

Still edible?

Consumer behaviour and knowledge on handling food

Anke Möser, Juliane Yildiz, Gießen

Summary

Empirical studies have found that each German throws out about 80 kg of edible food each year. In this context, the present study investigates consumer knowledge on the best before date [*Mindesthaltbarkeitsdatum*] and use-by date [*Verbrauchsdatum*], as well as how to use different methods to protect food from spoiling and the reasons for disposing of food. It was worrying that about a quarter of respondents were uncertain about the distinction between the best before date and the use-by date. With the help of cluster analysis, four different groups of consumers were identified. This showed that on the one hand only quite specific aspects of consumer behaviour were relevant. On the other hand, the group of “more careless consumers” were generally careless in handling food. It was possible to derive recommendations to reduce food waste.

Keywords: food waste, consumer knowledge, cluster analysis

Introduction

About a third of all edible food in the world is wasted [1]. According to a study performed by the Institute for Sanitary Engineering, Water Quality and Solid Waste Management Institutes (ISWA), about 70 % of this food is discarded by private households [2]. BERETTA et al. have confirmed that the values in Switzerland are about as high; about half of avoidable food waste in Switzerland comes from private households [3]. For Great Britain, QUESTED and JOHNSON have calculated that private households throw out about 22 % of purchased foods¹ [4]. There is therefore increasing interest in food waste in industrial countries, with open discussion about the causes and possible solutions.

Background

EU Directive 2008/98/EU contains a general definition of the concept of waste [5]. According to the ISWA, “food waste” includes domestic food

waste, food from catering establishments, food from agricultural production, together with waste in food processing and in wholesaling and retailing. Moreover, it includes all foods that were discarded even though they were edible [2]. In addition, food waste is subdivided into avoidable, partially avoidable and unavoidable waste [2]. Avoidable food waste includes food waste that “was unconditionally edible at the time of its disposal or which would have been edible had it been eaten in good time” [2]. This also includes waste from agricultural production, works kitchens, restaurants and the final consumer. Unavoidable food waste includes inedible food components, such as bones and banana skins, not to forget potato peel and the green parts of radishes, which are normally removed during processing. In contrast, partially avoidable food waste covers food that is not consumed for reasons of personal preference, such as bread crusts or apple peel. This also includes mixtures of avoidable and unavoidable waste, such as cooking residues or canteen waste.

The issue of food waste is closely related to whether the food is la-

Citation:

Möser A, Yildiz J (2015) Still edible? Consumer behaviour and knowledge on handling food. *Ernährungs Umschau* 62(4): 52–58

This article is available online:

DOI: 10.4455/eu.2015.010

¹ There are various different approaches to determine the amounts of waste disposed of by private households: examination and quantification of the waste, evaluation of diaries or records or determining the difference between quantities purchased and consumed (for a more detailed description of the different methods see [2, 4]). However, it is generally difficult to compare the fractions of food waste in different countries or studies, as some countries include some agricultural waste, and some not.

belled to show the latest date when the food is edible. In accordance with § 7 of the Ordinance on Food Labelling (LMKV), the “best before date” [*Mindesthaltbarkeitsdatum* (MHD)] of a food means the date “up to which the food retains its specific properties if stored under appropriate conditions”. However, this does not mean that the food cannot be eaten after this date. On the other hand, the use-by date is given for “foods that are very sensitive to being spoiled by microbial activity and which may rapidly present an acute risk to human health” [6]. Consumers can recognise this distinction on the basis of the information “use by”, which is placed in front of the date, or the note as to where the date can be found on the packaging. As they are more easily spoiled, foods with a use-by date must also have an imprint of the “necessary conditions of storage”. Moreover, it is illegal to sell foods with a use-by date after this date [6].

BAUHHUS et al. discussed whether the crucial problems are not agricultural production and storage, but rather the consumer’s consumption habits [7]. It may then well be asked why so much food is wasted at home and how this can be prevented. There have been few studies that have recorded consumer attitudes in dealing with food. In a study commissioned by the BMELV, 84 % of those who occasionally threw away food said that their most common reason for doing so was that “the food was spoilt or the best before date had passed” [8]. Less frequent explanations were “because they had bought too much” (28 %), “because the pack was too large” (19 %) or “because it didn’t taste good” (16 %). If it is assumed that food is still edible after the best before date, it follows that food waste could be greatly reduced if this parameter were correctly interpreted. Other authors have observed that consumers frequently misunderstand the best by date [7, 9]. For example, “consumers often think that a food is no longer edible after the best by date and should therefore be disposed of” [10].

