

1 **Highlights**

- 2
- Food waste in consumer households is a sustainable development challenge
- 3
- We relate food(waste)-related lifestyle to waste, awareness, and socio-demographics
- 4
- Five segments emerge across five Northern / Western European countries
- 5
- Distinct marketing approaches are needed depending on the segment in question
- 6
- Food retailers and NGOs working with reducing food waste can apply segmentation

7

1 **My style, my food, my waste! Consumer food waste-related lifestyle segments**

2

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13 **Author contributions**

14 All authors were equally involved in the design of the survey. Jessica Aschemann-Witzel
15 conducted the analysis with input from the other authors and drafted the manuscript. All authors
16 contributed to the writing of the manuscript, made substantive intellectual contributions to the
17 scientific content and approved the final manuscript.

18

19 **Declaration of interests**

20 We declare no competing financial interests.

21

22 **Ethics statement**

23 The study followed the rules of the responsible ethical committee of the region as well as the
24 research centre's ethical principles (following the Helsinki declaration) in designing and
25 conducting the research. No identifying personal information was gathered about the respondents
26 given the data was received anonymously from the research company organizing the consumer
27 panels. Only adult respondents were included.

28

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3 **Abstract**

4 Adapting responsible food marketing practices to different customer types can make a valuable
5 contribution to reducing food waste. The current study investigated the relation between food
6 (waste)-related lifestyle patterns and self-reported food waste, choices for suboptimal food, and
7 food waste awareness using a survey with 4214 consumers across five Northern and Western
8 European countries. Results show differences in food wastage, suboptimal choices, and
9 awareness for five clusters of consumers identified on the basis of food (waste)-related lifestyle
10 patterns. Findings of commonalities allow deriving general food marketing actions targeted to
11 these different consumer lifestyles.

12

13 **Keywords**

14 Food Waste; Food-related Lifestyle; Consumer Behaviour segmentation

15

16 **1. Introduction**

17 *1.1 Food waste as a sustainability issue*

18 Halving food waste is listed as a sub-goal of the UN sustainable development goals (UN, 2015).
19 Tackling food loss and waste typically appears among the combination of measures needed in
20 order to transform our food system within the boundaries of the planet (EAT, 2019; Foley et al.,
21 2011; Hawken, 2017; Keating et al., 2014). At times, food waste reduction is discussed as a ‘no
22 regrets’ activity that also entails a business case (Project drawdown, 2020). Reducing food waste
23 saves money (Buzby and Hyman, 2012), decreases environmental impact (Alexander et al.,
24 2017), and appears more ethical and fair (Gjerris and Gaiani, 2013). As such, reducing food
25 waste seems to be an easy-to-achieve and synergistic objective.

26 However, the mounting body of literature on food waste drivers in the supply chain and
27 consumer behaviour underlines that only at a first glance, food waste appears as a ‘no-brainer’:
28 food loss and waste are caused by a diversity of factors across various supply chain stages and
29 deriving from multiple policies (Garrone et al., 2014; Priefer et al., 2016), supply chain
30 stakeholders (Eriksson et al., 2017; Gruber et al., 2016; Hooge et al., 2018), or individual
31 consumer goals (Aschemann-Witzel et al., 2015; Aschemann-Witzel, 2016; Hebrok and Boks,
32 2017; Quested et al., 2013; Schanes et al., 2018). There are quite a lot of trade-offs between
33 avoiding food waste on the one hand, and achieving other food-related goals on the other, as, for
34 example, food safety and healthy eating (van Boxtael et al., 2014; Watson and Meah, 2012),
35 providing enjoyable meals that signal appreciation and care (Aschemann-Witzel et al., 2019;
36 Graham-Rowe et al., 2014; Visschers et al., 2016), or the convenience of preparing food and
37 being flexible and spontaneous in meal planning (Romani et al., 2018; Stefan et al., 2013).

38 *1.2 Food marketing and food waste*

39 Food marketing is among the factors that influence food waste (Aschemann-Witzel et al., 2015;
40 Cicatiello et al., 2016; Cicatiello et al., 2017; Teller et al., 2018). Food marketing considerations
41 determine the assortment breadth of food products in supermarkets, the degree to which cosmetic
42 specifications are applied to the fruit and vegetables sourced from suppliers (Hooge et al., 2018;
43 Loebnitz et al., 2015) or the type of take-back agreements chosen (Eriksson et al., 2017), the
44 pricing strategies applied to different unit sizes or on running price promotions (Le Borgne et al.,
45 2018; Tsalis, 2020), and the communication of products, offers, or activities to avoid food waste
46 (Kulikovskaja and Aschemann-Witzel, 2017; Louis and Lombart, 2018; Young et al., 2018), to
47 name just a few. Food waste at the retail stage has been found to be underestimated (Cicatiello
48 and Franco, 2020). Much critique about supply chains and retailers causing food waste has been
49 voiced (Devin and Richards, 2016; Stuart, 2009). In the light of this critique, tackling food waste
50 has become one of the issues that retailers address in their corporate sustainability strategies
51 (Aschemann-Witzel et al., 2016; Evans et al., 2017b).

