

# Displaying Sustainability Related Information on Meals – The Role of Design and Information Depth from a Consumer's Perspective

Nina Langen<sup>1</sup>, Mounaim Rhozyel<sup>1</sup>, Christine Göbel<sup>2</sup>, Melanie Speck<sup>3</sup>, Tobias Engelmann<sup>4</sup>, Holger Rohn<sup>4</sup>, Petra Teitscheid<sup>2</sup>

<sup>1</sup> Technische Universität Berlin, Institute of Vocational Education and Work Studies  
Division of food consumption / food science, Marchstr. 23, 10587 Berlin, Germany

<sup>2</sup> University of Applied Sciences, Institute of sustainable nutrition, Corrensstr. 25, 48149 Münster, Germany

<sup>3</sup> Wuppertal Institute for Climate, Environment and Energy, Döppersberg 19, 42103 Wuppertal, Germany

<sup>4</sup> f10 Institute – Institut für nachhaltiges Wirtschaften gGmbH, Alte Bahnhofstraße 13, 61169 Friedberg, Germany  
[nina.langen@tu-berlin.de](mailto:nina.langen@tu-berlin.de)

---

## ABSTRACT

Food labels are able to support consumers in making more sustainable food choices in out-of-home consumption situations. Thereby, the effect of changing consumption behaviour depends on the format of food labels and on the information it provides. In order to assess the importance of the amount of information as well as the design of food labels displaying sustainability aspects, we test different formats of food labels using a best-worst choice design. So far, no research tested a variation of information depth while keeping label designs fixed. We find clear preferences across both dimensions. Results indicate that consumers regard labels with a higher information depth as more helpful in order to choose a sustainable meal. For the label design it became obvious that the slider-design is preferred over footprints and traffic light label design.

**Keywords:** food label, sustainability labelling, consumer preferences, best-worst scaling, out-of-home consumption

---

## 1 Introduction

The agricultural and food sector has a strong ecological relevance and faces huge challenges regarding loss of fertile soils, raised nutrient levels in water bodies and high carbon emissions that drive climate change, just to name a few. Current patterns in production and consumption of food increase environmental crises instead of providing solutions to them, although changing dietary behaviour offers a great potential to do so. However, there is growing scientific interest in the field of sustainable nutrition and, in particular, of changing consumption behaviour. One intensively discussed approach to trigger more sustainable food choices is the use of food labels. Food labels display particular product information visually, perform as additional product attribute and may facilitate decision making under restricted cognitive processing (Caswell & Padberg, 1992). As such, food labels provide additional product information to consumers that cannot be obtained without labelling. Much research has been done on food (packaging) labeling especially in the retail sector (Campos et al., 2011; Grunert & Wills, 2007; Cowburn & Stockley, 2005). Food labels display particular product information visually, perform as additional product attribute and may facilitate decision making under restricted cognitive processing (Caswell & Padberg, 1992). It could be shown that such a labelling is able to change consumption patterns towards *healthier* nutrition choices (e.g. Thorndike et al., 2012) even though more research is needed in order to validate these results (Grunert & Wills, 2007; Sacks et al., 2009). In this regard the determinants that influence the labels' effectiveness on consumers' choice are still in the spot of research activities.

The focus of the study is to provide insights about how sustainability labels should be designed in order to support consumers in making more sustainable food choices. Since out-of-home catering is one of the fastest growing economic sectors in the field of food supply (Nestlé, 2011), we chose to test different sustainability labels in the context of a university canteen. Thereby, we assess the relevance of information depth and label design. The first section sets the theoretical background and summarizes the scientific state of knowledge regarding the use of food

labels and the influencing factors of their effect on consumption behavior. On this basis, we tested consumers' preferences for the amount of information as well as for the design of a sustainability label. Methodically, we applied a best-worst choice experiment and discuss the result.

## 2 Literature Review

### *Understanding and use of food label*

At least for the retail sector, the literature clearly indicates a broad interest in food-labels by consumers (Grunert & Wills, 2007; Cowburn & Stockley, 2005). Especially for strongly processed food products and in case a product is bought for the first time, consumers demand for information on ingredients and nutritional content (Grunert & Wills, 2007). Regarding packaged food products, a majority of consumers indicates to consider food-labels when shopping and to have a positive attitude towards food labels in general (Talagala & Arambepola, 2016; Bosman et al., 2014; van der Merwe et al., 2014, Hall & Osses, 2013; Vemula et al., 2013; Osei et al., 2012; Chen et al., 2011; Ellis & Glanville, 2010; Rothman et al., 2006; Coulson, 2000). Ares et al. (2013) could further prove via eye-tracking technique that consumers actively search for label information on food packages.

The issue how information provided via labels is understood and cognitively processed by consumers is assessed differently in the pertinent literature. As stated, if consumers are asked whether they consider food labels while shopping they indicate to do so (Grunert & Wills, 2007). However, various studies suggest that although consumers look at food labels, they often have problems to correctly interpret the information (Vemula et al., 2013; Watson et al., 2013; van der Merwe et al., 2012; Jacobs et al., 2010; Nørgaard & Brunsø, 2009; Rothman et al., 2006; Cowburn & Stockley, 2005; Tessier et al., 2000). In particular, nutritional information as well as guideline daily amounts (GDA) pose difficulties for consumers. Van Herpen and van Trijp (2011) could show that information provided by nutrition tables is hardly processed, even though consumers state to consider nutrition tables as helpful. There are, however, several studies suggesting that consumers do interpret nutritional information of food labels correctly, especially regarding the nutritional and health value of products (Festila et al., 2014; Grunert, Fernández-Celemín, et al., 2010; Grunert, Wills, et al., 2010). It is proven that consumers more easily estimate the health value of a labeled product. Furthermore, the understanding of food label information is positively correlated with the consumers' nutritional knowledge (Soederberg-Miller & Cassady, 2015; Grunert, Wills, et al., 2010; Drichoutis et al., 2006).