Survey on food handling

In May 2014, the Giessen University Department of Nutritional Science carried out a survey on food waste. Standardised oral interviews were performed with 165 respondents, in order to determine consumer knowledge on best before dates and use-by dates, as well as the use of different methods to protect food from spoiling and the reasons for disposing of food.² With the help of cluster analysis, typical behaviour patterns in food disposal were then identified. 60 % of the respondents were female; the mean age was 37.7 years and the mean household contained 2.2 persons. Comparison of the composition of the sample with the overall population of Germany [11] shows that men, older people and persons without higher school leaving qualifications were underrepresented in the sample. This should be born in mind when interpreting the results.

Method

Aside from the descriptive evaluation, this study explored different reasons for domestic disposal of foods by employing a cluster analysis as a multivariate statistical procedure. This led to the identification within the sample of different consumer groups, with similarities in several variables related to their attitudes. For this purpose, the participants were bundled into objectively plausible groups on the basis of their assent to different statements (♦ Box) [12–14].

The advantage of this procedure is that the participants can be appropriately bundled on the basis of several characteristics [13]. Hierarchical cluster analysis was used as the classification algorithm. The Euclidean distance (or “L2 distance”) was used to measure the distance between two objects and the Ward procedure to assess the distance between two already formed clusters.

Results

Most of the interviewed consumers correctly distinguished the use-by date and the best before date. 71 % of the respondents stated that it was essential to comply with the use-by date, but not with the best before date. However, about 7 % did not see any difference between the two dates. 4 % thought that it was absolutely essential to comply with the best before date, but not the use-by date. 18 % stated that they did not know the answer. ♦ Figure 1 shows that the respondents used the information from the best before date in different ways for different products. For more easily spoiled foods, such as dairy products, bread and packed sausage products, the proportion of respondents who disposed of the product after the best before date lay between 8 % (dairy products, bread) and 24 % (sausage). On the other hand, hardly anyone threw

Statements in the Questionnaire

“Too much was purchased”
 “We unexpectedly ate elsewhere”
 “We were not interested in eating the food we had or in preparing something from it”
 “The food went bad earlier than I had expected”
 “There was no opportunity to cook the food, or to freeze it or make it possible to keep it”
 “There were only large packs in the supermarket”

Level of Acceptance

“strongly disagree”, “disagree”, “undecided”, “agree” or “strongly agree”

² The interviews were performed during the summer term of 2014 by students as part of the course on “Methodological Basics in Behavioural Research” within the Professorship Nutrition Education and Consumer Behaviour, Giessen University. Participants were randomly recruited from arbitrary members of the students’ social circle. This should be born in mind when interpreting the results. The questionnaire included 17 questions.

away dry products, canned food or sweets after the best before date and about one third of the consumers in the survey stated that they totally ignored the best before date for these products.

There are also different patterns of behaviour for fresh food when the product shows signs of spoiling. If an apple has brown spots or if there is a single mouldy strawberry in the dish, about three quarters of the respondents would remove the spot or the strawberry and eat the rest. On the other hand, almost 70 % of the respondents stated that they would dispose of discoloured meat. 9 % stated that they would find another use for dry bread without mould and would perhaps toast it, use it to make breadcrumbs or feed it to animals (♦ Figure 2).

The respondents used quite different strategies in the kitchen to protect food from spoiling. 88 % stated that they warmed up the residues on the following day. 85 % froze the residues and 75 % found other uses for the residues. Less frequent strategies included bottling (20 %), using cooking residue apps (13 %), pickling (6 %) or food sharing (4 %), in which food is shared with other people and not thrown away.