52 In developing tactical approaches to avoiding and reducing food waste in the interaction between
53 the retailer and the consumer, some core elements of marketing become particularly relevant:
54 consumer segmentation, targeting, and positioning (Grunert, 2019). Having in mind that
55 extensive consumer research has shown that complex drivers of food waste interact and affect
56 consumers, it is apparent that there are no one-fits-it-all approaches. Thus, reconsidering the
57 impact of food marketing action on the extent of waste, and why consumers waste food or not,
58 includes thinking of diverse types of consumers in the customer base. An established theory
59 applied to segmenting consumers in the food area is food-related lifestyle (Grunert, 2019). The
60 food-related lifestyle measure acknowledges that consumers differ in their underlying values
61 (Schwartz, 1992; Schwartz and Bardi, 2001) and that they express different opinions, practices

62 and behaviours across different interactions with food in their lives (Brunsø et al., 2004;
63 Scholderer et al., 2004). To date, few research studies have explored segments of consumers with
64 regard to lifestyle as well as food waste (Delley and Brunner, 2017; Gaiani et al., 2018;
65 Mallinson et al., 2016). A range of studies have segmented consumers with regard to food waste
66 (Di Talia et al., 2019; Richter, 2017), but these studies did so within a single country.

67 *1.3 Research objective*

68 On this backdrop, the present research developed a food-related lifestyle measure applied to the
69 issue of food waste. Food waste as caused by a diversity of individual and context-related factors
70 (Aschemann-Witzel et al., 2015; Boulet et al., 2020) calls for an understanding of food waste in
71 the context of the lifestyles that consumers lead. We thus expand an established food-related
72 lifestyle measure with items relevant for food waste and apply it to food waste related variables.

73 A cluster analysis was conducted with the goal of determining segments of consumers in survey
74 data from five Northern and Western European countries. In each country, five clusters were
75 determined and described. By comparing the patterns of a food (waste)-related lifestyle and
76 differences in a range of food waste-related variables and socio-demographics across the
77 countries, we aimed to develop recommendations for food marketing and social marketing
78 approaches for different consumer segments that emerge as common across countries. Food
79 marketers and NGO's working on food waste reductions can use these recommendations in order
80 to target distinct consumer-citizen segments in responsible marketing practices and social
81 marketing aiming to reduce food waste. The study thus makes an essential contribution to the
82 understanding of the relationships between food-related lifestyles and food waste drivers such as
83 awareness and behaviours. It contributes to developing responsible food marketing and policies
84 and actions against food waste.

85

86 **2. Material and Methods**

87 *2.1 Sample*

88 Consumers from five European countries – Denmark, Germany, Norway, Sweden, and the
89 Netherlands – were surveyed. These countries represent northern and western countries of
90 Europe, being relatively similar in lifestyle, eating habits and cultural issues, for instance, when
91 compared to the Mediterranean countries. With this selection we aimed to avoid creating
92 consumer segments solely on the basis of cultural differences. At the same time, it is currently
93 unknown whether cultural similarities are also reflective in food wastage patterns. It is therefore
94 important to study a variety of countries. For example, the selected countries differed in the
95 extent to which food waste had received societal and social media attention at the time of the
96 study, which can affect consumer awareness. A 10-15-minute long questionnaire was
97 administered online in the summer of 2015 by an ESOMAR-certified market research agency.
98 Quotas were applied to nationally representative online panels to achieve a sample representing
99 each country's population in terms of gender, age, region of residence, as well as income and
100 education (see Table 1). In total, 4303 respondents filled out the survey, resulting in at least 850
101 respondents per country.