A central question for the purpose of this study is the extent to which food label affect the consumer behavior. There is broad agreement that the use of food labels is influenced by the nutritional knowledge as well as by the fundamental interest in nutrition (Cha et al., 2014; Hall & Osses, 2013; Hess et al., 2011; Drichoutis et al., 2005). Consumers less interested in a healthy diet are less likely to change consumption patterns based on food label information (Carrillo et al., 2012). Studies with a focus on food label in out-of-home settings also confirm differences in the effectiveness of food labels regarding purchase behavior. While Sonnenberg et al. (2013) as well as Lassen et al. (2014) could measure an effect of labels on purchase behavior, Vyth et al. (2011) and Harnack et al. (2008) could not. Harnack & French (2008) explored the effects of calorie information in restaurants and canteens. They find that nutritional knowledge is critical in changing the purchase behavior towards healthier choices. Lassen et al. (2014) used a keyhole-label to mark healthier meals in a staff canteen. Thereby, the average calorie intake was significantly reduced. Vyth et al. (2011) labelled healthier meals in a staff canteen with a health tick. Although there was no significant effect on total sales of healthier meals, customers with a general interest in health issues chose a healthier meal more frequently.

One of the influencing factors in this regard is cognitive dissonance which may lead to ignoring of conflicting information (Feistinger, 1962) as has been shown for nutrient food labels for healthy food options. These are more likely to be followed by individuals who anyway consume more healthy food options than by those who do not (Hoefkens et al., 2012; Van't Riet et al., 2013). Another factor is the ease with which a food label can be understood. In this respect the traffic light system is discussed as a label format relatively easy to understand and to apply. Hence, it is suggested to be appropriate in supporting consumers to make healthier choices (UK Department of Health, 2016; van Herpen & van Trijp, 2011). The amount of complexity is reduced to a minimum as the information depth is limited to just one indicator. In a supermarket setting, complexity of the label might be a critical factor since many purchase decisions have to be made within a relatively short time frame.

### *Complexity and design of food label*

Feunekes et al. (2008) compared eight different front-of-pack nutritional information label that differ in complexity and design. Some of the labels are considered to be rather complex (traffic-light, wheel of health, GDA) while others

provide rather simple information (health tick, smileys, stars). The results of a survey indicate that there is no significant difference between the complex and the simple label regarding user-friendliness. However, the complex labels supported the consumers' understanding of the information significantly more effectively than the simple ones. In addition, the wheel of health and the traffic-light label were rated both as rather trustworthy as well as more preferred compared to the others (Feunekes et al., 2008). Grunert and Wills (2007) also confirm that most consumers are able to correctly interpret label information, regardless of their complexity. However, they suggest to rather apply simple information on labels in order to facilitate cognitive processing in real-life shopping situations. Further studies validate consumers' preferences for less complex food labels (Djekic & Smigic, 2016; Hawley et al., 2012; Cowburn & Stockley, 2005), also in order to approach customers that have difficulties in understanding food label information properly (Nørgaard & Brunsø, 2009; Tessier et al., 2000).

Information processing under time pressure sets limits to the amount of information displayed by food labels. In this respect, a difference exists between the retail sector and the out-of-home catering. In out-of-home catering, the time frame for choosing a meal varies between several seconds and many minutes. Therefore, there are indications that complex labels are preferred in out-of-home settings (Hoefkens et al., 2012). Results from the retail sector also indicate that consumers demand for more detailed information in case of highly processed food products as well as ready-made meals (Grunert & Wills, 2007). However, there are no scientific findings on how much information consumers exactly ask for in out-of-home settings.

Besides the dimension of complexity, the visual layout of food labels plays a crucial role in influencing purchase decisions. There is agreement that color coding supports information processing significantly (Clare & Hancer, 2016; Babio et al., 2013; Hoefkens et al., 2012; Drichoutis et al., 2006). To an extent, color-coding deciphers text information and supports the information processing considerably (Grunert & Wills, 2007). In this regard, Borgmeier and Westenhoefer (2009) could show that GDAs work best if their numbers are highlighted by a colored background. Balcombe et al. (2010) proved in a choice experiment that consumers avoid buying products whose nutrition table contains values that are marked in red color (especially for salt content and saturated fatty acids).

In out-of-home catering, it is also suggested that nutritional values should be highlighted by colors in order to trigger more sales of low-calorie meals (Liu et al., 2012). Hoefkens et al. (2012) recommend a label format consisting of GDA information in combination with visual interpretation aid. Following Bruder et al., (2013), Roberto et al. (2012) as well as Hawley et al. (2012) the traffic light system is most effective in supporting consumers' choices. Roberto et al. (2012) compared the consumers' understanding of GDA information with a traffic-light system that only displays 'high', 'middle' and 'low'. This simple traffic-light system supported consumers most effectively to distinguish healthy food products from unhealthy ones. In an experimental auction, Drichoutis et al. (2009) measured a higher willingness to pay for products which were marked by a traffic light label compared to other label designs.

Overall, the literature clearly suggests an effect of the design of labels on consumer behavior. Nonetheless, there are studies that regard the design of food labels to have a subordinated role (Tait et al., 2016; Rousu & Corrigan, 2008), also compared to the displayed information (Gaschler et al., 2010). Although the literature provides several valuable indications regarding the optimal design of food labels, we found no publication that explicitly aims at the optimal number of indicators of food labels given the same visual design in out-of-home catering. This study aims at closing this gap by testing varying label designs in a best-worst choice experiment.