Food handling depends not only on product characteristics, but also on personal behaviour. With the help of

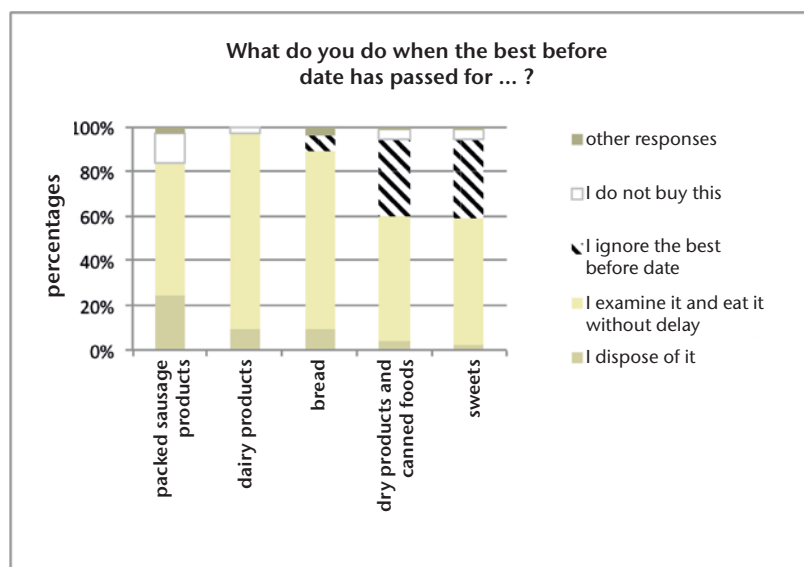


Fig. 1: Consumer behaviour after the best before date for different products

cluster analysis, four different types of behaviour were identified with respect to food disposal. Cluster formation was based on the reasons given for disposing of food. ♦ Figure 3 shows the differences between the clusters with respect to food handling. Thus, 42 % of consumers could be classified as the type of “more careless consumers”, who disposed of food for a wide variety of reasons. In contrast, the “more responsible consumers” (26 %) stated that they tended not to dispose of food in their households. The “eaters elsewhere” group (17 %) mainly dis-

posed of food because of unplanned food consumption elsewhere. Members of the latter group agreed particularly strongly with the statement that “There are only large packs in the supermarket” (“disposal due to large packs”).

♦ Table 1 characterises these four types on the basis of socio-demographic characteristics. Thus, the “disposers due to large packs” were mostly female and younger, lived in the smallest households and had lower income than the other types.

