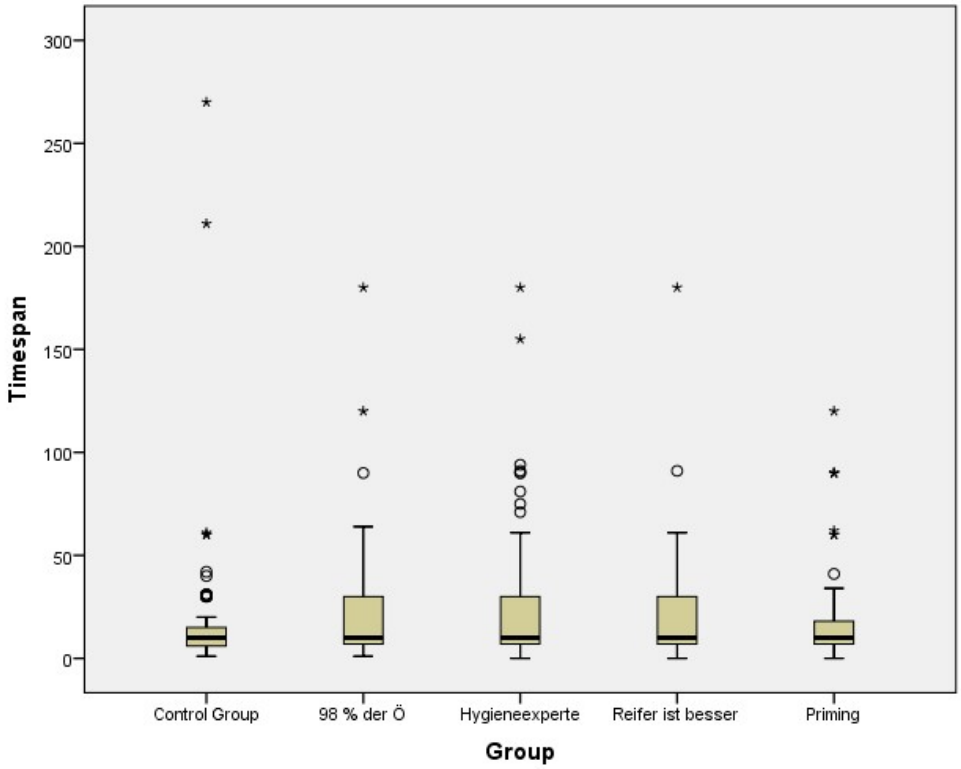


Figure 14: Boxplot of Time Span in the Groups

Kruskal Wallis test shows no significant differences for the variable time span in the four nudged groups and the control group (X^2 (4, N = 446) = 3.37, p = .499).

There are no significant sex differences in the variable time span tested with a T-test for independent samples (t (444) = 0.39, p = .698).

Hypothesis: If the participant would not consume the yogurt, they rate the liking lower.

In the group that does not rate the yogurt edible, the liking is significantly lower than in the group which would still consume the product tested with Kruskal Wallis (X^2 (1, N = 449) = 40.04, p = 0.000) (see Figure 15).

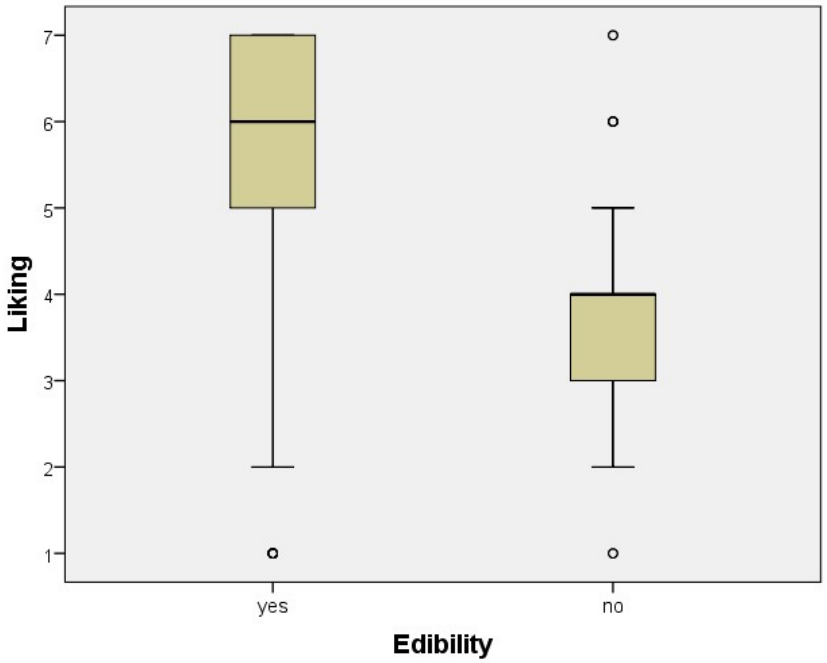


Figure 15: Boxplot of Liking in the Groups of Edibility

Hypothesis: If the participant would not consume the yogurt, they rate the smell worse.

The participants who say the yogurt is not edible rate the smell significantly lower than when the edibility was answered positive tested with Kruskal Wallis (X^2 (1, N = 449) = 30.84, p = .000) (see Figure 16).

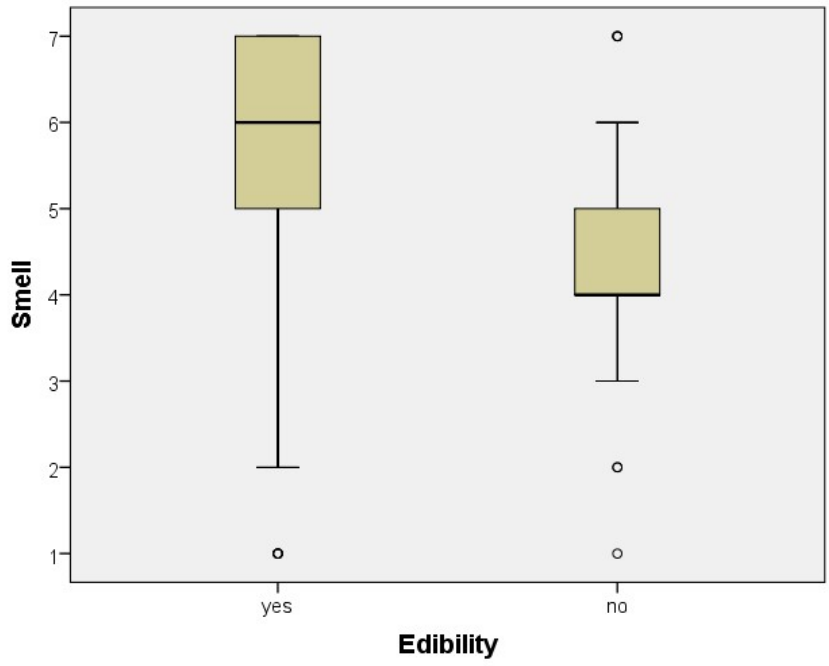


Figure 16: Boxplot of Smell in the Groups of Edibility

Hypothesis: If the participant would not consume the yogurt, they rate the sour taste more intense.

There are no significant differences between the participants who state the yogurt edible and the ones who say it is not edible in the rating of the taste (X^2 (1, N = 449) = 1.15, p = .285) (see Figure 17).

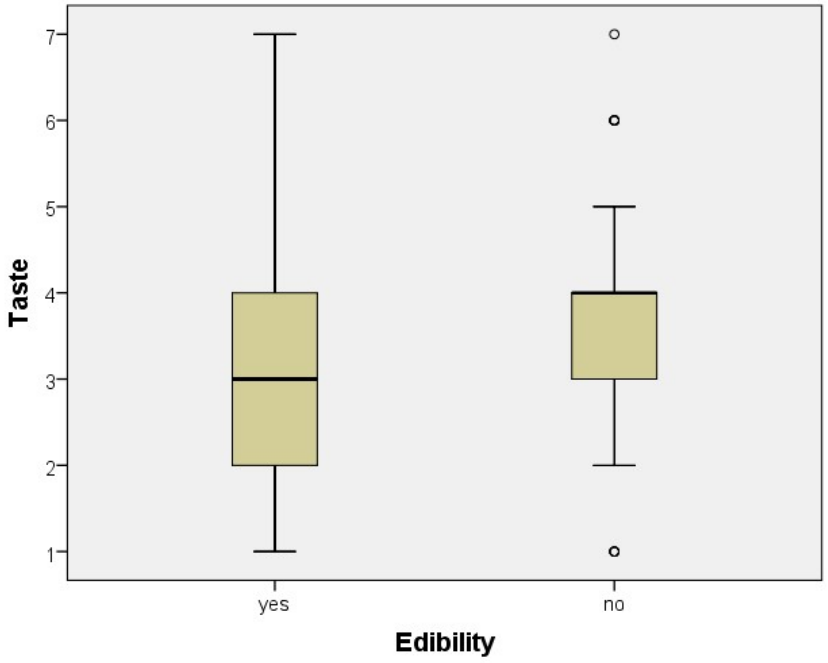


Figure 17: Boxplot of Taste in the Groups of Edibility

Hypothesis: If the participant would not consume the yogurt, they rate the safety worse.

People who would not consume the yogurt rate the safety significantly worse than people who would eat the product (X^2 (1, N = 449) = 44.83, p = .000) (see Figure 18).