102

103 Insert Table 1 here

104

105 *2.2 Food (waste)-related lifestyle*

106 The measure of consumers' food-related lifestyle (FRL) originally consisted of 69 statements
107 measured on a 7-point Likert scale (Brunsø et al., 2004; Brunsø and Grunert, 1995; Scholderer et

108 al., 2004). The scale contains five sub-scales: 1) purchasing motives, 2) quality aspects, 3)
109 consumption situations, 4) ways of shopping, and 5) cooking methods, and are called ‘aspects’.
110 Each aspect has a number of dimensions. The measure has been widely applied (Grunert, 2019)
111 and validated across countries (Grunert et al., 2011; Huang et al., 2015) as well as in relation to
112 different issues within the food domain (Pérez-Cueto et al., 2010; Ryan et al., 2004). With the
113 purpose of using the FRL in connection to consumer food waste, we adapted and added items as
114 well as shortened the measure for reasons of space. Out of the original 69 items of the FRL, 19
115 were retained covering all five aspects of the FRL, but omitting some of its sub-dimensions and
116 omitting repeated items within each dimension (focusing on dimensions and items that in
117 previous FRL studies emerged as particularly important for explaining cluster differences). The
118 adaptations and additions were done taking point of departure in previous research of the authors
119 (Aschemann-Witzel et al., 2015; Aschemann-Witzel et al., 2017a) as well as following other
120 empirical research papers on food waste (Lyndhurst, 2010; van Boxstael et al., 2014; Watson and
121 Meah, 2012; Williams et al., 2012; WRAP, 2013) or sustainability in food (Boer et al., 2004;
122 Chrysochou et al., 2010; Hartmann et al., 2013; Lea and Worsley, 2008). The items were pre-
123 tested, translated to the five languages, back-translated, compared to the original text, reconciled
124 for eventual discrepancies in meaning, compared across some of the five languages as per the
125 research team’s multilingual capabilities, and finalised. The measure used in the study contains
126 54 statements, categorized into five sub-scales: 1) purchasing and consumption motives, 2)
127 quality aspects, 3) consumption situations, 4) ways of shopping, and 5) ways of cooking and
128 handling food. The data and approach outlined here and an analysis of the Danish sub-sample
129 alone have been described earlier (Aschemann-Witzel et al., 2018b). In the present paper, we
130 present an analysis of clusters in all five countries, and a comparison across the five countries,

131 leading to a development of profiles of consumer segments that are based on commonalities
132 across the country analysis.

133 *2.3 Self-reported food waste, suboptimal food choices, and food waste awareness*

134 We aimed to build segments of respondents based on their food (waste)-related lifestyle, and
135 then assessing how these segments differ in terms of food waste. To this end, we asked
136 respondents to assess their food waste expressed in percentage and per food category. The
137 question was phrased as follows: ‘If you would try to estimate your own household, how much
138 of the following food [Fresh fruit and vegetables, Milk and dairy, Bread and other bakery
139 products, Meat and fish, Prepared dishes/meals] that you buy or cook ends up being thrown away
140 at home?’ While this measure of food waste has been used repeatedly in research (for example,
141 Delley and Brunner, 2017; Mallinson et al., 2016), it is increasingly acknowledged that it might
142 be affected by a self-reporting bias (Refresh, 2016) and by self-perceptions (Falasconi et al.,
143 2019), and that self-report measures of food waste under-report food waste compared to waste
144 sorting (Elimelech et al., 2019) or compared to diary studies (Giordano et al., 2019). At the same
145 time, self-report measures of food waste have been found to at least correlate with the amount of
146 waste measured by more exact methods (van Herpen et al., 2019). Moreover, the weaknesses of
147 self-report measures of food waste are relevant when assessing the amount of food waste,
148 whereas the current study used this measure solely to compare food waste between groups.
149 Previous research has shown that in the consumer’s mind, “food waste” refers to waste of what is
150 edible (Rohm et al., 2017), thus excluding what the profession defines as “unavoidable waste”.
151 Therefore, the concept of food waste was not defined in the questionnaire. In the absence of any
152 other specification to the consumers, this question item implicitly focused on avoidable food
153 waste.

154 As a further measure of behaviour of relevance for food waste, we measured frequency of
155 choosing an ‘optimal’ against a sub-optimal product of the same type across six categories and in
156 two contexts: in the supermarket and at home. **Optimal food choice can be a cause of food waste**
157 **in both stores and consumer homes, as in both contexts suboptimal food might end up being**
158 **wasted (Aschemann-Witzel, 2018a).** An experimental hypothetical binary choice task was used
159 (the same as in Hooge et al., 2017). The question was phrased as follows: ‘Imagine that you are
160 in a supermarket ready to select [category]. Given an identical price, which one would you
161 choose? / Imagine that you are at home ready to select [category]. Which one would you
162 choose?’ The products were shown as pictures and presented an optimal versus a suboptimal
163 product from the following categories (sub-optimality in store/home in parenthesis): (brown
164 spot) apple, (crooked) cucumber, (close to expiration date/past expiration date) milk, (close to
165 expiration date/past expiration date) yoghurt, (dented package) juice, and (some broken) biscuits.
166 The variable was then calculated as a count of how often an optimal product was chosen across
167 the six choices.