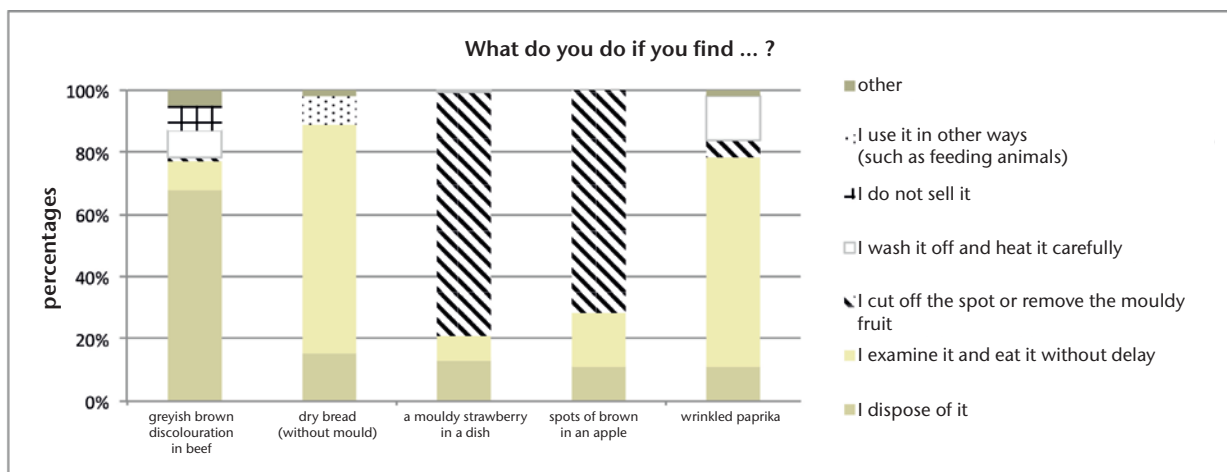


Fig. 2: Consumer behaviour with different products with signs of spoiling

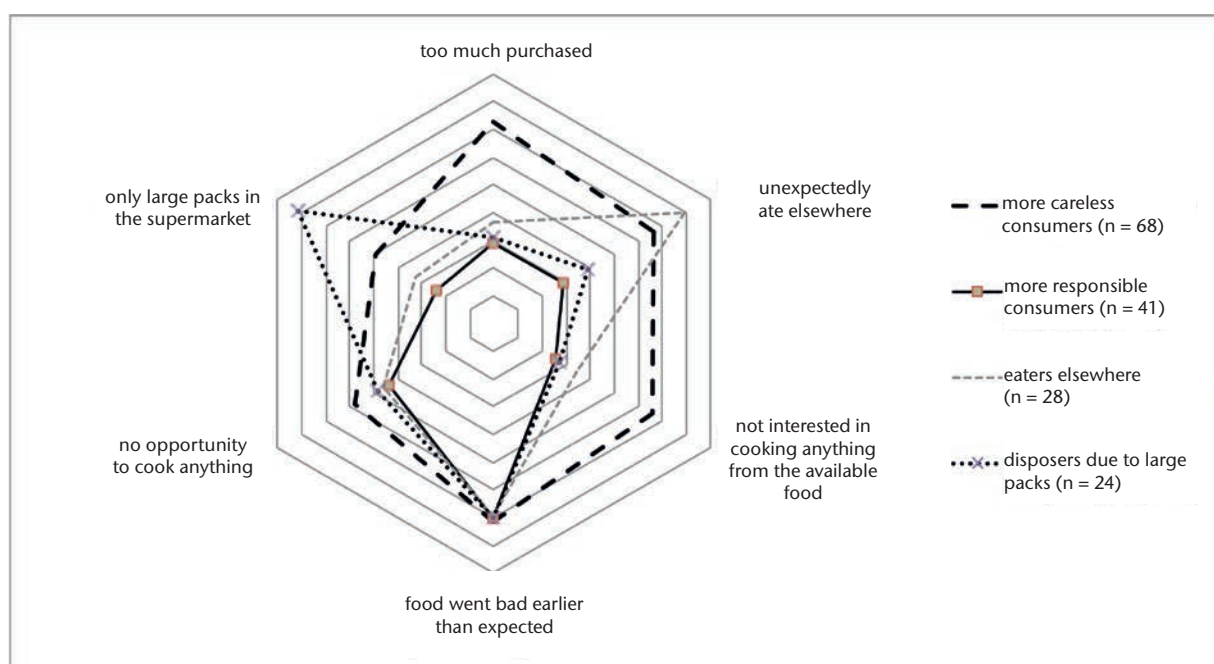


Fig. 3: Food handling by clusters*

* The figure shows the agreement to the individual statements.

(means; 1 = strongly disagree; 5 = strongly agree); points more on the outside indicate better agreement with the statement

In contrast, the proportion of men, older persons and persons without higher educational qualifications was markedly higher in the “more responsible consumers” than in the other groups.

There were also marked differences between the individual groups with respect to purchasing behaviour. “Disposers due to large packs” tended to make unplanned purchases, but to go shopping rather more rarely than the other groups. In contrast, 95 % of “more responsible consumers” tended to make planned shopping trips. They went shopping several times a week, mostly with at least three purchases per week.

The level of knowledge of the different clusters was then compared. It was striking that about 20 % of the members of each of the clusters “more careless consumers”, “eaters elsewhere” and “disposers due to large packs” did not know whether there was any difference between the best before and use-by dates. This proportion was clearly less (10 %) in the “more responsible consumers”

(♦ Figure 4). It may have been a consequence of this ignorance that 17 % of the “disposers due to large packs” and 4 % of the “more careless consumers” reported that they disposed of dry products and tinned food when the best before date had passed. In the other clusters, these products were not disposed of after the best before date.

Discussion and Conclusions

The present study focussed on investigating consumer knowledge of the best before and use-by dates, the use of different methods to protect from spoiling and the reasons for disposing of food. On the other hand, the actual behaviour (the quantity of waste produced) was not recorded, so that comparison with other empirical studies is difficult. A critical point is that the sample size and thus the numbers in the individual clusters are comparatively small and the data are not representative.

The results should therefore be regarded as a preliminary indication of how consumer habits influence food waste.

In an Austrian study, SELZER confirmed that attitudes (e. g. desire for variety, wish for a choice) and excessive purchases (e. g. due to availability) are often given as the reasons for food disposal [15]. However, in contrast to the present study, SELZER did not distinguish between different groups of consumers. The clusters determined in the present study show that only quite specific aspects of consumer behaviour are relevant (e. g. disposal due to unexpected eating elsewhere or due to large packs). On the other hand, the “more careless consumers” tended to be generally more careless in handling food.