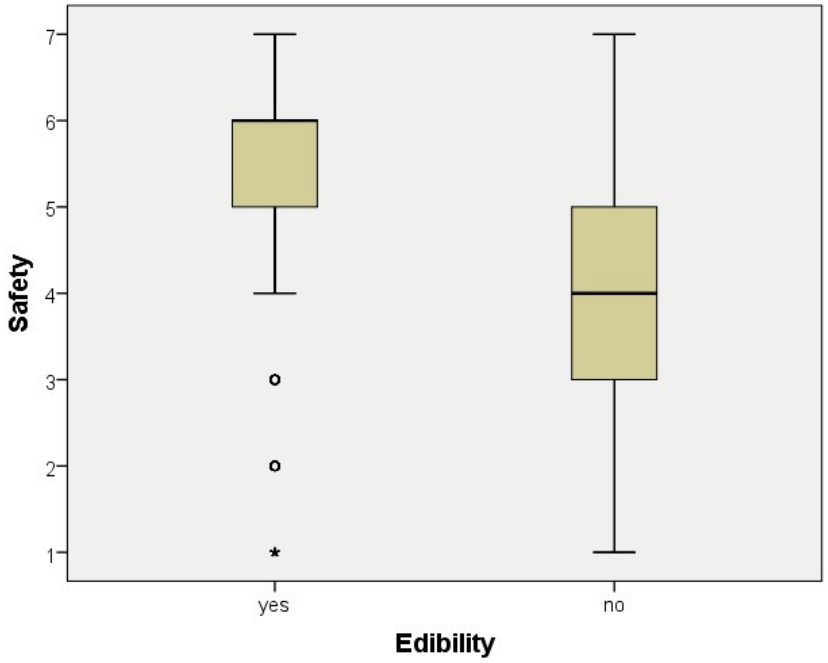


Figure 18: Boxplot of Safety in the Groups of Edibility

In all the groups together, 77.5% of the participants rate the product as safe (categories 5-7). Median and mode for the safety rating is 6 taken across all groups (see Table 12 and Figure 19).

Table 12: Overall Safety Rating

		Frequency	Percent	Cumulative Percent
Rating	1 - very unsafe	14	3.1	3.1
	2	19	4.2	7.3
	3	24	5.3	12.7
	4	44	9.8	22.5
	5	103	22.9	45.4
	6	141	31.4	76.8
	7 - very safe	104	23.2	100.0
	Total	449	100.0	

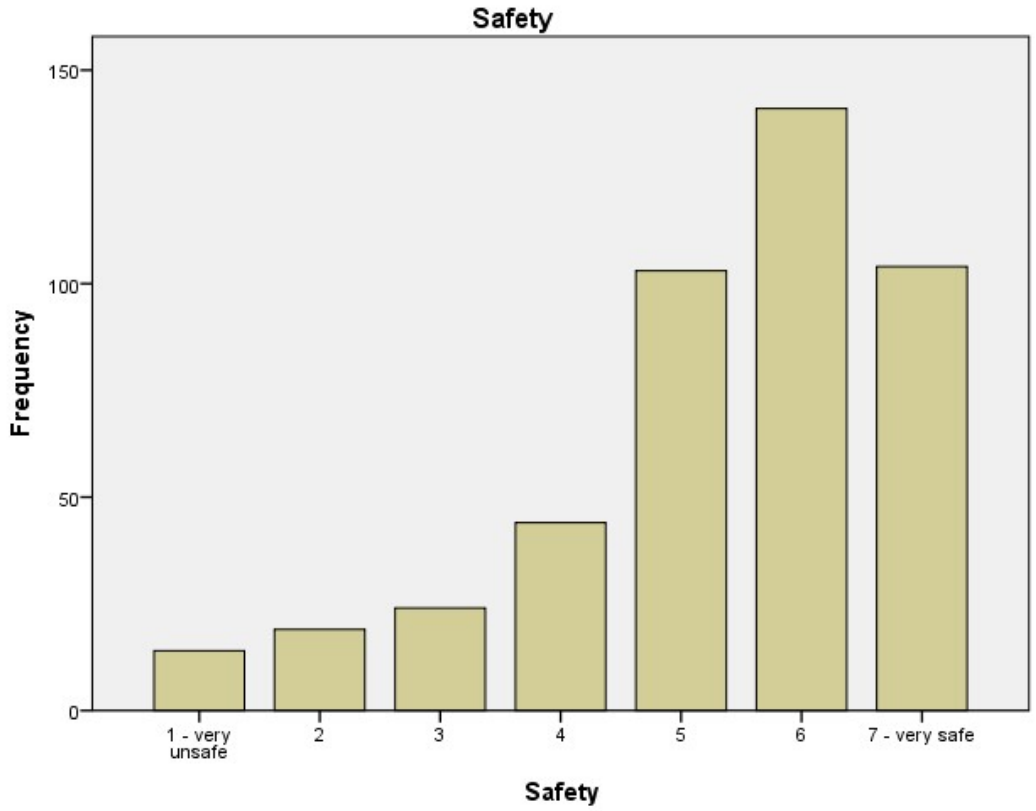


Figure 19: Bar Chart of the Assessment of Safety

Hypothesis: Nudged participants rate the liking higher than the control group.

Kruskal Wallis test shows no significant difference between the sexes in the rating of the liking (X^2 (1, N = 449) = 1.46, p = .228).

There is a significant difference between the groups in the variable liking tested with Kruskal Wallis (X^2 (4, N = 449) = 12.35, p <0.05) (see Figure 20).

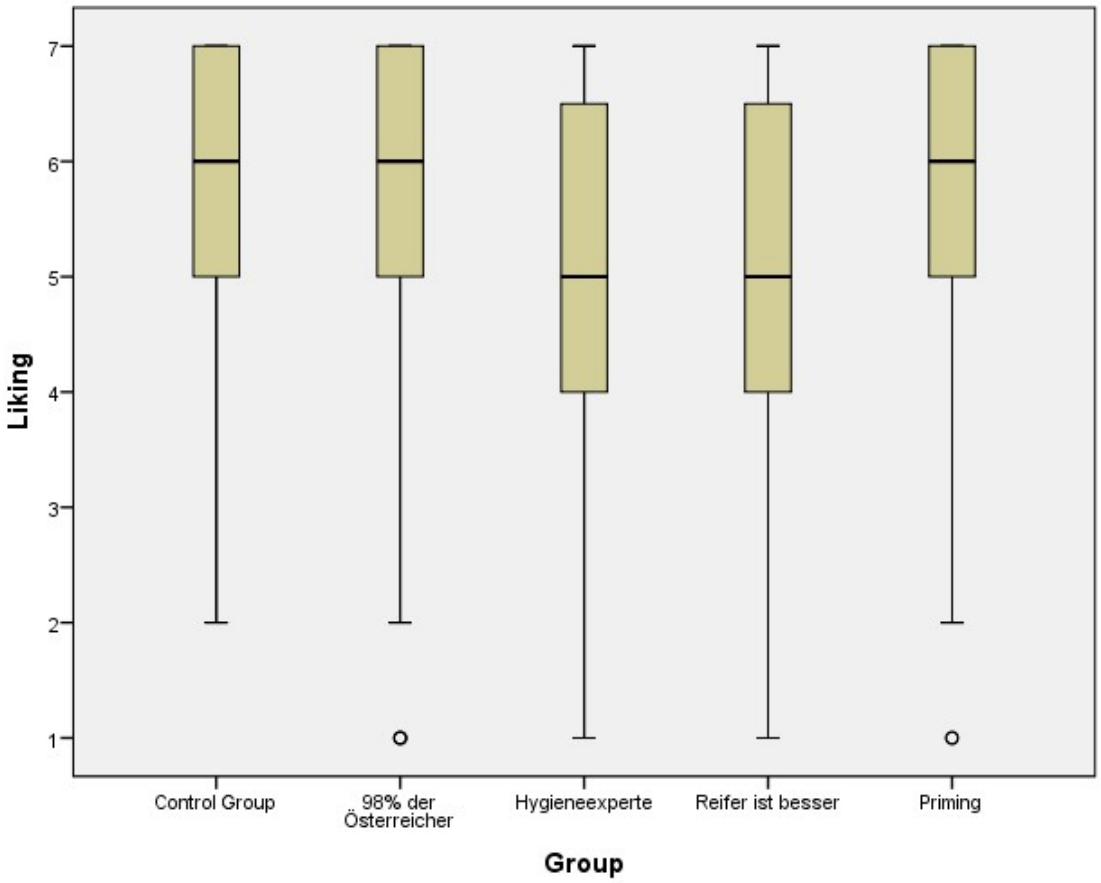


Figure 20: Boxplot of Liking in Each Group (1 – not enjoyable at all, 7 – very enjoyable)

The four nudged groups are tested separately against the control group with Mann-Whitney test. For this purpose, the alpha-level is corrected with the Bonferroni method: 0.05/4 = 0.0125. The resulting alpha level is 0.0125.

Control group against nudge group “98% der Österreicher” shows no significant difference at an alpha level of 0.0125 (z = -1.45, p = .148).

Control group vs. nudge group “Hygieneexperte” shows a significant difference (z = -2.94, p = .003). The nudged group rates the liking significantly lower than the control group.

Testing the control group vs. the nudge group “Reifer ist besser” yielded no significant difference between the two groups can be detected (z = -2.33, p = .02).

Control group vs. nudge group “Priming” does not differ significantly either (z = -0.36, p = .716).

Hypothesis: Nudged participants rate the sour taste less intense than the control group.

There are no significant differences in the five groups concerning the rated intensity of the sour taste of the yogurt tested with Kruskal Wallis (X^2 (4, N = 449) = 5.78, p = .216).

Hypothesis: Nudged participants rate the safety of the product higher than the control group.

The safety ratings in the five groups do not differ significantly according to Kruskal Wallis test (X^2 (4, N = 449) = 2.177, p = .703).

Hypothesis: People who think they produce less food waste than the average Austrian are more likely to consume the yogurt with an exceeded best before date compared to people who think they produce the same or more than the average.

About two thirds of the participants (63.3%) think that they are producing less food waste a week than seen on the picture. Only 28.1% say that they are producing the same amount weekly and 8.7% say they produce more (see Figure 21).