168 The questionnaire also addressed respondents’ knowledge on the extent of food waste as well as
169 the respondents’ opinion on how important it is to address food waste. **We measured the**
170 **importance of food waste compared to other pressing societal issues to avoid response bias and**
171 **to motivate respondents to put the issue of food waste in perspective with other societal issues**
172 **when answering this item.** The items ‘According to what you have heard or would guess: how
173 much of ... the world’s food do you think is wasted (in % across the global food supply chain)? /
174 ... the foods in households are wasted (in % of the food bought)?’ and ‘How important is it to
175 reduce food waste in comparison to ... reducing obesity in our society? / ... reducing
176 environmental pollution in our society? / ... stabilizing the economy in our society?’ were

177 answered on a 7-point scale ranging from ‘much less important’ to ‘much more important’. The
178 self-reported food waste, suboptimal food choices, and food waste awareness data is
179 characterized in Table 2.

180

181 Insert Table 2

182

183 *2.4 Analysis*

184 To address common method variance, we used a variety of scale types, multiple items for the
185 sub-scale of the food (waste)-related lifestyle measure and randomized the sequence of all items
186 (Chang et al., 2010; Fuller et al., 2016). The data was analysed for each country separately, but
187 in the same manner to allow for a discussion of findings across countries. As a first step,
188 exploratory factor analysis (principal component analysis with Varimax rotation) was applied to
189 each of the theoretically derived sub-scales (the five ‘aspects’) of the lifestyle measure (similar to
190 Huang et al., 2015). We then inspected factor loadings of the dimensions within each aspect. We
191 kept items when they loaded with at least 0.4 on the expected factor as well as unequivocally on
192 that factor (at least 0.25 more than on another) (Tabachnik and Fidell, 2007), when this held in at
193 least four of the five countries. We retained lifestyle dimensions when they contained at least two
194 items and were sufficiently reliable (Cronbach alpha of at least 0.5, Huang et al., 2015; Kaiser,
195 1974), or, in case of only two items in the dimension, were significantly correlated (Tabachnik
196 and Fidell, 2007). At the end of this process, 31 items were kept that reflected five aspects and
197 pertained to 12 lifestyle dimensions (see Table 3).

198

199 Insert Table 3 here

200
201 Assessment of metric equivalence through multi-group structural equation modelling (Milfont
202 and Fischer, 2010) indicated that, while we found measurement weight and structural covariance
203 equivalence, there was no measurement residual equivalence. This supported our decision to
204 conduct separate country analysis. The countries in the study are culturally close and answering
205 behaviour typically fairly similar (Ares, 2016; Harzing, 2006; Hoffmann et al., 2013; Hofstede,
206 2001); however, a separate analysis in this study allows for country differences and nuances to
207 remain transparent.

208 To arrive at segments of consumers, we computed factor scores by calculating an averaged
209 variable for the responses to the items in each dimension (Tabachnik and Fidell, 2007), and then
210 conducted a two-step cluster analysis procedure (Punj and Stewart, 1983). A hierarchical cluster
211 analysis of three random sub-samples of two to five percent of the sample was conducted to
212 assess the appropriate number of clusters, and we inspected the agglomeration schedule and
213 dendrogram. Deciding on a five-factor solution as most appropriate, also when comparing across
214 the countries, we then conducted a K-Means cluster analysis with five clusters and in each of the
215 countries.

216 As the last step, we characterized each cluster in terms of how they differed from each other with
217 ANOVAs and respective post-hoc Games-Howell or Scheffé tests. The characterization was
218 done for the lifestyle dimensions as well as for the self-reported food waste, suboptimal food
219 choice, food waste awareness, and the socio-demographic data. For variables at nominal or
220 ordinal measurement levels, Pearson chi-square tests (two-sided) were used. The results of these
221 analyses for every country separately can be found in Tables 4a-e).

222

223 Insert Tables 4a-e here

224

225 **3. Results**

226 In the following, the clusters of each country are characterized. The numbering of the clusters
227 follows the numbers in the tables 4. We particularly point to where clusters are significantly
228 different from other clusters (comparisons such as ‘least/most likely’ refer to comparisons with
229 the other four clusters). Subsequently, we outline which commonalities emerge, that is, what
230 kind of profiles appear to be similar across the countries, and based on these observations, we
231 derive five segments of consumers.