At the level of product categories, SELZER demonstrated that 31 % of the respondents disposed of meat, fish and tofu and 26 % disposed of milk products and eggs out of uncertainty as to whether the food was still fresh [15]. On the other hand,

| | More careless consumers (n = 68) | More responsible consumers (n = 41) | Eaters elsewhere (n = 28) | Disposers due to large packs (n = 24) |
|--|----------------------------------|-------------------------------------|---------------------------|---------------------------------------|
| age (years) | 37.1 | 42.8 | 34.8 | 31.4 |
| proportion of women (%) | 62 | 56 | 46 | 79 |
| school leaving exam A-levels or equivalent (%) | 80 | 63 | 71 | 79 |
| household size (in persons) | 2.4 | 2.5 | 1.9 | 1.7 |
| net household income per person (€/month)* | 861 | 935 | 951 | 785 |

Tab. 1: Characterisation of the cluster types on the basis of socio-demographic characteristics

* The calculation of the household income per person was based on income recorded by categories. Each class mean was then divided by the number of persons in the household, without weighting for adults and children.

only 9 % of study participants disposed of grain, cereals, noodle snacks or similar for reasons connected with freshness or taste. Thus SELZER confirmed that there are differences in consumer behaviour after the best before date [15], as found in the present study.

It is nevertheless a worrying finding that about a quarter of all respondents were uncertain about the distinction between use-by and best before dates. Similarly, the German study of *Cofresco Frischhalteprodukte GmbH & Co. KG* concluded that about a third of all consumers dispose of foods in principle once the best before date is passed and that there are socio-demographic differences in this respect [16]. Moreover, the waste diaries in the Cofresco study show that consumers clearly underestimate the actual quantities of waste food. Thus, the quantity of waste food recorded in the diaries was about 3.5-fold greater than the values estimated by the consumers [16]. Our results indicate that one reason for this may be the consumers' lack of knowledge about the best before date, coupled to general carelessness in handling food, as in our type of the "more careless consumers". In their review article, PARFITT et al. report similar problems with the labels "use by" and "best before" [17]. For this reason, the former Federal Ministry of Food and Agricul-

ture (BMELV) in Germany advocates proper procedures for dealing with the best before date throughout the marketing chain [10].

The households used different strategies to protect food from spoiling. 85 % used freezing, but only a fifth used bottling and fewer than 10 % pickled products. It should then be born in mind that consumers may have to make special purchases for bottling or preparing jams and use fewer foods that they have produced themselves, e. g. from their own garden. These results are consistent with the findings of the National Consumption Study II (NVS II), according to which consumers freeze food much more frequently (87 % of study participants) than bottling (45 %) or pickling (23 %) [18].

In order to support more sustainable nutrition, it might be possible to reduce disposal problems [7]. Current initiatives include the campaigns on food waste and disposal behaviour developed by the former BMELV, e. g. the information campaign "too good for the bin" ["Zu gut für die Tonne"], as initiated in 2011 [19]. The campaign's internet page provides the consumer with information, including the meaning of the best before date and tips about improving food storage. This information campaign is also intended for all other actors in the food value added chain, in

order to reduce food waste. Another example is the Internet page entitled "edible" ["essenswert"] [20]. This is a Bavarian initiative, with a similar structure to that of the BMELV, but attempts to convince regional actors. The motto of the online portal "foodsharing" is "share food, don't throw it away". In this platform, registered users have the direct possibility of offering food for sale or of purchasing food. The portal's operators report that they have already helped to prevent more than 950,000 kg food from being thrown away (status: 23 January 2015) [21].

On the basis of the present study, actions can be recommended to reduce avoidable food waste in households. As advocated by the ISWA, these recommendations should focus on how to support households to consume food in good time and to understand that the best before date should not be regarded as a use-by date [2].

1. Some households possess expertise in how foods can be prevented from spoiling and exploit this in practice. Traditional procedures for preserving foods should be revived. This is indeed becoming more popular, as there is a trend towards giving friends self-made products, such as jam. However,

more effort should be made to transmit this knowledge, particularly to younger people, perhaps in night schools.

2. Some households are also ignorant about the correct use of information about use-by and best before dates. Information campaigns such as the BMELV flyer “plate or bin” [“Teller oder Tonne”] [19] use examples to explain this problem. It would be desirable to transmit this knowledge, perhaps to schoolchildren or to food retailers.