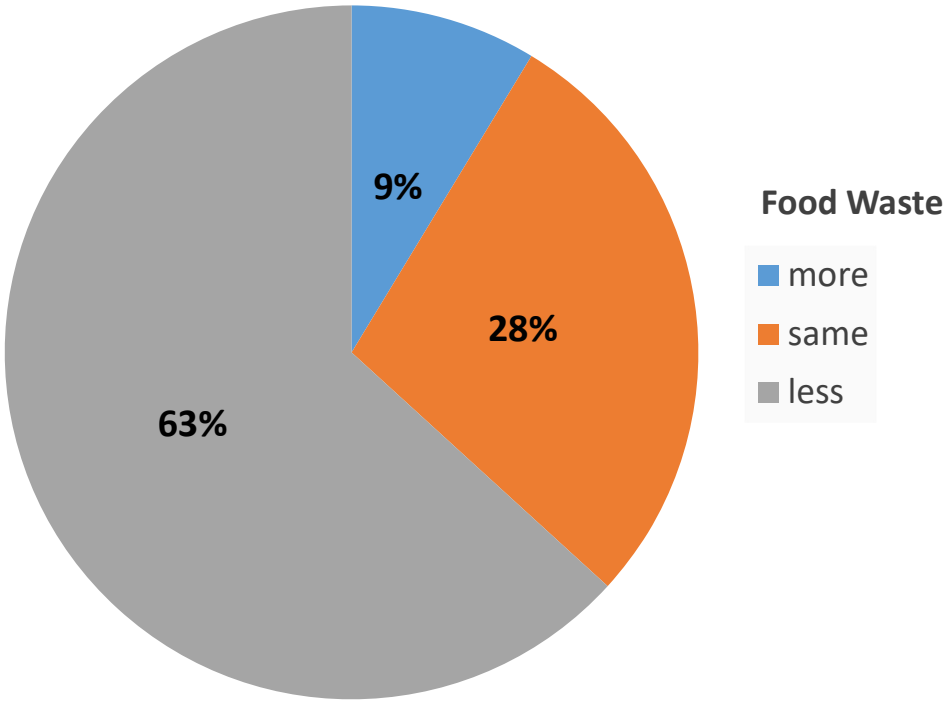


Figure 21: Estimation of Personal Food Waste Amount (more, same or less than average)

There are no significant differences in the edibility across the three groups of participants who guess they produce more, the same or less food waste (X^2 (2, N = 449) = 0.924, p = .630) (see Table 13).

*Table 13: Cross Tabulation Food Waste * Edibility*

			Edibility		Total
			yes	no	
Food Waste	more	Count	35	4	39
		% within Food Waste	89,7%	10,3%	100,0%
	same	Count	118	8	126
		% within Food Waste	93,7%	6,3%	100,0%
	less	Count	259	25	284
		% within Food Waste	91,2%	8,8%	100,0%
Total		Count	412	37	449
		% within Food Waste	91,8%	8,2%	100,0%

Hypothesis: People who think they produce less food waste than the average are more likely to offer the yogurt to their guests compared to people who think they produce the same amount or more than the average.

Of the participants who guess the amount of food waste they produce is lower than average, a higher percentage is also willing to offer the yogurt to guests (49.6%). Of the participants who think they produce more food waste than average, a lower percentage is still offering the yogurt to guests (38.5%). This difference is not significant (X^2 (2, N = 449) = 3.526, p = .172) (see Table 14).

*Table 14: Cross Tabulation Food Waste * Guests*

			Guests		Total
			yes	no	
Food Waste	More	Count	15	24	39
		% within Food Waste	38,5%	61,5%	100,0%
	Same	Count	52	74	126
		% within Food Waste	41,3%	58,7%	100,0%
	Less	Count	141	143	284
		% within Food Waste	49,6%	50,4%	100,0%
Total		Count	208	241	449
		% within Food Waste	46,3%	53,7%	100,0%

3.3 KNOWLEDGE BEST BEFORE DATE

First of all, a frequency distribution of the reasons to dispose of food chosen by the participants was done (see Figure 22). The reason most chosen is “product expired”. 88% of participants chose this reason for personally generating food waste.

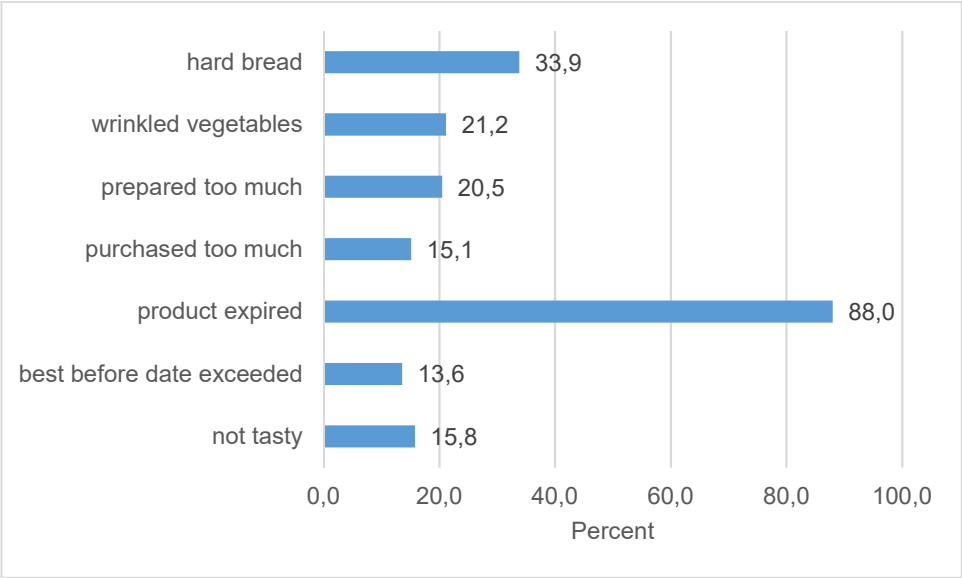


Figure 22: Frequency of Reasons for Food Waste

Furthermore, the participants were offered a field called “other reasons” where they handwrote statements which were retrospectively categorized as follows:

- Forgotten or overlooked food items: vergessen bzw. übersehen (4 times);
- Package or portion sizes: zu große Menge für 2 Personen; Zu große Verpackungsmenge für z. kl. Haushalt; kleinere Mengen gibt es leider nicht immer;
- Mould, perishable food: Schimmel (6 times); habe Angst, dass es verdorben ist; nur bei Fleischwaren;
- Preparation failures and leftovers: verbranntes Essen; Restprodukte; Endstücke vom Gemüse, Schalen, Sehnen; Gemüseschalen;
- Storaging: schlechte Lagerung bzw. Lagerungsmöglichkeiten; Im Kühlschrank gefroren;
- Alternative use of food waste: hartes Brot bringe ich zum Altbrot-Behälter; hartes Brot verfüttere ich im Garten an Vögel; landet nicht auf dem Müll, Hühner und andere;
- Negation of food waste: es landen keine Lebensmittel im Müll; gar nicht; normalerweise landen bei uns keine LM im Müll;

Of all the participants, 75.3% chose the correct definition of the best before date (guarantee of the producer for the quality of the product). 24.7% decided for one of the incorrect definitions offered.

Hypothesis: Participants who do not know the correct definition of the best before date choose the reason "best before date exceeded" to dispose food to a higher percentage.

*Table 15: Cross Tabulation Knowledge best before date * Best before date exceeded (as a reason or no reason to dispose food); bbd = best before date*

			Best before date exceeded		Total
			Not a reason	reason	
Knowledge best before date	Correct	Count	290	48	338
		% within Knowledge bbd	85,8%	14,2%	100,0%
	Incorrect	Count	98	13	111
		% within Knowledge bbd	88,3%	11,7%	100,0%
Total		Count	388	61	449
		% within Knowledge bbd	86,4%	13,6%	100,0%

Of the 338 participants who knew the correct meaning of the best before date (Producers' guarantee for the quality of the product) 14.2% chose the exceeded best before date as a reason for disposing of the product. Of the 111 participants who do not know the meaning of the best before date only 11.7% choose the exceeded best before date as a reason to through the yogurt away. This difference is however not significant (X^2 (1, N = 449) = 0.441, p = .507).

To go into more detail, table 16 shows the percentages of choosing the reason "Best before date exceeded" to dispose the yogurt among the different definition groups. If the answer "Expiry date of the product" is chosen, there is the highest percentage (21.4%) of also choosing the reason "Best before date exceeded" to dispose of the yogurt. This observation is not significant. Also, the very low number of participants in this group (N = 11) limits the power of this result (X^2 (3, N = 449) = 1.95, p = .583).

*Table 16: Cross Tabulation Definition best before date * Best before date exceeded (as a reason or not a reason to dispose food)*

			Best before date exceeded		Total
			Not a reason	reason	
Knowledge best before date	Producers' guarantee (correct definition)	Count	290	48	338
		% within Knowledge bbd	85,8%	14,2%	100,0%
	Expiry date of the product	Count	11	3	14
		% within Knowledge bbd	78,6%	21,4%	100,0%
	Expiry date for sale	Count	82	9	91
		% within Knowledge bbd	90,1%	9,9%	100,0%
	I don't know	Count	5	1	6
		% within Knowledge bbd	83,3%	16,7%	100,0%
Total		Count	388	61	449
		% within Knowledge bbd	86,4%	13,6%	100,0%

Hypothesis: Participants who know the right definition of the best before date are more likely to consume the yogurt.

91.7% of the people who chose the right definition of the best before date rate the yogurt as edible. This is almost the same percentage as in the group of people who did not know the right definition of the best before date – namely 91.9%. Pearson Chi Square shows no significant differences between the group with the right definition and the incorrect definition regarding the edibility (X^2 (1, N = 449) = 0.003, p = .953).

Hypothesis: Participants who know the right definition of the best before date are more likely to offer the yogurt to guests.