232 *3.1 Cluster characterization per country*

233 In **Germany**, cluster 1 emerged as rather involved with food (judging by the significantly higher
234 means across most dimensions); this cluster is also the one most likely assessing meals as a
235 social event. It includes more younger respondents. Cluster 2 is moderately involved with food
236 (with relatively high means across various statements), and it emerged that this cluster least
237 likely chooses convenience food and most likely plans meals. The cluster majorly consists of
238 females and of respondents with higher incomes, and they report the least food waste. Cluster 3
239 shows the highest share of low-income respondents, and is least likely to choose the optimal food
240 first at home (although only statistically significant when compared to cluster 4). As a
241 characterization of cluster 3, it appears that the dimension of price has a high relevance (as can
242 be seen in the dimensions price-quality relation and price as a criterion). Clusters 1 to 3 assess
243 the issue of food waste as important, while clusters 4 and 5 do so to a lesser extent. Cluster 4 is
244 characterized by being least normative in avoiding food waste and most likely to choose the
245 optimal product at home (compared to cluster 3). The cluster is further characterized by self-

246 reporting most food waste, and by respondents who are more likely younger and male. Lastly,
247 cluster 5 emerged as rather uninvolved with food (judging by the significantly lower means
248 across most dimensions).

249 In the **Netherlands**, cluster 1 is rather uninvolved with food, and the cluster is most likely to
250 choose the optimal product first at home (although only statistically significant when compared
251 to cluster 3). Cluster 2 also appears rather uninvolved with food and more likely chooses
252 convenience food (jointly with cluster 4). Cluster 2 assesses food waste low in importance
253 (similar to cluster 1) and reports most food waste (jointly with cluster 4, but only statistically
254 different from clusters 3 and 5), and has the highest share of younger respondents. Cluster 3 is
255 somewhat involved with food and the least likely of all to choose convenience food; moreover,
256 this cluster counts most females, they report less food waste (jointly with cluster 5), and has a
257 lower likelihood to choose the optimal product at home (although only statistically different
258 when compared to cluster 1). Cluster 4 encompasses respondents involved with food, and this
259 cluster is also the one most likely to assess meals as a social event and to assess food waste as an
260 important topic. Together with cluster 2, they report more food waste. There are fewer low
261 income respondents in this cluster. Cluster 5, finally, is most likely to plan meals compared to
262 the other clusters, reports less food waste (jointly with cluster 3), and includes more of the lower
263 income group.

264 Among the **Danish** respondents, cluster 1 emerged as involved with food and regards food waste
265 as more important compared to the other clusters; together with cluster 2, cluster 1 is more likely
266 to assess meals as a social event. Cluster 2 is rather uninvolved with food – apart from the social
267 event aspect of it – and includes most of the lower income respondents (although not statistically
268 different from clusters 4 and 5) as well as the older age group (together with cluster 4). Cluster 3

269 is most likely to choose convenience food and appears to attach somewhat more importance to
270 price (as can be seen in the price dimension as a criterion). This cluster is less likely to choose
271 the optimal products at home (together with cluster 4, but not statistically different from 1).
272 Cluster 4, in turn, is moderately involved with food, but is most likely to plan meals of all
273 clusters. They also report the least food waste, are less likely to choose the optimal products (as
274 cluster 3), and tend to be of older age. Cluster 5 is uninvolved with food, assesses food waste as
275 least important compared to the other clusters, and reports the highest food waste of all clusters.
276 Cluster 5 consists mostly of men and younger respondents, and this cluster tends to choose the
277 optimal products.

278 In the **Swedish** data, cluster 1 emerged as most involved with food and – jointly with cluster 2 –
279 best at planning meals. Cluster 1 shows a high share of females (although only significantly
280 different from cluster 3). Cluster 2 is moderately involved with food, and least likely (as cluster
281 3) to use convenience food. There is a higher share of high-income respondents. Cluster 3 is
282 characterized by low involvement with food, high awareness of the extent of food waste but
283 assessing it as lowest in importance, reporting most food waste, and mainly consisting of men
284 (although only significantly different from cluster 1). Cluster 4 is characterized by respondents
285 most likely to choose convenience food. This cluster attaches more importance to price (as can
286 be seen in the price dimension as a criterion) and contains the highest share of low-income
287 respondents (although only statistically different to cluster 2). Finally, cluster 5 in the Swedish
288 data set ranges in the middle across various dimensions. This cluster appears to be relatively less
289 interested in price (as can be seen in both the dimension of the price-quality relation and price as
290 a criterion), while meals are most important as a social event (jointly with clusters 1 and 2,
291 though). Income appears to be relatively higher (yet only statistically different from cluster 4).