3. The German Scientific Advisory Committee for Agricultural Politics recommends that more sustainable nutrition could be supported if the “concept of the best before date were reconsidered” [7]. This is similar to the initiative from the EU agriculture ministers to abolish best before dates on long lived foods such as noodles, rice, coffee or tea [22]. The present study confirms that dry products, conserves and sweets are hardly ever thrown out after the best before date and that about a third of consumers state even that they never observe the best before date for these products. The initiative from the EU agriculture ministers should therefore be implemented and it should be considered whether additional products can be excluded from the best before date (e. g. mineral water or sugar).

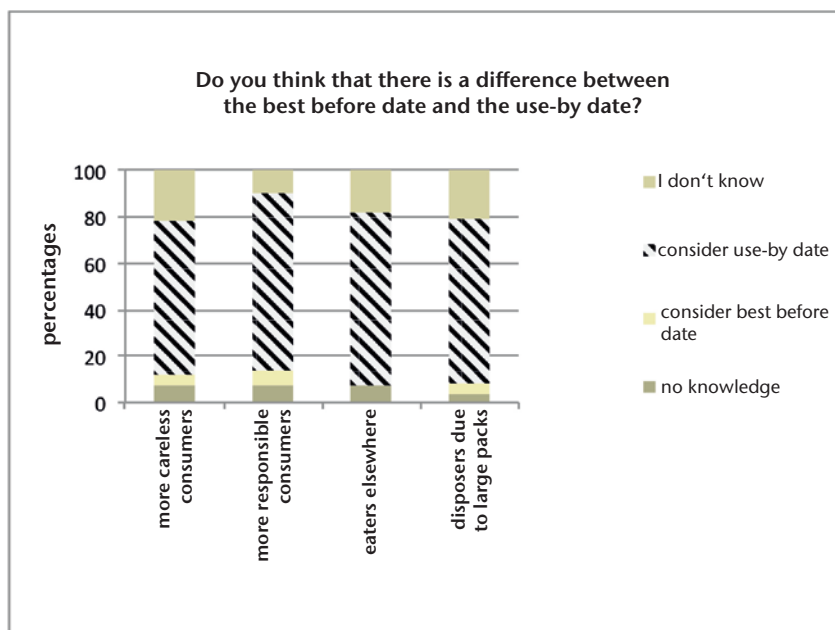


Fig. 4: Knowledge of best before and use-by date by cluster

PD Dr. Anke Möser

Universität Gießen

Institut für Agrarpolitik und Marktforschung
Senckenbergstr. 3, 35390 Gießen

Dr. Juliane Yildiz

Universität Gießen

Institut für Ernährungswissenschaft
Senckenbergstr. 3, 35390 Gießen

E-Mail: juliane.yildiz@ernaehrung.uni-giessen.de

Conflict of Interest

The authors declare no conflict of interest according to the guidelines of the International Committee of Medical Journal Editors.