### **3 Hypothesis and research design**

Based on the above elaborated findings two hypothesis were tested:

#### **H1: There is a main effect for the number of indicators.**

Various studies suggest that simple labels help consumers to interpret label information with relatively less cognitive effort. Therefore, we expect labels containing more than just one indicator to be rated as "less helpful to choose lunch".

#### **H2: There is no main effect for the design.**

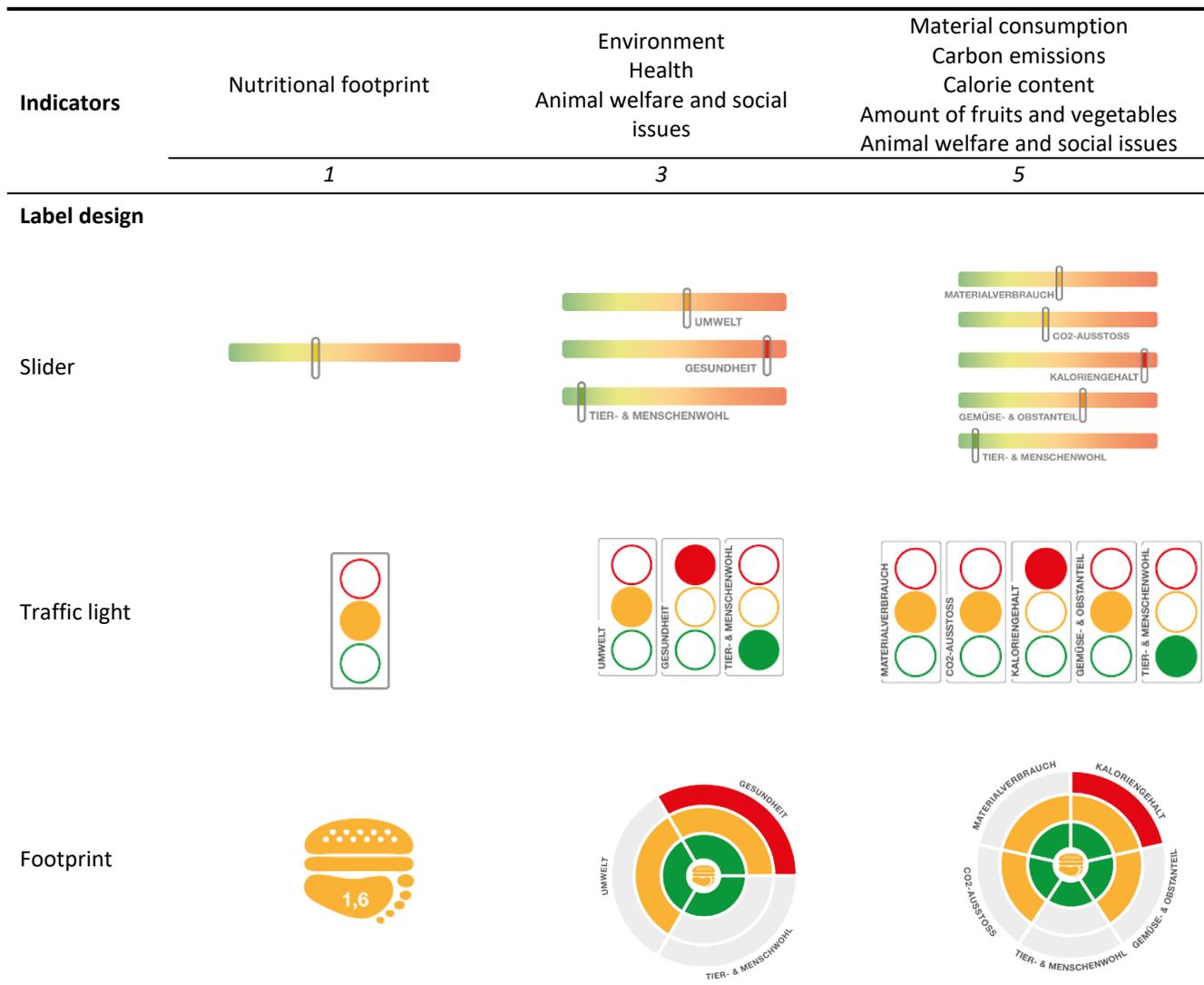
All three design schemes use the traffic light colours. Therefore, we do not expect a certain design to be rated significantly better or worse.

As some studies suggest that comprehensibility (Feunekes et al., 2008) and reliability (Janssen & Hamm, 2012) are critical factors for the acceptance of food label, we expect those labels that are rated high in these categories to be

more successful in the choice experiment. In order to analyze the data we performed a simple counting analysis which adds up the best and worst counts and provides a comparative ranking (e.g. Louviere et al., 2013; Cohen, 2009; Mueller & Rungie, 2009; Orme, 2009). The design of the study was developed via Sawtooth software and the data was analyzed in Stata.

Within the project NAHGAST three different label designs (slider vs. footprint vs. traffic light) and a set of five different sustainability indicators were developed. The sustainability indicators used to display the resource use, the carbon emissions, the calorie content, the share of vegetables and fruits as well as animal and human welfare (basis for the development are the indicators and limits for a sustainable every day nutrition developed by Lukas et al., 2016). In total, nine variations of labels were tested; the three designs presenting either one, three or five indicators (see Figure 1). In this way, the information depth varies along three levels up to the label designs containing five indicators. The approach to vary the information depth while keeping the designs fixed and measure their effect on consumers' preferences has not been done yet. In order to reveal consumers' preferences on these label variations we applied a format of best-worst scaling (BWS) among the guests of the canteens of the university of Bonn/Germany. BWS allows to assess relative preferences in a comparably easy manner and produces results that are interpretable on an interval scale (Flynn et al., 2008; Finn & Louviere, 1992). In contrast to discrete choice experiments, the respondents are forced to discriminate between the presented items as they mark not only the 'best' item but also the 'worst'. Hence, the data provides considerably more statistical information (Louviere et al., 2013).