Of the 338 participants with the correct definition of the best before date 46.4% would offer the yogurt to their guests. When choosing the wrong definition (N = 111) 45.9% would still offer the product to guests. This difference is not significant (X^2 (1, N = 449) = 0.009, p = .926).

Hypothesis: Participants who do not know the right definition of the best before date are more likely to consume the nudged yogurts than the yogurts without a nudge.

For this purpose, all the subjects that chose the right answer to the definition of the best before date were filtered out. 111 participants remained – the ones that chose the wrong definition. By looking just at the participants who chose the incorrect definition of the best before date, there are no differences in the edibility answers of the nudged yogurts group and the control group (X^2 (4, N = 111) = 6.23, p = .183). It is interesting though that of those participants, none deemed the control yogurt not edible, whereas the nudged yogurts are rated as not edible by 3.7 to 17.6% of the participants.

The same test was conducted with the group of participants who did know the correct definition of the best before date. This time, all the participants who chose the wrong definition were filtered out. 338 participants remain for the following Chi Square test. Here the distribution looks different. Whereas 4.8% of the control group rate the yogurt as not edible, between 4.5% and 10.8% of the nudged groups say the yogurt was not edible. However, these differences are not significant (X^2 (4, N = 338) = 3.77, p = .438).

3.4 FOOD WASTE BELIEFS

In the questionnaire, information about the degree of consent to various food waste beliefs was raised. The participants could decide for one of five categories on a scale going from 1 – “I don’t agree at all” to 5 – “I totally agree”. First the food waste beliefs are presented with the frequencies of each category and descriptive characteristics like median and mode. The seven food waste beliefs in the questionnaire with their modes and medians are presented as follows (see Figure 23-29).

Sustainability: Environmental sustainability is very important to me.

The median and mode is 5. This represents that a majority (56.8%) of the participants fully consent to the belief ‘sustainability’.

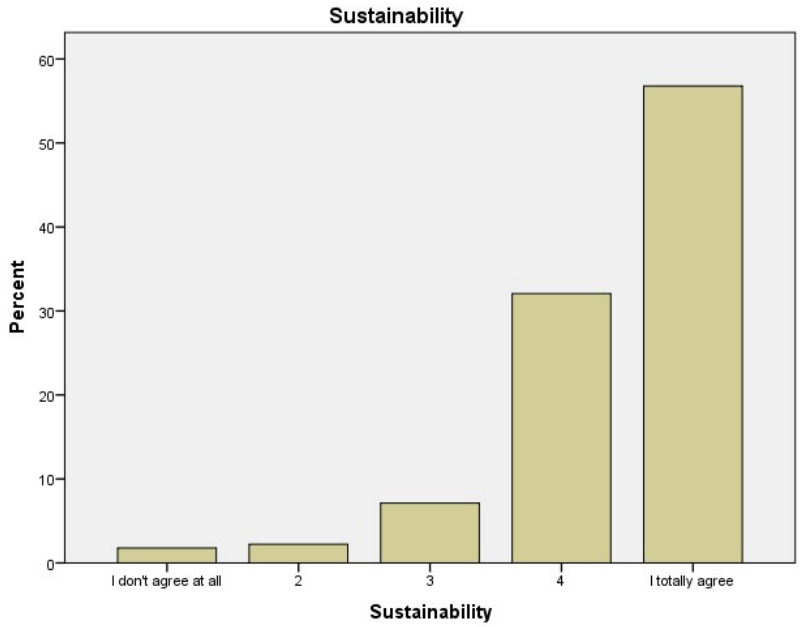


Figure 23: Consent to the Belief Sustainability

'Environmental impact': Food waste has a negative effect on the environment.

Median and mode is 5.

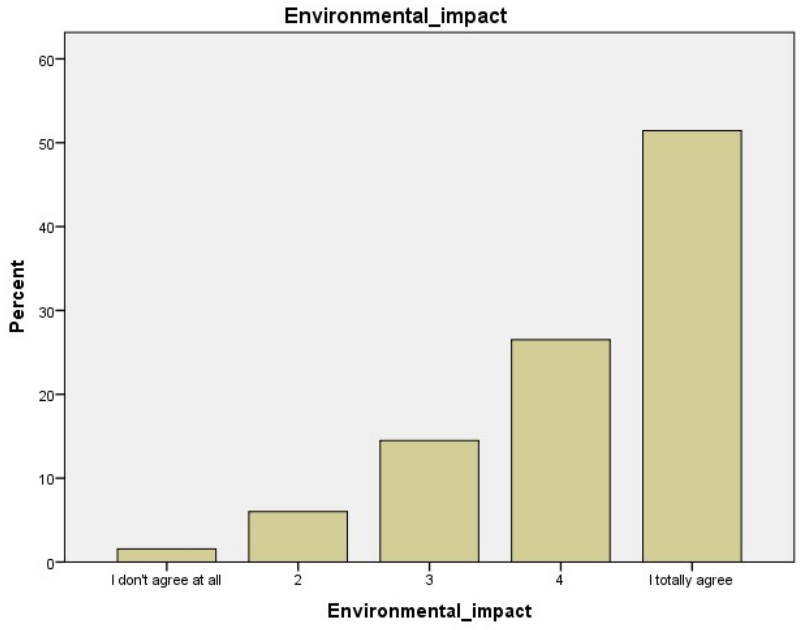


Figure 24: Consent to the Belief Environmental Impact

'Society impact': I feel one person's food waste can have a negative impact on society (widening the gap between over- and undernutrition).

Median is 4 and mode is 5. 50% of the values are higher than 4, 50% are lower. 5 ("I totally agree") is the category that was chosen the most.

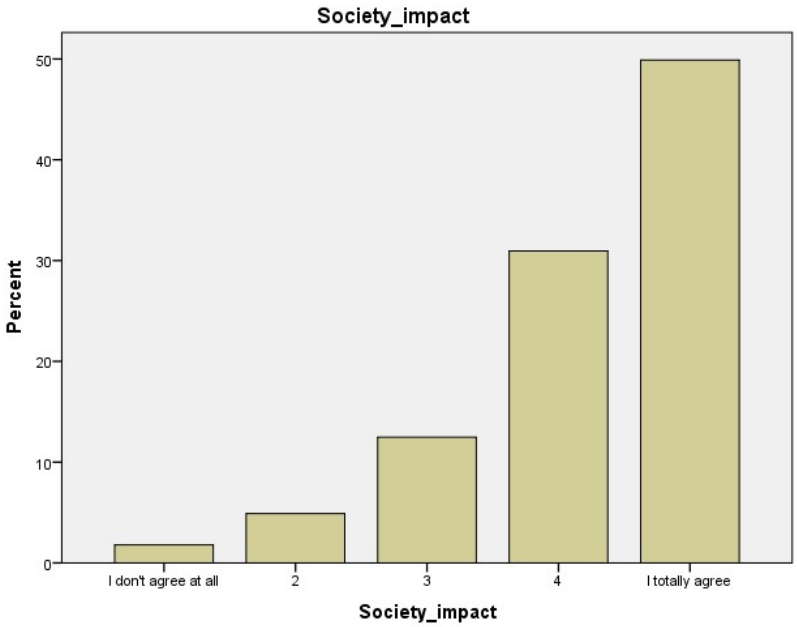


Figure 25: Consent to the Belief Society Impact

'One person environment': I feel one person's food waste can have a negative effect on the environment.

The median is 4 and the mode is 5.

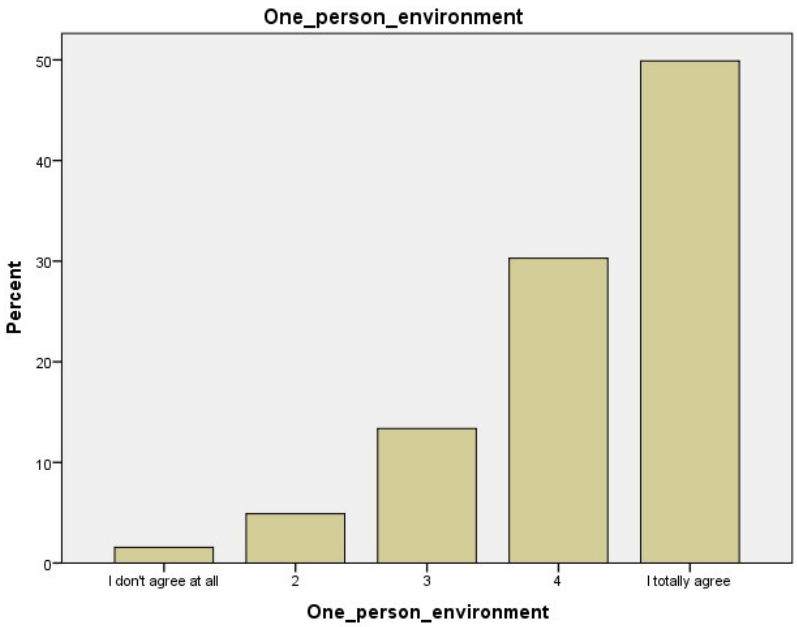


Figure 26: Consent to the Belief One Person Environment

'Reducing world hunger': I feel my efforts to decrease food waste can assist in reducing world hunger.

The median and the mode is 3. Here, the participants consent is not as high as in the other categories. In fact, 73.3% of the participants are located within the first three categories that present the lowest consent.