References

1. Food and Agriculture Organization of the United Nations (FAO). Global Food Losses and Food Waste. Extent, Causes and Prevention. Rome (2011)
2. Institut für Siedlungswasserbau, Wassergüte- und Abfallwirtschaft (ISWA) (2012) Ermittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland. Universität Stuttgart. URL: www.bmel.de/SharedDocs/Downloads/Ernaehrung/WvL/Studie_Lebensmittelabfaelle_Langfassung.pdf?jsessionid=6EF830ED80CDC6B039B017517CE90794.2_cid376?__blob=publicationFile Zugriff 27.06.14
3. Beretta C, Stoessel F, Baier U, Hellweg S (2013) Quantifying food losses and the potential for reduction in Switzerland. *Waste Manage* 33: 764–773
4. Quested T, Johnson H (2009) Household food and drink waste in the UK: A report containing quantification of the amount and types of household food and drink waste in the UK. Banbury. URL: www2.wrap.org.uk/downloads/Household_Food_and_Drink_Waste_in_the_UK_Nov_2011.8c8c4d6c.8048.pdf Zugriff 25.07.14
5. Richtlinie 2008/98/EG des Europäischen Parlaments und des Rates vom 19. November 2008 über Abfälle und zur Aufhebung bestimmter Richtlinien. Amtsblatt der Europäischen Union L 312/3
6. Verordnung über die Kennzeichnung von Lebensmitteln (LMKV) URL: www.gesetze-im-internet.de/lmkv/index.html Zugriff 30.09.14
7. Bauhus J, Christen O, Dabbert S et al. (2012) Ernährungssicherung und nachhaltige Produktivitätssteigerung. Stellungnahme des Wissenschaftlichen Beirats für Agrarpolitik beim Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz. URL: www.bmelv.de/SharedDocs/Downloads/Ministerium/Beiraete/Agrarpolitik/Stellungnahme-Ern%C3%A4hrungssicherung.pdf?__blob=publicationFile Zugriff 25.07.14
8. Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV) (2011) Der Wert von Lebensmitteln – Umfragen im Auftrag des BMELV. URL: www.bmel.de/SharedDocs/Downloads/Presse/ForsaUmfrageWertVonLM.pdf?jsessionid=6EF830ED80CDC6B039B017517CE90794.2_cid376?__blob=publicationFile Zugriff 04.09.14
9. Koester U (2012) Wegwerfen von Lebensmitteln einerseits, hungernde Bevölkerung andererseits: Ineffizient und unmoralisch? IAMO Policy Briefs, Leibniz-Institut für Agrarentwicklung in Mittel- und Osteuropa, No. 7
10. Bundesministerium für Ernährung, Landwirtschaft (BMEL) (o.J.) Das Mindesthaltbarkeitsdatum – BMEL sieht Aufklärungsbedarf. URL: www.bmel.de/DE/Ernaehrung/UmgangLebensmittel/ZuGutFuerDieTonne/_Texte/Mindesthaltbarkeit_kein_Verfallsdatum.html Zugriff 25.07.14
11. Zensusdatenbank Zensus 2011 der Statistischen Ämter des Bundes und der Länder (2014) (Hg). München. URL: <https://ergebnisse.zensus2011.de> Zugriff 29.09.14
12. Backhaus K, Erichson B, Plinke W, Weiber R. Multivariate Analysemethoden: Eine anwendungsorientierte Einführung. 13., überarb. Aufl., Springer-Verlag, Berlin (2011)
13. Brosius F. SPSS 16. Das mitp-Standardwerk. Redline GmbH, Heidelberg (2008)
14. Fromm S. Datenanalyse mit SPSS für Fortgeschrittene 2: Multivariate Verfahren für Querschnittsdaten. VS Verlag für Sozialwissenschaften, Wiesbaden (2010)
15. Selzer M. Die Entsorgung von Lebensmitteln in Haushalten: Ursachen – Flüsse – Zusammenhänge. Wien: Universität für Bodenkultur Wien, Institut für Abfallwirtschaft (2010)
16. Cofresco Frischhalteprodukte GmbH & Co. KG (2011) Save Food Studie. Das Wegwerfen von Lebensmitteln – Einstellungen und Verhaltensmuster. Quantitative Studie in deutschen Privathaushalten. Ergebnisse Deutschland. URL: www.cofresco.de/pdf/Results_Save_Food_Study_Germany.pdf Zugriff 25.07.14
17. Parfitt JP, Barthel M, Macnaughton S (2010) Food waste within food supply chains: quantification and potential for change to 2050. *Philos Trans R Soc London B Biol Sci* 365: 3065–3081
18. Max-Rubner-Institut (MRI) (2008) Bundesforschungsanstalt für Ernährung (Hg). Nationale Verzehrstudie II, Ergebnisbericht Teil 2. Karlsruhe. URL: www.was-esse-ich.de/uploads/media/NVS_II_Abschlussbericht_Teil_1_mit_Ergaenzungsbericht.pdf Zugriff 27.06.14
19. Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV) (2012) Teller oder Tonne? Informationen zum Mindesthaltbarkeitsdatum. Berlin. URL: www.bmel.de/SharedDocs/Downloads/Broschueren/Flyer-Poster/Flyer-MHD.pdf?jsessionid=CE9532028D27EB5EA24AE1044957FC78.2_cid288?__blob=publicationFile Zugriff 27.06.14
20. Ernährungsinstitut Kinderleicht (2015) Bayerischen Infokampagne essensWert. URL: www.essenswert-bayern.de Zugriff 23.01.15
21. Foodsharing e.V. (2014) Foodsharing.de. URL: <http://foodsharing.de> Zugriff 23.01.15
22. Lebensmittelzeitung (LZ) (2014) Kein MHD für Pasta, Reis & Co. Lebensmittelzeitung 66, 23. Mai 2014: 18

DOI: 10.4455/eu.2015.010