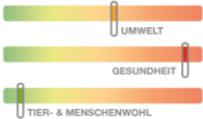
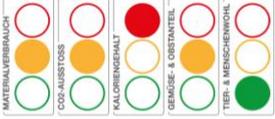
Figure 1: Labels tested



In our survey, respondents had to choose both the most helpful and the least helpful label to support their choice of the meal. Every respondent answered eight choice sets with four alternatives per choice set (for an example of a choice set in German language, see Figure 2). In total n=101 students completed the survey which led to 101x8x2=1.616 choices. We applied four different versions of the experiment in order to ensure that every label

appears equally often with every other label. Subsequent to the best-worst choice experiment, respondents were asked to evaluate each label design in terms of clarity, comprehensibility, reliability, and amount of information (on a five-point scale).

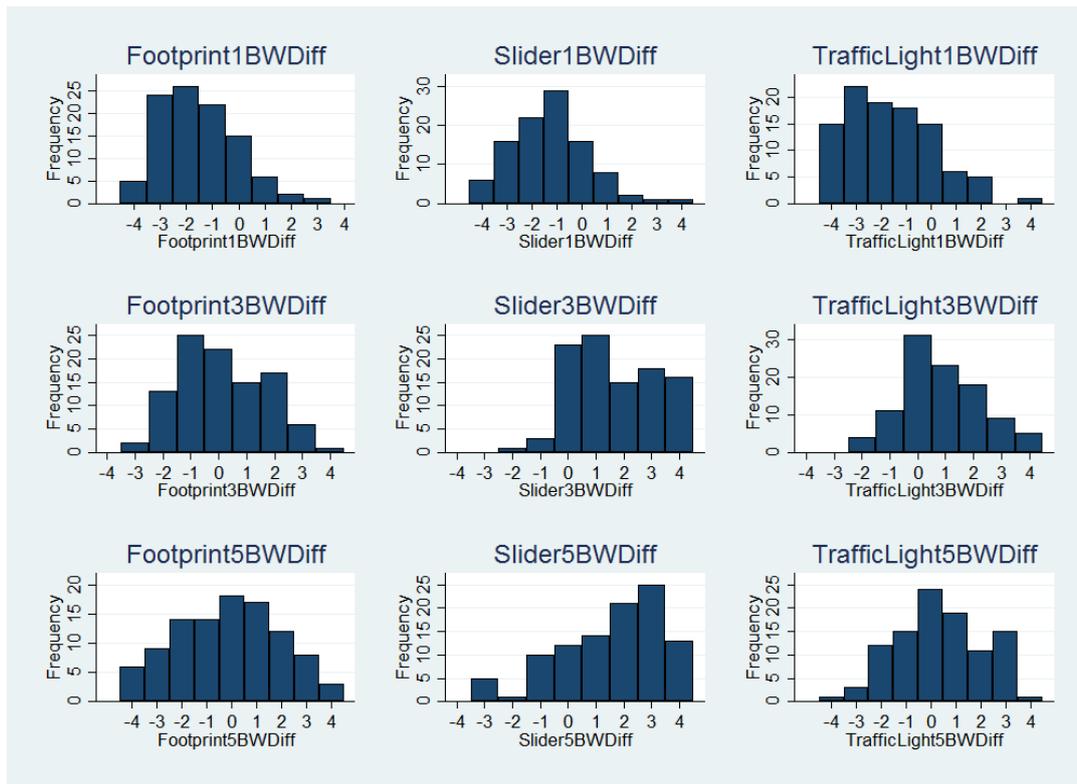
Figure 2: Example of a choice set in German language

am wenigsten hilfreich	Label	am meisten hilfreich
[ ]		[ ]
[ ]		[X]
[X]		[ ]
[ ]		[ ]

#### 4 Results

The counting analysis requires the data to be edited as follows: if a specific label was chosen as “most helpful”, the choice is coded as +1. If a label is chosen as “least helpful”, it is coded as -1 (Sawtooth Software, 2005). Every label appears up to four times across the eight choice sets. Hence, the scale of the best-worst difference per label on an individual level ranges between -4 and 4. A label reaches the maximum value in case it is chosen as “most helpful” every time it appears. The results are displayed in figure 3.

Figure 3: Distribution of best-worse counts by label



While the design of the experiment was balanced the questionnaires obtained are slightly biased, meaning that the labels appear differently often across the different versions of the choice experiment. To deal with this characteristic we follow Flynn et al. (2007) who propose to weight the counts by the appearance of the specific label for each version. This results in the ranking presented in table 1. The labels are sorted by their average best-worst counts.