292 Finally, among the respondents from **Norway**, cluster 1 lies in the middle across many
293 dimensions. Cluster 1 appears to show food involvement in terms of culinary interest (as can be
294 seen by the dimensions of self-fulfilment and cooking), consists of respondents of higher
295 education (distinct from clusters 2 and 5, similar though to clusters 3 and 4), and gives less
296 importance to the price (as can be seen in both the dimension of price-quality relation and price
297 as a criterion). Cluster 2 tends to more likely assess meals as a social event (although this
298 dimension ranges rather low in all clusters) but is otherwise not involved with food. This cluster
299 wastes most food, and is most likely to choose the optimal products at home. In addition, this
300 cluster consists mostly of younger people (similar to cluster 3) and has the highest share of males
301 (although not statistically different from cluster 5). Cluster 3 contains younger respondents as
302 well, but this group shows food involvement in terms of culinary interest (see the dimensions of
303 self-fulfilment and cooking). Cluster 3 is least likely to plan meals, and gives second highest
304 importance to price (after cluster 4). Cluster 4 is rather involved with food, less likely to buy
305 convenience food, and most likely to plan meals. This group has the highest share of females
306 (but only significantly different from cluster 2). Finally, cluster 5 is rather uninvolved with food
307 and is the most likely to choose convenience food. This group gives highest importance to price
308 in the price-quality relation and has the highest share of low income (only significantly different
309 from cluster 1, though).

310 *3.2 Commonalities across countries*

311 Comparing the five-cluster solutions and the characteristics of the clusters across the countries,
312 some commonalities emerge in this observation.

313 Firstly, a profile repeatedly surfacing is that of the food-uninvolved, young, male respondents
314 who assesses food waste as relatively less important. They self-report food waste considerably

315 more than others, and they often choose the optimal food item first, before usage of the sub-
316 optimal food. We call this segment the “*Uninvolved young male waster*” for the purpose of
317 distinction. The segment is particularly apparent in cluster 3 in Sweden, cluster 2 in Norway,
318 cluster 5 in Denmark, cluster 4 in Germany, and cluster 2 in the Netherlands.

319 Secondly, another profile that repeatedly appears is that of respondents who are uninvolved or
320 less involved with food, who focus on price, and have a preference for convenience foods. These
321 respondents often relate to a lower income. We call this segment the “*Convenience and price-*
322 *oriented low income*” for distinction. This group tends to report low amounts of food waste. It is
323 found in cluster 5 in Norway, cluster 4 in Sweden, cluster 3 in Germany, cluster 3 in Denmark,
324 but does not emerge clearly in the Netherlands.

325 Thirdly, another profile found commonly in the countries is characterized by a certain
326 involvement with food, planning meals, using less convenience food, reporting the lowest
327 amount of food waste and showing a higher likelihood to select suboptimal products first for
328 consumption. This profile tends to consist of older respondents or female respondents,
329 sometimes with a fairly higher income, and thus appears rather ‘housewifely’. We call this
330 segment the “*Well-planning cook and frugal food avoider*”. In Norway, this becomes apparent
331 in cluster 4, in Germany in cluster 2, in Denmark in cluster 3. In the Netherlands, however, it is
332 less clear and emerges as part of clusters 3 and 5, while in Sweden, it seems to be part of cluster
333 2, but maybe also 1.

334 A fourth profile is characterized by high involvement with food and high importance given to the
335 issue of food waste, a higher tendency to use meals as social events, and sometimes being less
336 likely to plan meals or to care about prices. This group frequently consists of young or female
337 respondents, We call this segment the “*Young foodie*”. Relative to the other segments in each

338 country, consumers in this group tend to report relatively high levels of food waste. It can be
339 seen in cluster 3 in Norway, cluster 1 in Germany, cluster 4 in the Netherlands, but this group
340 does not emerge clearly in Denmark and Sweden.

341 Finally, a fifth profile with a less distinct characteristic might be respondents with a certain food
342 involvement, in particular a culinary interest, with less importance given to price and lower use
343 of convenience food. This segment sometimes include higher educated, higher income, or
344 elderly consumers. We call this segment the “*Established*”. This segment appears in segment 1
345 in Norway and cluster 2 in Denmark, maybe cluster 5 in Sweden, but does not emerge in
346 Germany and in the Netherlands. The segments of commonality described here are visualized in
347 Figure 1.