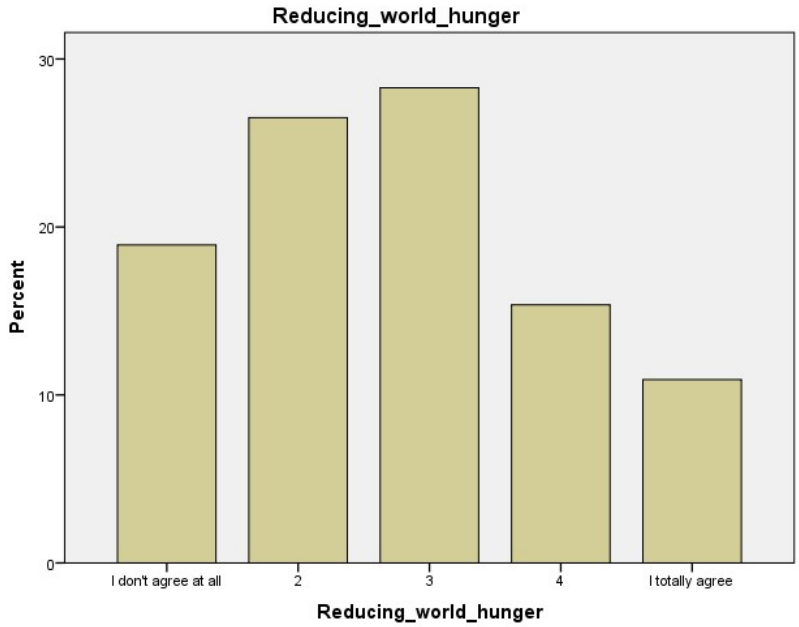


Figure 27: Consent to the Belief Reducing World Hunger

'Consumer': I feel the consumer contributes to the total amount of food waste on a large scale.

The median and the mode is 5.

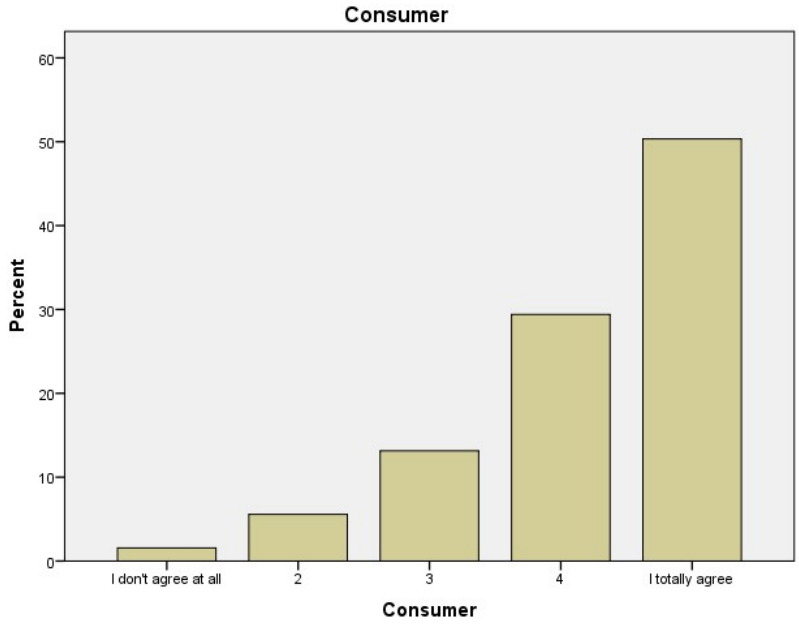


Figure 28: Consent to the Belief Consumer

'Conscience': I feel bad when I throw away food.

Median and mode is 5. This belief is the one with the highest percentage of category 5 of all the beliefs - 74.2% of the participants totally agree that they feel bad when they are throwing away food.

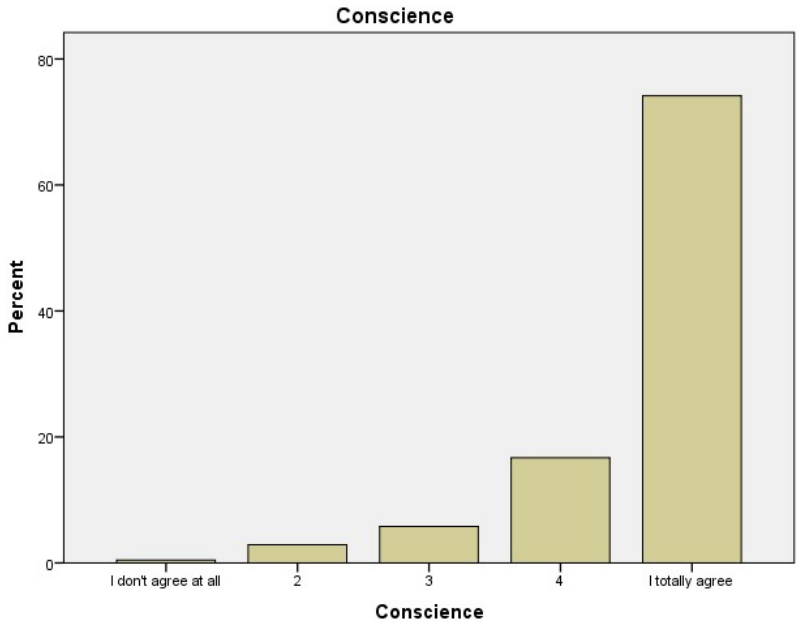


Figure 29: Consent to the Belief Conscience

There are some sex-specific differences in this category tested with Mann Whitney. Generally, women show a higher consent – they agree to the food waste beliefs to a higher degree.

When it comes to 'conscience' women feel significantly worse when they are throwing away food than men do (z = -4.90, p = .000).

Hypothesis: Participants who rate the yogurt edible have a stronger consent to the food waste beliefs.

A Kruskal Wallis test with Chi Square test was conducted to test if the variable edibility correlates with higher rankings in the food waste beliefs.

There are no significant differences in any of the food waste beliefs regarding edibility although in most cases food waste beliefs rank higher in the edibility group than in the groups that do not rate the yogurt edible (Exception: Food waste belief 'conscience').

Hypothesis: Participants who estimate their produced amount of food waste lower than average consent stronger to the food waste belief 'sustainability'.

A Kruskal Wallis test was done with the nominal variable food waste (with the categories more, same and less) and the ordinal variable 'sustainability'.

Participants who state that they are producing less food waste than the average Austrian have a significantly higher ranking of their consent to 'sustainability' (X^2 (2, N = 449) = 27.84, p = .000) (see Figure 30).

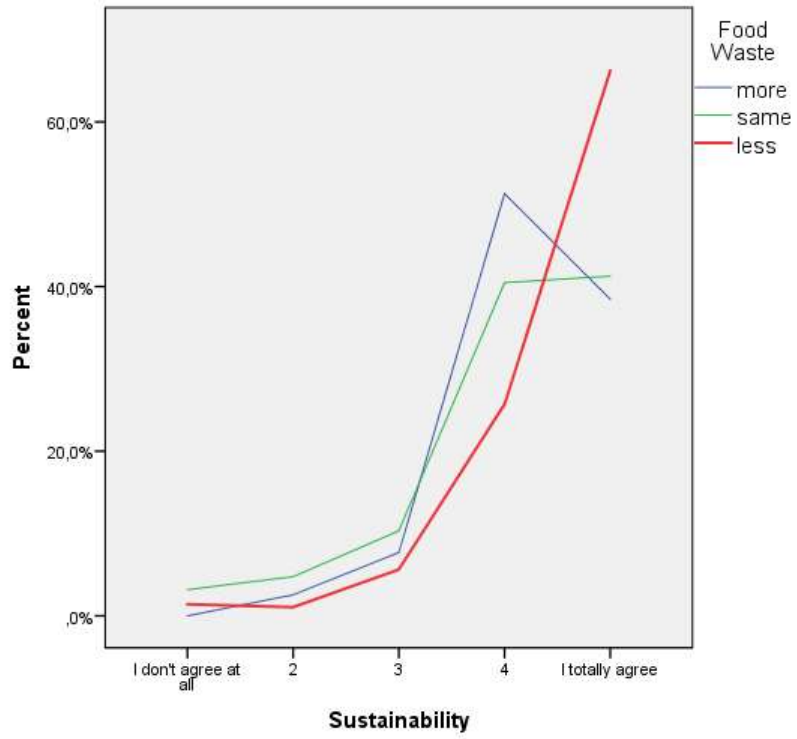


Figure 30: Consent to Sustainability in the Groups of Estimated Amount of Food Waste (less, same or more)

Among the participants that rate their personal amount of food waste less than average, 66.2% say they totally agree to the food waste belief 'sustainability'. The other groups (more and the same amount of food waste) choose the highest class of consent to the belief 'sustainability' to a lower percentage (~41%).

Hypothesis: Participants with a strong consent to the food waste belief 'sustainability' know the right definition of the best before date.

This hypothesis cannot be confirmed with the statistical test Kruskal Wallis (X^2 (1, N = 449) = 0.004, p = .949).

Hypothesis: Participants with a strong consent to the food waste beliefs consume the yogurt longer.

Kruskal Wallis test shows higher rankings in categories of strong consent. Thus, the timespan is significantly longer, the higher the consent to 'sustainability' is (X^2 (4, N = 449) = 28.47, p = .000).

Hypothesis: Correlations of food waste beliefs with each other:

All the food waste beliefs correlate positively and significantly with each other (p < .05). In some cases, the correlation is stronger than in others. The three highest and three lowest correlated pairs are:

'Environmental impact' and 'One person impact'

If the participants chose a high consent to the belief that food waste has a negative impact on the environment in general, there is also the tendency that they show high consent to the belief that one person's food waste has an impact on the environment (r (N = 449) = 0.66, p = .000).

'Society impact' and 'One person impact'

There is a positive correlation between the belief that food waste can have a negative effect on society and that one person's food waste has a negative impact on the environment (r (N = 449) = 0.40, p = .000).

'Society impact' and 'Environmental impact'

High consent to the belief "Food waste can have a negative effect on society" correlates with high consent to the belief "Food waste has negative effect on the environment" (r (N = 449) = 0.34, p = .000).

The following pairs of food waste beliefs show positive significant correlations as well, if to a lower degree than the pairs above.

'Environmental impact' and 'Reducing world hunger'

Spearman correlation is 0.186 for consent to the belief that food waste has a negative impact on the environment and the belief that one's efforts to decrease food waste can assist in reducing world hunger ((r (N = 449) = 0.19, p = .000).