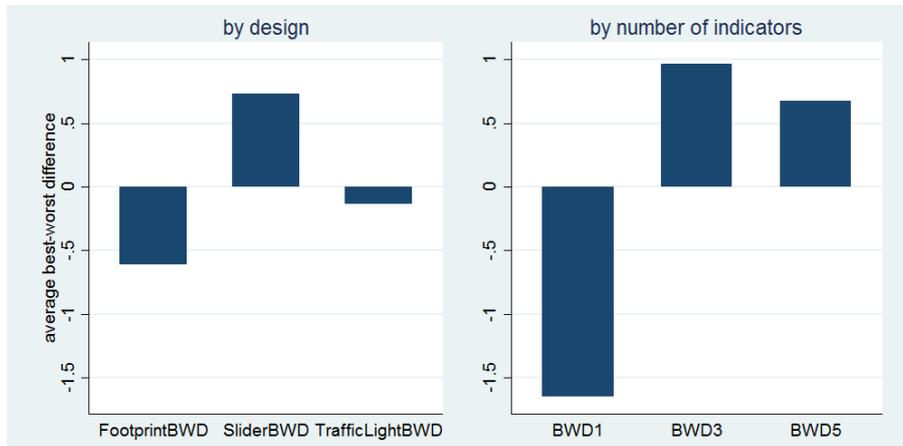
Table 1: Ranking of labels by their average best-worst difference

	mean	sd	min	max	sum
1. Slider3	1.83	1.66	-2.00	4.00	185
2. Slider5	1.76	2.07	-4.00	4.00	177
3. Traffic~3	0.96	1.63	-2.67	4.00	97
4. Traffic~5	0.41	1.92	-4.00	4.00	41
5. Footpri~3	0.10	1.81	-4.00	4.00	10
6. Footpri~5	-0.15	2.35	-4.00	4.00	-15
7. Slider1	-1.39	1.70	-4.00	4.00	-141
8. Traffic~1	-1.76	1.93	-4.00	4.00	-178
9. Footpri~1	-1.79	1.71	-4.00	4.00	-180
N	101				

We identify a strong preference on labels with higher information content. All three labels displaying only one indicator ranked lowest. The respondents consider these labels as least helpful for choosing their lunch. Besides, the results indicate a clear preference for the slider-design displaying three and five indicators. The traffic-light-design displaying five indicators as well as the footprint-design displaying three and five indicators have a relatively balanced best-worst count. If the counts are sorted both by design and by indicators, this tendency is highlighted (Figure 4). The left side of figure 4 displays the average rating for each class of design and the right side shows the same for every

number of indicators. We find clear preferences across both dimensions. The slider-design is slightly preferred over the traffic-light-design while the footprint-design is rated least helpful with a negative average best-worst difference. Regarding the optimal number of indicators, the respondents clearly regard the labels containing only one indicator as least helpful.

Figure 4: Average best-worst difference by design and by number of indicators



## 5 Concluding discussion of findings, limitations and further research

With the aim to promote more sustainable food choices in out-of-home consumption situations we tested different label designs and information depth to identify the most preferred design and the most preferred depth of information. We presume that labels are able to support guests in making more sustainable food choices in out-of-home consumption situations. In particular, in situations where consumers' decisions making is restricted due to limited cognitive processing food labels displaying particular product information visually can perform as additional product attribute and may facilitate decision. Furthermore, we assume that the extent to which consumption behaviour can be influenced depends on the format of food labels and on the information it provides.

Within the project NAHGAST three different label designs (slider vs. footprint vs. traffic light) and a set of five different sustainability indicators were developed. The sustainability indicators used display the resource use, the carbon emissions, the calorie content, the share of vegetables and fruits as well as animal and human welfare. In total, nine variations of labels were tested; the three designs presenting either one, three or five indicators. In this way, the information depth varies along three levels up to the label designs containing five indicators. BWS was used to elicit relative preferences of consumers.

The results suggest that consumers consider labels with a higher information depth as more helpful in order to choose a sustainable meal. Hence, research hypothesis, H1 (there is a main effect for the number of indicators) is supported by the estimation results. In this regard, we can confirm the findings of Feunekes et al. (2008) who also could show that rather complex labels support consumers' understanding of the information significantly more effective than simple ones. In contrast to Feunekes et al. (2008), we explicitly tested a varying complexity keeping the design fixed. We suspect that consumers rather accept a complex sustainability label in the environment of a canteen than in a supermarket, since consumers have more time to make a choice and, hence, can process more detailed information. In this regard, our results are in accordance with Hoefkens et al. (2012) who also confirm a consumers' preference for rather complex labels in a catering environment.

The second hypothesis H2 (there is no main effect for the design) is not confirmed by the study results. Instead, we find a preference for the slider-design compared to the two other label designs.

This study is subject to different limitations. First, the measurement of the amount of information consumers indicate as helpful in order to use a label for decision making in out-of-home consumption situations was hypothetical. The labels were not tested in the field and consumers' decision making was not monitored as conditional of label design and complexity. This was considered reasonable as practise partners were not willing to test different label formats in their settings to not confuse their guests. The study is therefore rather a pre-study to select the best label format which then can be applied in a real world setting. The goal of the hypothetical experiment was therefore to reduce the amount of possible label designs and information amounts to one label which hopefully is accepted by practitioners to test in the field. Second, the sample is a convenience sample comprised exclusively of students. Due to the high

homogeneity in our sample, one should be tentative to apply our findings to other social groups or settings, since it can be expected that the level and determinants of consumers' preferences for information depth and label design differ according to socio-demographics such as age, income and education as well as out-of-home settings such as fast food restaurants or gourmet restaurants.

To overcome the named limitations, we will test the label identified in this study in different out-of-home consumption settings with more diverse samples in spring 2017. Hence, the results of this study form the basis of testing the effectiveness of sustainability labels in the field. The mostly preferred label will be used for interventions at company canteens in order to estimate changes in actual consumption behaviour. We see great potential in promoting sustainable food choices in out-of-home catering and regard this study as an important contribution to the transformation towards sustainable food systems.