348

349 Insert figure 1 here

350

351 **4. Discussion**

352 *4.1 Segments*

353 The cluster analysis of survey data from the five Northern-Western European countries led to a
354 five-cluster solution based on the food-related lifestyle measure adapted to the issue of food
355 waste. Applying this five-cluster solution to each country and observing the commonality in
356 findings, also with regard to how the clusters differ in self-reported food waste, choice of the
357 optimal or the suboptimal food, food waste awareness, and socio-demographic characteristics,
358 profiles of five different consumer segments appeared.

359 To expand the understanding of consumer segments related to food waste, it is valuable to view
360 the current findings in relation to the few existing European studies on food waste-related

361 consumer segmentations. First, a cluster analysis study based on self-reported waste and reasons
362 for wastage of food in Italy in the study by Gaiani et al. (2018) using a convenience sample
363 revealed seven different segments. Gaiani et al. (2018) thereby identified a ‘frugal’ and often
364 older segment, which has some correspondence to the ‘... frugal food avoiders’ in our study. The
365 ‘exaggerating cook’ bears a certain similarity to the food-involved consumers in our study, who
366 both report higher food wastage (Gaiani et al., 2018). Second, a Swiss study explored consumers
367 of a random, telephone-directory based sample with regard to food waste attitude, perceptions
368 and behaviours (Delley et al., 2017). The sub-scales focused on aspects and measures of
369 particular relevance for food waste, and the findings showed six clusters. The resulting
370 ‘conservative’ cluster has quite some overlap with the ‘Well-planning cook and frugal food
371 avoider’ in our study; both segments appear to have housewifely characteristics. A notable
372 difference is that the ‘conservative’ group does not report less food waste, whereas the ‘well-
373 planning ...’ group in our study does report less food waste. Delley et al. (2017) also identify a
374 group of young men indifferent to the issue of food waste and food, which is very much in line
375 with the ‘uninvolved young male waster’ in our study; but also the ‘non-conscious’ in another
376 Italian sample (Di Talia et al., 2019) or the ‘careless food wasters’ in a German sample (Richter,
377 2017). The so-called ‘short-termist’ in the Swiss study bears some similarity to the ‘convenience
378 and price-oriented ...’ in our study, given that both clusters are characterized by price orientation
379 and lower food involvement. Third, a segmentation study on young consumers in the UK and on
380 the relation between food waste and convenience food also applied a self-reported measure of
381 food waste (Mallinson et al., 2016). This study identified five segments and showed that a
382 convenience-food orientation goes hand in hand with greater food waste (Mallinson et al., 2016).
383 This finding is only partly replicated in our study, as the group that places greatest emphasis on

384 convenience food is not necessarily the one reporting most food waste. Finally, the analysis of
385 the Danish sub-set of the present data has been described previously elsewhere (Aschemann-
386 Witzel et al., 2018b); the differences in the cluster characterizations stem from the fact that the
387 current study focuses on pinpointing commonalities across several countries.

388 *4.2 Limitations and future research*

389 Some observations could be made concerning the current study. First, including more questions
390 on the motives and reasons for wastage could have shed additional light on the characterization
391 of the segments. For example, consumers may have very different motives to select optimal or
392 suboptimal products, such as choosing suboptimal products in the store to reduce systemic food
393 waste at the retailer, or choosing optimal products in the store to reduce the likelihood of food
394 waste occurring at home. It has been found that the expected food waste plays a role for
395 consumer choices (Le Borgne et al., 2018). Therefore, future studies should include measures to
396 study the underlying motives.

397 Second, the use of self-report measures in the current study may be subject to biases.
398 Respondents might not be able to recall having wasted food or alter their answers according to
399 how they would like to behave. . We therefore emphasize the importance of interpreting the
400 present self-reported food waste measures only as relative measures and not as absolute food
401 waste measures. Yet, even though self-reports typically underestimate food waste (Cicatiello and
402 Giordano, 2018; Elimelech et al., 2019; Giordano et al., 2019), recent research has shown that
403 self-reported food waste measures can have a good correlation to objectives measures of food
404 waste (Refresh, 2016, also reported in van Herpen et al., 2019, this refers to estimates of waste
405 per category of the past week). What we cannot say assess is whether the consumer segments in
406 our study relatively differ in the degree to which they underestimate food waste in the self-report.

407 The extent to which different segments deviate in self-reporting bias could be an interesting
408 question for further research.