'Consumer' and 'Conscience'

The beliefs "The consumer contributes to the total amount of food waste on a large scale" and "I feel bad when I throw away food" correlate positively. The correlation is however weaker than in the first three examples (r (N = 449) = 0.18, p = .000).

'Conscience' and 'Reducing world hunger'

When participants feel bad when throwing away food they also tend to believe that their efforts to decrease food waste can assist in reducing world hunger (r (N = 449) = 0.15, p = .000).

4 DISCUSSION

With the overarching goal to reduce consumer caused food waste, the present study deals with date labelling – specifically the best before date – as a reason for the consumer to dispose of food. Based on literature, the assumption is that the misunderstanding of the meaning of the best before date leads to unnecessary food waste (BIOIS 2011). In the present study, nudging was analyzed as a tool to come by the powerful effects date labels have on consumers. Nudging is meant to influence the consumers without limiting their choices (Hausman and Welch 2010). Sunstein (2014) claims that nudging can be applied to enhance pro-environmental consumption. As a basis for the present study, the MINDSPACE framework by Dolan et al. (2012) was applied.

The main research questions of the present study are:

- How does nudging influence the acceptance of a yogurt with an exceeded best before date?
- Is the knowledge about the definition of the best before date related to the acceptance of the yogurt and to the food waste behavior?
- Which role do food waste beliefs play regarding the acceptance of the yogurt and reasons to dispose food?

4.1 ACCEPTANCE OF A YOGURT WITH EXCEEDED BEST BEFORE DATE

The overall acceptance of the yogurts with exceeded date labels is high in the present study. 91.8% would still consume the yogurt after the best before date. On average across all groups the participants would still consume the yogurt for 19.7 days after the best before date. These findings are basically the same than in the co-study by Lisa Erbschwendtner (2017), who worked on the same data but with different nudge groups.

Bolton and Alba (2012) found out that consumers show a high willingness to prevent food waste when they already have the food items in their homes - even if these food items are suboptimal. In a large-scale survey with more than 4000 participants from the Netherlands, Denmark, Norway, Sweden, and Germany the acceptance of several suboptimal food items in supermarkets and at home were evaluated. Here, only 46.9% of the respondents were willing to consume a yogurt with a one week exceeded best before date at home (De Hooge et al. 2017). In the present thesis, the high degree of willingness to consume the yogurt could be explained by the sample which was possibly aware of the aim of the study – to lower food waste. This point will be discussed in detail later.

The present study shows no preference of the nudged yogurts over the control yogurts when all of them have exceeded date labels. This is demonstrated in the assessment of the edibility, willingness to offer the yogurt to guests, the timespan for how long the yogurt would be consumed, the safety, acceptance, taste, and smell. In both the nudge and the control group the willingness to offer the yogurt to guests is lower than the general assessment of the edibility. Half of the participants that rate the yogurt edible would nevertheless not offer the product to their guests. This might be a reference that the participants are willing to take the chance for themselves but they are not sure enough of the safety to also offer it to guests.

Nudged yogurts also do not show a higher acceptance among the participants who do not know the correct definition of the best before date. Therefore, it is not possible to conclude that nudging is an effective tool to counter a lack of knowledge when aiming to reduce or prevent food waste.

There is the possibility that the participants answered the questionnaire to some degree according to social desirability. They were consciously or unconsciously assuming that the topic of food waste should be answered in a certain way to meet the social expectation, which is in this context to avoid food waste.

This assumption is strengthened by the fact that the sample stems to a big part from Facebook groups and friends which are already well informed about environmental and food related topics. Furthermore, information about the topic of the study was given beforehand even though it was tried to avoid influencing the participants too much into the direction of food waste.

Hence there is a chance that the participants were simply not responding to the nudges or felt like they had to give up their autonomy (Schnellenbach 2015).

The trend is that the nudged yogurts were rated worse than the control yogurt. This is particularly the case with the messenger nudge “Hygieneexperte”. A reason for that can only be assumed – maybe the hygiene expert meant too much of an authority to the participants or the information of a hygiene expert is not exactly increasing the appetite.

On the social norms yogurt, it says “98% of all the Austrians would still eat the yogurt” – possibly the participants were correctly assuming that this number is made up. This may have stirred suspicion among the participants and reduced their trust into the study in general. What would not have been possible in the “real world” could yet have an influence on the present study – as Demarque et al. (2015) state. In this case, the participants could have been disturbed by the high percentage on the picture and therefore rated it worse.

In the co-study by Lisa Erbschwendtner (2017), the nudged groups based on the MINDSPACE mechanisms messenger, salience, commitment, and priming are not found more approving than the control group either. Interestingly, also here the messenger nudge is connected to a lower acceptance among the participants. The messenger nudge of Erbschwendtner, presenting a famous Austrian skier, shows a lower willingness to consume the yogurt than the control group (Erbschwendtner 2017).

Among the personal reasons for producing food waste (entered into the questionnaire's "other reasons" section), participants frequently numbered "mould". Other recurring comments referred to leftovers being fed to pets or simply stated that "no food waste is produced in our household". These comments seem to reflect an urge to express concern about and awareness of sustainability-related issues. It is therefore possible that the participants were less likely to be influenced by the nudges applied in the first place because they were already familiar with the subject.

The majority of participants estimates their personal amount of food waste to be lower than the average. In the present thesis, the willingness to consume the yogurt and offer it to guests is not connected to the estimated amount of personal food waste. De Hooge's survey (2017) has yielded results to the contrary: here they are more willing to consume suboptimal food, when the participants perceive their household food waste to be lower.

4.2 KNOWLEDGE BEST BEFORE DATE

In the present study, 75.3% knew the correct definition of the best before date – which is a "guarantee of the producer for the quality of the product". Only for 13.6% the exceeded best before date is a reason to through food away. This reason is also not chosen more often by participants who did not know the correct meaning of the best before date.

Of the participants who chose the wrong definition of the best before date, 91.9% would consume the yogurt after that date and 45.9% would still offer the yogurt to their guests. These numbers do not differ significantly from the participants who chose the correct definition of the best before date.

The sample of the present thesis knew about the meaning of the best before date to a higher percentage compared to what research in the UK has shown, where up to half of the participants confused the date labels "sell by" and "use by" (BIOIS 2011). In the UK study, it is estimated that 20% of the food waste could be due to this misunderstanding of labels. The present study cannot corroborate to such a high degree that the date label is responsible for food waste.

4.3 FOOD WASTE BELIEFS

The consent to the food waste beliefs presented is generally high. The statement that yielded the lowest agreement was the belief that their efforts to decrease food waste could assist in reducing world hunger. This being the most serious impact reducing food waste might have, the participants' comparatively low consent indicates that even if they show a high awareness of sustainability-related issues, they do not believe their actions have a serious impact on a global scale.

Participants who strongly consent to the statement that sustainability is important for them also estimate their personal amount of food waste to be lower than average. Similarly, if the consent to sustainability is high, they plan to use the yogurt longer. In the survey of De Hooge et al. (2017) similar observations could be made – consumers that commit highly to environmental sustainability are more willing to consume suboptimal food items such as yogurts with past best before dates.

However, a high consent to the belief of sustainability does not indicate knowledge about the definition of the best before date. Also, the assessment of edibility and the willingness to offer the yogurt to guests does not correlate positively with the degree of consent to the food waste beliefs.

The Bio Intelligence Service confirms these findings (BIOIS 2010). They state that despite a growing general environmental awareness an unconscious wasteful behavior has established among consumers.

Women show partly a higher consent to the food waste beliefs. They approve particularly more to feeling bad when throwing away food. This could indicate that women feel more personal guilt than men do when it comes to food waste.

In the present thesis women are not significantly more often responsible for the food purchases in their households than men, nonetheless they show higher consent for food waste beliefs.

4.4 CRITICISM OF NUDGING

As enthusiastic as the authors get about their research of libertarian paternalism, there are also critical voices. The main questions around the ethics of libertarian paternalism or nudging are:

- How obtrusive is governmental interference in peoples' lives?
- How transparent should paternalism be?

(Frerichs 2011)

Schnellenbach (2015) criticizes that libertarian paternalism leads to an externalization of responsibility to the choice architect. The responsibility for consumption decisions as well as long term preferences and values are shifted from the consumer to a nudging planner.

Because nudging relies on the intuitive and non-conscious mechanisms of choice making it is sometimes accused to be manipulative or tricking people (Marteau et al. 2011; Lehner et al. 2016). There are worries that governments could abuse the tool of nudging at the expense of people (Hausman and Welch 2010). Schnellenbach (2015) raises the argument that instead of choice architects making use of the failures of human decision-making processes the consumer could be enlightened about the typical mechanisms and make better decisions.

The transparency of libertarian paternalism also plays a role when it comes to the concern Goodwin (2012) brings up: It is a fact that nudging often works especially among the poorly informed people (Thaler and Sunstein 2008). Well informed people are often not influenced in the same way by nudging. Now there is a chance that the less informed people might have to take the burdens of an intervention while the well-informed people can enjoy the pleasant success (Goodwin 2012). This could mean that the less informed people take the risk of consuming a suboptimal product because they are more likely to be influenced by nudging.

Acceptance of nudging and libertarian paternalism relies on the measures used (e.g. nudging) and the goals to be reached by these measures. Even if the goals are accepted, the approach to reach these goals may be perceived to be too intrusive. If the governmental interventions are very intrusive, the goals have to be justified even more (Lehner et al. 2016).

4.5 LIMITATIONS

Limitations of the study include the relatively low age of participants (mean age 31 y), the surplus of female participants and the mostly academic surroundings from which the participants derive. Also, as mentioned before, the link was placed in groups that have in the broadest sense something to do with food, healthy lifestyles, food technology or environmental issues. By this way as many participants as possible should be addressed. But this is a weak point too because the participants are likely to be sensitized to the topic of microbiology or food waste and their patterns of filling out the questionnaire may therefore resemble one another or be in a certain way in general.