## 6 References

- Babio, N., Vicent, P., López, L., Benito, A., Basulto, J., & Salas-Salvadó, J. (2013). Adolescents' ability to select healthy food using two different front-of-pack food labels : a cross-over study. *Public Health Nutrition*, 17(6), 1403–1409. <https://doi.org/10.1017/S1368980013001274>
- Balcombe, K., Fraser, I., & Falco, S. Di. (2010). Traffic lights and food choice: A choice experiment examining the relationship between nutritional food labels and price. *Food Policy*, 35(3), 211–220. <https://doi.org/10.1016/j.foodpol.2009.12.005>
- Borgmeier, I., & Westenhoefer, J. (2009). Impact of different food label formats on healthiness evaluation and food choice of consumers : a randomized-controlled study, 12, 1–12. <https://doi.org/10.1186/1471-2458-9-184>
- Bosman, M. J., Van Der Merwe, D., Ellis, S. M., Jerling, J. C., Badham, J., Bosman, M. J. C., & Van Der Merwe, D. (2014). South African adult metropolitan consumers' opinions and use of health information on food labels. *British Food Journal*, 116(4), 30–43. <https://doi.org/10.1108/BFJ-12-2011-0298>
- Bruder, A., Honekamp, W., & Hackl, J. M. (2013). [Effects of calorie information and nutrition traffic light on alimentation behaviour in public catering]. *Gesundheitswesen*, 75(8-9), e119–25. <https://doi.org/10.1055/s-0032-1327737>
- Campos, S., Doxey, J., & Hammond, D. (2011). Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutrition*, 14(8), 1496–1506. <https://doi.org/10.1017/S1368980010003290>
- Carrillo, E., Varela, P., & Fisman, S. (2012). Influence of Nutritional Knowledge on the Use and Interpretation of Spanish Nutritional Food Labels. *Journal of Food Science*, 71(1), 1–8. <https://doi.org/10.1111/j.1750-3841.2011.02479.x>
- Caswell, J. A., & Padberg, D. I. (1992). Toward a More Comprehensive Theory of Food Labels. *American Journal of Agricultural Economics*, 74(2), 460–468. <https://doi.org/10.2307/1242500>
- Cha, E. S., Kim, K. H., Lerner, H. M., Dawkins, C. R., Bello, M. K., Umpierrez, G., & Dunbar, S. B. (2014). Health literacy, self-efficacy, food label use, and diet in young adults. *American Journal of Health Behavior*, 38(3), 331–339. <https://doi.org/10.5993/AJHB.38.3.2>
- Chen, X., Jahns, L., Gittelsohn, J., & Wang, Y. (2011). Who is missing the message ? Targeting strategies to increase food label use among US adults. *Public Health Nutrition*, 15(5), 760–772. <https://doi.org/10.1017/S1368980011002242>
- Clare, G., & Hancer, N. (2016). The Influence of Tunable LED Lighting Systems on Consumer Food Label Perceptions. *Food and Nutrition Sciences*, 7, 566–576.
- Cohen, E. (2009). Applying best-worst scaling to wine marketing. *International Journal of Wine Business Research*, 21(1), 41–49. <https://doi.org/10.1108/17511060910948008>
- Coulson, N. S. (2000). An application of the stages of An application change model to consumer use of food labels. *British Food Journal*, 102(9), 661–668.
- Cowburn, G., & Stockley, L. (2005). Consumer understanding and use of nutrition labeling: a systematic review. *Public Health Nutr*, 8(1), 21–28. <https://doi.org/10.1079/PHN2004666>
- Cowburn, G., & Stockley, L. (2005). Consumer understanding and use of nutrition labelling : a systematic review. *Public Health Nutrition*, 8(1), 21–28. <https://doi.org/10.1079/PHN2004666>

- Djekic, I., & Smigic, N. (2016). Food labels – status and consumers’ attitude on the Serbian food market. *Nutrition & Food Science*, 46(2), 204–216. <https://doi.org/10.1108/NFS-09-2015-0102>
- Drichoutis, A. C., Lazaridis, P., & Nayga, R. M. (2005). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics*, 32(1), 93–118. <https://doi.org/10.1093/erae/jbi003>
- Drichoutis, A. C., Lazaridis, P., & Nayga, R. M. (2006). Consumers’ use of nutritional labels: a review of research studies and issues. *Academy of Marketing Science Review*, 9(9), 1–22.
- Drichoutis, A. C., Lazaridis, P., & Nayga, R. M. (2009). Would Consumers Value Food-Away-From-Home Products With Nutritional Labels ? *Agribusiness*, 25(May 2006), 550–575. <https://doi.org/10.1002/agr>
- Ellis, S., & Glanville, T. (2010). Trans Fat Information on Food Labels : Consumer Use and Interpretation. *Revue Canadienne de La Pratique et de La Recherche En Di  t  tique*, 71(4), 2010. <https://doi.org/10.3148/71.1.2010.6>
- Feistinger, L. (1962). *A Theory of Cognitive Dissonance* (2nd ed.). Stanford University Press.
- Festila, A., Chrysochou, P., & Krystallis, A. (2014). Consumer response to food labels in an emerging market : the case of Romania. *International Journal of Consumer Studies*, 38, 166–174. <https://doi.org/10.1111/ijcs.12085>
- Feunekes, G. I. J., Gortemaker, I. A., Willems, A. A., Lion, R., & van den Kommer, M. (2008). Front-of-pack nutrition labelling: Testing effectiveness of different nutrition labelling formats front-of-pack in four European countries. *Appetite*, 50(1), 57–70. <https://doi.org/10.1016/j.appet.2007.05.009>
- Finn, A., & Louviere, J. J. (1992). Determining the Appropriate Response to Evidence of Public Concern: The Case of Food Safety. *Journal of Public Policy & Marketing*, 11(2), 12–25. <https://doi.org/10.2307/30000270>
- Flynn, T. N., Louviere, J. J., Peters, T. J., & Coast, J. (2007). Best – worst scaling : What it can do for health care research and how to do it, 26, 171–189. <https://doi.org/10.1016/j.jhealeco.2006.04.002>
- Flynn, T. N., Louviere, J. J., Peters, T. J., & Coast, J. (2008). Estimating preferences for a dermatology consultation using Best-Worst Scaling: comparison of various methods of analysis. *BMC Medical Research Methodology*, 8(1), 76. <https://doi.org/10.1186/1471-2288-8-76>
- Gaschler, R., Mata, J., St  rmer, V. S., K  hnel, A., & Bilali  , M. (2010). Change detection for new food labels. *Food Quality and Preference*, 21(1). <https://doi.org/10.1016/j.foodqual.2009.08.013>
- Grunert, K. G., Fern  ndez-Celemin, L., & Wills, J. M. (2010). Use and understanding of nutrition information on food labels in six European countries. *Journal of Public Health*, 18, 261–277. <https://doi.org/10.1007/s10389-009-0307-0>
- Grunert, K. G., & Wills, J. M. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health*, 15, 385–399. <https://doi.org/10.1007/s10389-007-0101-9>
- Grunert, K. G., Wills, J. M., & Ferna, L. (2010). Nutrition knowledge , and use and understanding of nutrition information on food labels among consumers in the UK   . *Appetite*, 55, 177–189. <https://doi.org/10.1016/j.appet.2010.05.045>
- Hall, C., & Osses, F. (2013). A review to inform understanding of the use of food safety messages on food labels. *International Journal of Consumer Studies*, 37, 422–432. <https://doi.org/10.1111/ijcs.12010>
- Harnack, L. J., French, S. a, Oakes, J. M., Story, M. T., Jeffery, R. W., & Rydell, S. a. (2008). Effects of calorie labeling and value size pricing on fast food meal choices: results from an experimental trial. *The International Journal of Behavioral Nutrition and Physical Activity*, 5, 63. <https://doi.org/10.1186/1479-5868-5-63>
- Harnack, L. J., & French, S. A. (2008). Effect of point-of-purchase calorie labeling on restaurant and cafeteria food choices : A review of the literature. *International Journal of Behavioral Nutrition and Physical Activity*, 6, 3–8. <https://doi.org/10.1186/1479-5868-5-51>
- Hawley, K. L., Roberto, C. A., Bragg, M. A., Liu, P. J., Schwartz, M. B., & Brownell, K. D. (2012). Review Article The science on front-of-package food labels. *Public Health Nutrition*, 1–10. <https://doi.org/10.1017/S1368980012000754>
- Herpen, E. Van, & Trijpp, H. C. M. Van. (2011). Front-of-pack nutrition labels . Their effect on attention and choices when consumers have varying goals and time constraints   . *Appetite*, 57(1), 148–160. <https://doi.org/10.1016/j.appet.2011.04.011>
- Hess, R., Visschers, V. H. M., & Siegrist, M. (2011). The role of health-related , motivational and sociodemographic

- aspects in predicting food label use : a comprehensive study. *Public Health Nutrition*, 15(3), 407–414. <https://doi.org/10.1017/S136898001100156X>
- Hoefkens, C., Chellattan, P., Huylenbroeck, G. Van, & Camp, J. Van. (2012). What nutrition label to use in a catering environment ? A discrete choice experiment. *JOURNAL OF FOOD POLICY*, 37(6), 741–750. <https://doi.org/10.1016/j.foodpol.2012.08.004>
- Jacobs, S. A., Beer, H. De, & Larney, M. (2010). Adult consumers' understanding and use of information on food labels : a study among consumers living in the Potchefstroom and Klerksdorp regions , South Africa. *Public Health Nutrition*, 14(3), 510–522. <https://doi.org/10.1017/S1368980010002430>
- Janssen, M., & Hamm, U. (2012). Product labelling in the market for organic food : Consumer preferences and willingness-to-pay for different organic certification logos. *Food Quality and Preference*, 25(1), 9–22. <https://doi.org/10.1016/j.foodqual.2011.12.004>
- Lassen, A. D., Beck, A., Leedo, E., Andersen, E. W., Christensen, T., Mejbørn, H., ... Tetens, I. (2014). Effectiveness of offering healthy labelled meals in improving the nutritional quality of lunch meals eaten in a worksite canteen q. *APPETITE*, 75, 128–134. <https://doi.org/10.1016/j.appet.2013.12.005>
- Liu, P. J., Roberto, C. a., Liu, L. J., & Brownell, K. D. (2012). A test of different menu labeling presentations. *Appetite*, 59(3), 770–777. <https://doi.org/10.1016/j.appet.2012.08.011>
- Louviere, J., Lings, I., Islam, T., Gudergan, S., & Flynn, T. (2013). An introduction to the application of (case 1) best-worst scaling in marketing research. *International Journal of Research in Marketing*, 30(3), 292–303. <https://doi.org/10.1016/j.ijresmar.2012.10.002>
- Lukas, M., Rohn, H., Lettenmeier, M., Liedtke, C., Wirges, M., Wiesen, K., ... Lenthe, C. von. (2016). Assessing Indicators and Limits for a Sustainable Everyday Nutrition. *Proceedings in Food System Dynamics*, 0(0), 299–313. <https://doi.org/10.18461/PFSD.2016.1633>
- Merwe, D. Van Der, Bosman, M., & Ellis, S. (2014). Consumers' opinions and use of food labels : Results from an urban – rural hybrid area in South Africa. *FRIN*, 63, 100–107. <https://doi.org/10.1016/j.foodres.2014.03.032>
- Merwe, D. Van Der, Bosman, M., Ellis, S., Beer, H. De, & Mielmann, A. (2012). Consumers' knowledge of food label information : an exploratory investigation in Potchefstroom , South Africa. *Public Health Nutrition*, 16(3), 403–408. <https://doi.org/10.1017/S136898001200287X>
- Mueller, S., & Rungie, C. (2009). Is there more information in best-worst choice data?: Using the attitude heterogeneity structure to identify consumer segments. *International Journal of Wine Business Research*, 21(1), 24–40. <https://doi.org/10.1108/17511060910948017>
- Nestlé. (2011). So i(s)st Deutschland 2011. *Nestlé-Studie - Zusammenfassung*, (Grafik 1), 1–12.
- Nørgaard, M. K., & Brunsø, K. (2009). Families' use of nutritional information on food labels. *Food Quality and Preference*, 20(8), 597–606. <https://doi.org/10.1016/j.foodqual.2009.07.005>
- Orme, B. (2009). MaxDiff Analysis: Simple Counting, Individual-Level Logit, and HB. *Research Paper Series*.
- Osei, M. J., Lawer, D., & Aidoo, R. (2012). Consumers' Use and Understanding of Food Label Information and Effect on their Purchasing Decision in Ghana ; A Case Study of Kumasi Metropolis Consumers' Use and Understanding of Food Label Information and Effect on their Purchasing Decision in Ghana ; *Asian Journal of Agriculture and Rural Development*, 2(3), 351–365.
- Roberto, C. A., Bragg, M. A., Schwartz, M. B., Seamans, M. J., Musicus, A., Novak, N., & Brownell, K. D. (2012). Facts Up Front Versus Traffic Light Food Labels. *American Journal of Preventive Medicine*, 7(2), 134–141. <https://doi.org/10.1016/j.amepre.2012.04.022>
- Rothman, R. L., Housam, R., Weiss, H., Davis, D., Cde, R. D., Gregory, R., ... Elasy, T. A. (2006). Patient Understanding of Food Labels - The Role of Literacy and Numeracy. *American Journal of Preventive Medicine*, 2006(x), 1–8. <https://doi.org/10.1016/j.amepre.2006.07.025>
- Rousu, M. C., & Corrigan, J. R. (2008). Estimating the Welfare Loss to Consumers When Food Labels Do Not Adequately Inform: An Application to Fair Trade Certification. *Journal of Agricultural & Food Industrial Organization*, 6.
- Sacks, G., Rayner, M., & Swinburn, B. (2009). Impact of front-of-pack " traffic-light " nutrition labelling on consumer food purchases in the UK. <https://doi.org/10.1093/heapro/dap032>