Another important point is the number of participants that could be reached (N = 449). The number investigated by G*Power (N = 615) could not be totally fulfilled for this study, which limits the power of the results.

From existing research with Nudging and Food Waste one can see that the success was often biggest when the study was undertaken in a closed environment like a canteen or a hotel. This is the case in the work of Kallbecken and Saelen (2013) where convincing reductions in food waste could be reached with Nudging in the restaurants of a hotel chain. Olstad et al. (2014) also claim that the contexts of decision making processes vary broadly among individuals and the effect of a nudge can therefore not be predicted precisely.

In the present study, the environment could not be controlled. Additionally, the participants did not have to make actual decisions beyond very theoretic ones. They were for example asked to estimate the safety risk, the smell or if they think they would like the product. Bio Intelligence Service (2010) declares that for the decision if food items are disposed of or not the consumer uses the date label as well as the sensory evaluation. Therefore, if tested in a laboratory the results of the present study may have been different.

The question remains, though, that if these applications work especially well in closed environments, would they also show comparable results if applied in the “real world”?

The next logical step that arises out of the present study is to conduct a similar study in a laboratory environment with real yogurts (with exceeded expiry dates) and with nudges printed on them, to make the participants actually consume the product and judge it according to their taste.

5 APPENDIX

Liebe/r Teilnehmer/in,

vielen Dank, dass Sie sich für unsere aktuelle Umfrage zum Thema **Präferenzen von Joghurt** interessieren.

Durch die Beantwortung des folgenden Fragebogens leisten Sie einen wichtigen Beitrag zur Forschung an der Universität Wien, dessen Forschungsteam vom Institut für Ernährungswissenschaften als verantwortlicher Veranstalter der Umfrage gilt.

Die Befragung dauert insgesamt etwa **5 Minuten**. Bitte lesen Sie die Fragen sorgfältig und beantworten Sie diese spontan, damit eine bessere Aussagekraft gewährleistet werden kann.

Alle Antworten werden anonymisiert ausgewertet und ausschließlich für Forschungszwecke verwendet!

Vielen Dank für Ihre Unterstützung!

5.1.1 EINWILLIGUNGSERKLÄRUNG

Ich wurde darüber aufgeklärt, dass die im Rahmen des folgenden Fragebogens erhobenen und gespeicherten Daten und Untersuchungsergebnisse ausschließlich im Sinne der Forschung verwendet werden. Durch das Betätigen des folgenden Buttons erkläre ich mich bereit, an der Studie der Universität Wien teilzunehmen.

Sind Sie mit der Einwilligungserklärung einverstanden?

☐ja

☐nein

5.1.2 FRAGEN ZUR PERSON

- Geschlecht: ☐Weiblich ☐männlich
- Alter:____*in Jahren*
- Höchste abgeschlossene Ausbildung: *Hauptschule, Pflichtschule, Polytechnische Schule, Handelsschule/Fachschule, Berufsschule, Kolleg, Matura/Abitur, Bachelor, Master, Magister, Diplom, Doktorat, Sonstiges:* _____
- Wie hoch ist Ihr durchschnittliches Nettoeinkommen monatlich, bzw.

wenn Sie kein Einkommen beziehen, welche finanziellen Mittel stehen Ihnen monatlich zur Verfügung?

☐weniger als 1000€

☐1000-1500€

☐1500-2000€

☐mehr als 2000€

- Sind Sie für den Lebensmitteleinkauf in Ihrem Haushalt zuständig?

  ☐immer

  ☐oft

  ☐selten

  ☐nie

- Wie oft konsumieren Sie Joghurt?

  ☐nie

  ☐einmal pro Monat

  ☐2-3 mal pro Monat

  ☐einmal pro Woche

  ☐2-3 mal pro Woche

  ☐4-5 mal pro Woche

  ☐täglich

  ☐2-3 mal täglich

  ☐öfter als 3 mal täglich

5.1.3 **NUDGE 1**

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?
  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?
  >Datumsfeld<

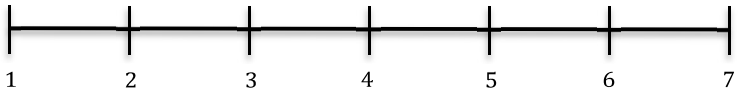
  Entsprechendes Datum auswählen

- Würden Sie dieses Produkt Ihren Gästen anbieten?
  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

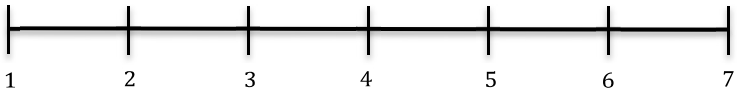
  1 = sehr unsicher 7 = sehr sicher



- Wie schätzen Sie den Geruch dieses Joghurts ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

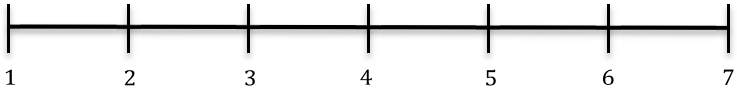
  1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

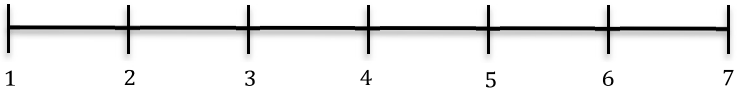
  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut



- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.4 **NUDGE 2**

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?

  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?

  >Datumsfeld<

  Entsprechendes Datum auswählen

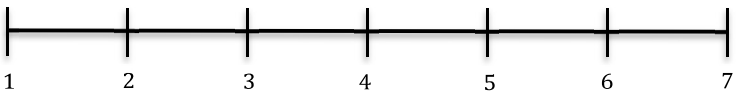
- Würden Sie dieses Produkt Ihren Gästen anbieten?

  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

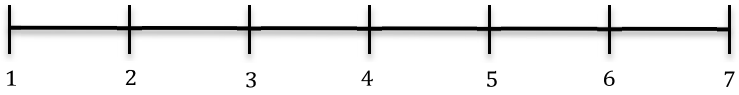
  1 = sehr unsicher 7 = sehr sicher



- Wie schätzen Sie den Geruch dieses Joghurts ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

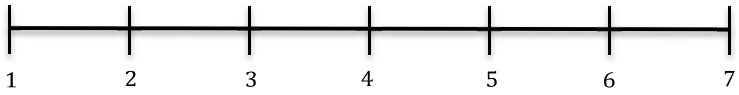
  1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut

- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.5 NUDGE 3

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?

☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?
  >Datumsfeld<

  Entsprechendes Datum auswählen

- Würden Sie dieses Produkt Ihren Gästen anbieten?
  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

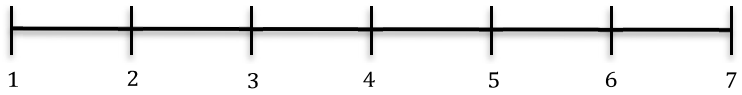
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = sehr unsicher 7 = sehr sicher

- Wie schätzen Sie den Geruch dieses Joghurts ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

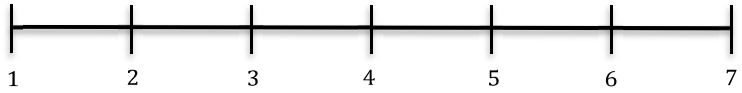
  1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

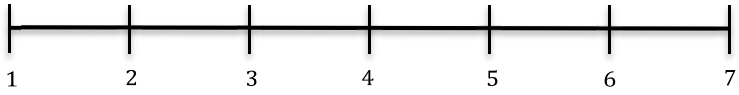
  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut



- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.6 **NUDGE 4**

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?
  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?
  >Datumsfeld<

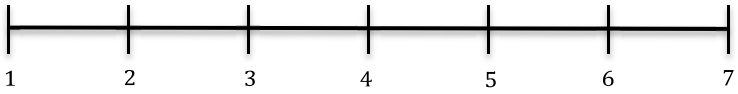
  Entsprechendes Datum auswählen

- Würden Sie dieses Produkt Ihren Gästen anbieten?
  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

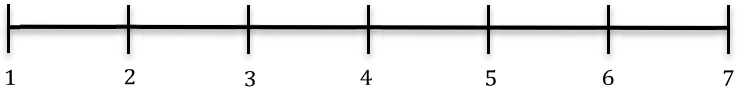
  1 = sehr unsicher 7 = sehr sicher



- Wie schätzen Sie den Geruch dieses Joghurts ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

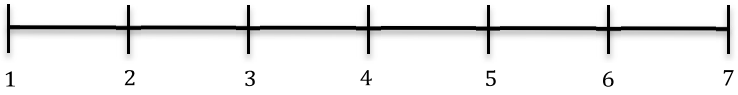
  1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut

- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.7 NUDGE 5

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?
  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?
  >Datumsfeld<

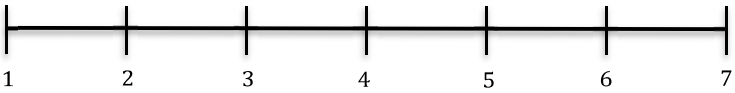
  Entsprechendes Datum auswählen

- Würden Sie dieses Produkt Ihren Gästen anbieten?
  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

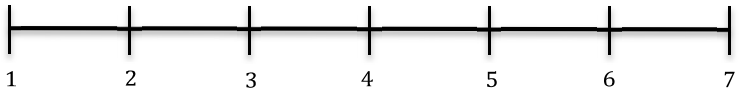
  1 = sehr unsicher 7 = sehr sicher



- Wie schätzen Sie den Geruch dieses Joghurts ein?

Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

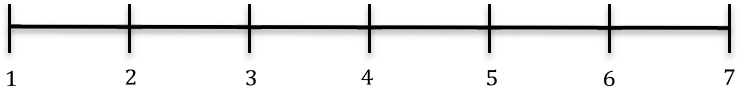
1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

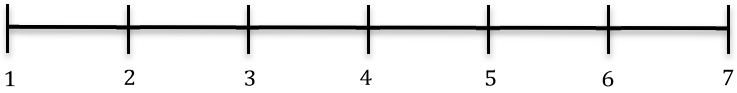
  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut



- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.8 NUDGE 6

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?
  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?
  >Datumsfeld<

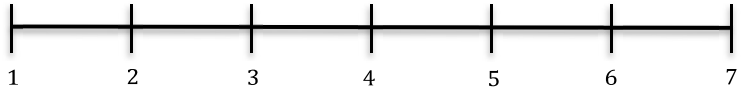
  Entsprechendes Datum auswählen

- Würden Sie dieses Produkt Ihren Gästen anbieten?
  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

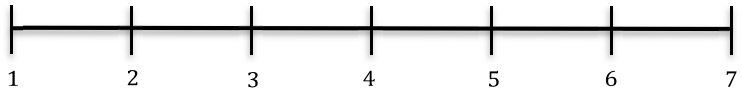
  1 = sehr unsicher 7 = sehr sicher



- Wie schätzen Sie den Geruch dieses Joghurts ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

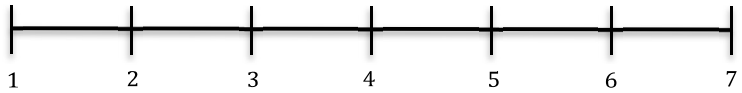
  1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

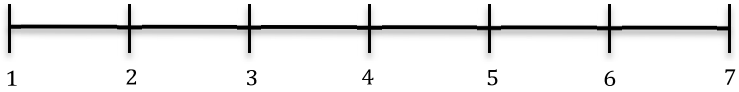
  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut



- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.9 **NUDGE 7**

Im Rahmen unserer Masterarbeit wollen wir einen Weg finden, unnötiger Lebensmittelverschwendung entgegenzuwirken. Helfen Sie mit, reduzieren wir gemeinsam Lebensmittelabfälle!

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?
  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?
  >Datumsfeld<

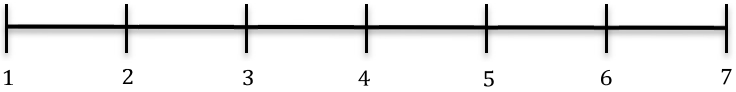
  Entsprechendes Datum auswählen

- Würden Sie dieses Produkt Ihren Gästen anbieten?
  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

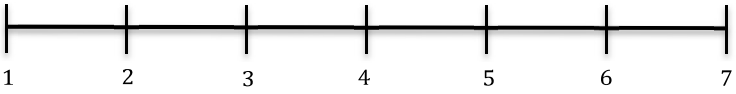
  1 = sehr unsicher 7 = sehr sicher



- Wie schätzen Sie den Geruch dieses Joghurts ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

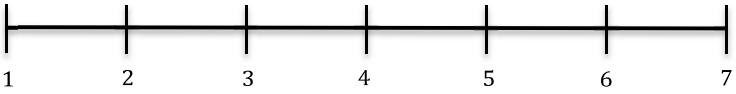
  1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

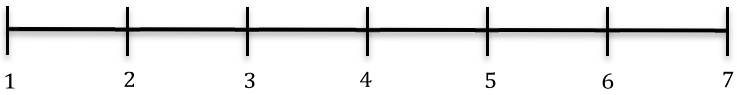
  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = überhaupt nicht 7 = sehr gut



- Wieviel würden Sie für dieses Produkt maximal bezahlen?

  Eingabe in € (zB.: 0,00) _____

5.1.10 KONTROLLGRUPPE

Stellen Sie sich vor, Sie öffnen heute Ihren Kühlschrank und sehen dieses Produkt:

- Ist dieses Joghurt zum Verzehr geeignet?

  ☐Ja ☐Nein

- Bis wann würden Sie dieses Produkt noch konsumieren?

  >Datumsfeld<

  Entsprechendes Datum auswählen

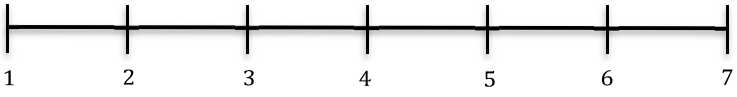
- Würden Sie dieses Produkt Ihren Gästen anbieten?

  ☐Ja ☐Nein

- Wie sicher schätzen Sie das Produkt ein?

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

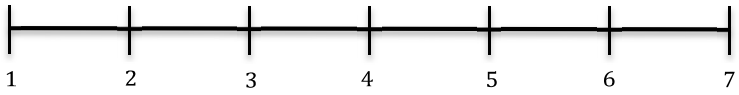
  1 = sehr unsicher 7 = sehr sicher



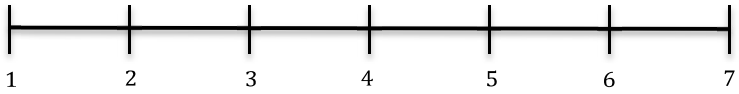
- Wie schätzen Sie den Geruch dieses Joghurts ein?

Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

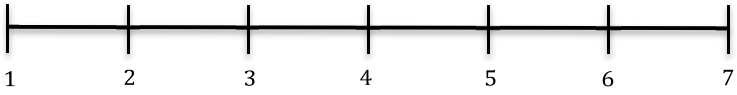
1 = sehr unangenehm 7 = sehr angenehm



- Bitte schätzen Sie den säuerlichen Geschmack dieses Produkts ein! Intensität des säuerlichen Geschmacks:
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = nicht wahrnehmbar 7 = stark wahrnehmbar



- Wie gut glauben Sie schmeckt Ihnen dieses Joghurt?
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = überhaupt nicht 7 = sehr gut



- Wieviel würden Sie für dieses Produkt maximal bezahlen?
  Eingabe in € (zB.: 0,00) _____

5.1.11 WEGWERFVERHALTEN

- Der durchschnittliche österreichische Konsument produziert wöchentlich 0,8 kg Lebensmittelabfall (siehe Foto).

  Schätzen Sie Ihre Abfallmenge im Vergleich dazu ein!

  ❑ mehr

  ❑ gleich viel

  ❑ weniger

- Aus welchen Gründen landen Lebensmittel bei Ihnen im Müll?
  Mehrfachantworten möglich
  - ❑ schmeckt nicht
  - ❑ Mindesthaltbarkeitsdatum überschritten
  - ❑ Produkt ist verdorben
  - ❑ zu viel eingekauft
  - ❑ zu viel gekocht
  - ❑ Gemüse ist schrumpelig
  - ❑ Brot ist hart
  - ❑ Sonstiges: ____

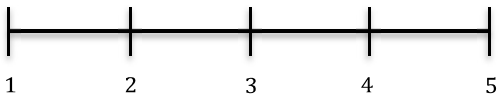
5.1.12 WISSEN MINDESTHALTBARKEITSDATUM

- Wissen Sie, was das Mindesthaltbarkeitsdatum bedeutet?
  - ❑ Garantie des Herstellers für die Qualität des Produktes
  - ❑ Ablaufdatum des Produktes
  - ❑ Ablaufdatum für Verkauf
  - ❑ Weiß ich nicht

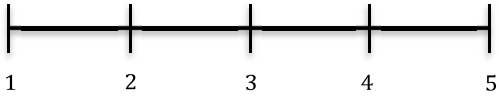
5.1.13 FOOD WASTE BELIEFS

Bitte geben Sie an, wie stark Sie den folgenden Aussagen zustimmen.

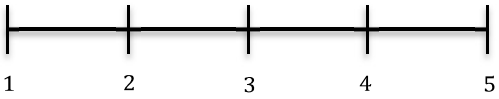
- Nachhaltigkeit ist sehr wichtig für mich.
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = Stimme gar nicht zu
  5 = Stimme voll und ganz zu



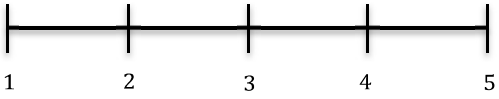
- Lebensmittelabfälle belasten die Umwelt.
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = Stimme gar nicht zu
  5 = Stimme voll und ganz zu



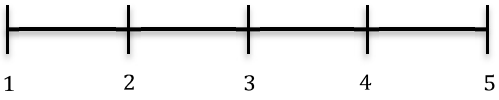
- Lebensmittelabfälle haben negative Folgen für die Gesellschaft (zB. vergrößern die Schere zwischen Überfluss und Unterernährung.
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = Stimme gar nicht zu
  5 = Stimme voll und ganz zu



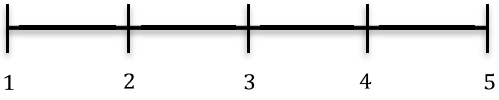
- Ich glaube der Lebensmittelabfall jedes Einzelnen kann negative Auswirkungen auf die Umwelt haben.
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = Stimme gar nicht zu
  5 = Stimme voll und ganz zu



- Ich glaube, wenn ich mich bemühe, Lebensmittelabfälle zu reduzieren, kann dies den Welthunger mindern.
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = Stimme gar nicht zu
  5 = Stimme voll und ganz zu



- Ich glaube, die Konsumenten tragen wesentlich zum gesamten Lebensmittelabfall bei.
  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken
  1 = Stimme gar nicht zu
  5 = Stimme voll und ganz zu

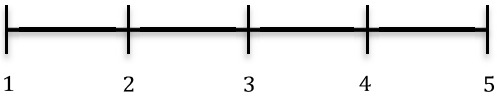


- Ich fühle mich schlecht, wenn ich Lebensmittel wegwerfe.

  Regler an der gewünschten Stelle platzieren durch Klick auf den Balken

  1 = Stimme gar nicht zu

  5 = Stimme voll und ganz zu



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