- Sawtooth Software, I. (2005). The MaxDiff System Technical Paper, Version 8. *Sawtooth Software - Technical Paper Series*.
- Soederberg-Miller, L. M., & Cassady, D. L. (2015). The effects of nutrition knowledge on food label use . A review of the literature ☆. *Appetite*, 92, 207–216. <https://doi.org/10.1016/j.appet.2015.05.029>
- Sonnenberg, L., Gelsomin, E., Levy, D. E., Riis, J., Barraclough, S., & Thorndike, A. N. (2013). A traffic light food labeling intervention increases consumer awareness of health and healthy choices at the point-of-purchase. *Preventive Medicine*, 57(4), 253–257. <https://doi.org/10.1016/j.ypmed.2013.07.001>
- Tait, P., Saunders, C., Guenther, M., Rutherford, P., & Miller, S. (2016). Exploring the impacts of food label format on consumer willingness to pay for environmental sustainability : A choice experiment approach in the United Kingdom and Japan. *International Food Research Journal*, 23(4), 1787–1796.
- Talagala, I. A., & Arambepola, C. (2016). Use of food labels by adolescents to make healthier choices on snacks : a cross- sectional study from Sri Lanka. *BMC Public Health*, 1–11. <https://doi.org/10.1186/s12889-016-3422-1>
- Tessier, S., Edwards, C. A., & Morris, S. E. (2000). Use and knowledge of food labels of shoppers in a city with a high proportion of heart disease. *Journal of Consumer Studies & Home Economics*, 24(1), 35–40.
- UK Department of Health. (2016). *Guide to creating a front of pack (FoP) nutrition label for pre-packed products sold through retail outlets*. Retrieved from [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/566251/FoP\\_Nutrition\\_labelling\\_UK\\_guidance.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566251/FoP_Nutrition_labelling_UK_guidance.pdf)
- Van't Riet, J., Werrij, M. Q., Nieuwkamp, R., de Vries, H., & Ruiters, R. A. C. (2013). Message frame and self-efficacy influence the persuasiveness of nutrition information in a fast-food restaurant. *Food Quality and Preference*, 29(1), 1–5. <https://doi.org/10.1016/j.foodqual.2013.01.007>
- Vemula, S. R., Gavaravarapu, S. M., Vardhana, V., Mendu, R., Mathur, P., & Avula, L. (2013). Use of food label information by urban consumers in India – a study among supermarket shoppers. *Public Health Nutrition*, 1–11. <https://doi.org/10.1017/S1368980013002231>
- Vyth, E. L., Steenhuis, I. H. M., Heymans, M. W., Roodenburg, A. J. C., Brug, J., & Seidell, J. C. (2011). Influence of Placement of a Nutrition Logo on Cafeteria Menu Items on Lunchtime Food Choices at Dutch Work Sites. *Journal of the American Dietetic Association*, 111(1), 131–136. <https://doi.org/10.1016/j.jada.2010.10.003>
- Watson, W. L., Chapman, K., Kelly, B., & Hughes, C. (2013). How well do Australian shoppers understand energy terms on food labels ? *Public Health Nutrition*, 16(3), 409–417.