409 Third, a clustering approach requires the researchers to make a number of strategic decisions, in
410 particular with regard to the number of clusters deemed adequate, which may affect the results.
411 For example, an analysis of another set of Danish data using a shorter food (waste)-related
412 lifestyle measure resulted in only four segments (Aschemann-Witzel, 2018b). We used an
413 extensive survey and a large consumer data set and focused on pointing to the factual tendencies
414 underlying probably typical and expected consumer profiles. We thus aimed to provide a
415 valuable and valid consumer clustering that can serve as the starting point for further research on
416 commercial (e.g. when a retailer analyses its own customer data base) and social marketing
417 applications (that is, marketing for non-commercial purposes such as food waste avoidance
418 campaigns).

419 Fourth, the present data were collected in 2015. It is possible that, in line with increasing efforts
420 in awareness-raising campaigns on food waste in Northern-Western European societies
421 (Szulecka et al., 2019), segments might have evolved over the last years. Mapping food waste
422 volumes, food waste awareness and food waste behaviours is a continuous research effort in a
423 changing society, and replication studies would be required to examine the future relevance of
424 the current findings.

425 Given the increasing role that online channels play in the future, it is important to study food
426 waste factors of online marketing, which is a topic yet under-researched. For example, it would
427 useful to study both off- and online perception of food, and to explore how motives, attitudes and
428 practices of consumer segments differ depending on the channels used. Recent research indicates
429 there might be a greater tendency to waste food when buying online (Ilyuk, 2018). Consumer

430 lifestyle groups might differ in the degree to which they more or less likely waste food when
431 shifting their purchases to online channels.

432 Our measure of the relative importance of food waste as opposed to other societal issues in the
433 health, environmental and economic domains did not contribute to the segment characterisation.
434 Future research may incorporate the Consumer's Concern for Food Waste (CCFW) scale
435 proposed by Le Borgne and colleagues (Le Borgne et al., 2016), which evaluates consumers'
436 worries about food waste at personal, interpersonal and global levels.

437

438 *4.3 Food marketing actions and food waste reduction activities*

439 A basic question to ask is whether retailers should care whether or not the food that they sell to
440 consumers is consumed or wasted. It does not appear a primary responsibility of retailers to
441 make their customers actually eat what they bought. In addition, one might even speculate
442 whether food waste is boosting sales, as the amount of food sold goes up. However, there would
443 be clearly ethical concerns about such a strategy, and retailers are increasingly regarding
444 themselves responsible for societal side-effects of their business as part of their corporate social
445 responsibility (Devin and Richards, 2016; Evans et al., 2017a). In addition to that, though, there
446 can be a good business case resulting from visibly and effectively working towards food waste
447 avoidance both in the store and in households, e.g. via a positive brand image or attracting
448 capable employees to the company (for a further discussion of this, see Aschemann-Witzel et al.,
449 2017b).

450 The different segments might be approached differently when it comes to the question of how
451 food marketing should tackle avoidance of food waste when addressing food consumers. This

452 holds both for food marketing by retailers or non-commercial, social marketing towards food
453 waste avoidance by non-governmental organisations (NGOs).

454 Regarding the “*Young foodie*”: Food-involved consumers who are socially active, can be
455 expected to read information more in-depth and be motivated by food waste avoidance
456 communication (Aschemann-Witzel, 2018a; Pearson et al., 2017). Given they are young and
457 more spontaneous and observant of food prices, they more likely use new technologies such as
458 for example apps for information or for finding offers such as leftovers from restaurants (Ciulli
459 et al., 2019). They are motivated to engage with positive buying in their choices, food waste
460 avoidance actions in eating out and socializing (e.g. doggy bags Sirieix et al., 2017 and apps such
461 as ‘too good to go’), thus acting as multipliers of information and practices. Deformed fruit and
462 vegetables have been found to be accepted better by a younger target group (Hooge et al., 2017;
463 Makhal et al., 2020), thus communicating these suboptimal foods to the younger seems
464 advisable. This could for example be in stores at universities, or food and vegetable otherwise
465 wasted could become incorporated into products appealing to younger consumer segments and to
466 on-the-go consumption, such as smoothies. Moreover, retailers might establish collaborations
467 with young people that engage as ‘food savers’ (Schanes and Stagl, 2019) by e.g. donating
468 surplus foods.

469 Consumers such as the “*Well-planning cooks and frugal food avoiders*” are also moderately
470 involved and engaged, and can also be expected to be reached through information and by
471 communication appealing to a food waste avoidance motivation, such as when suboptimal food
472 reduced in price is presented as avoiding food waste. In addition, though, this group can make
473 use of even more detailed information on practices to plan meals and food handling (Stancu et
474 al., 2016), that is, good household tips that require more advanced experience (e.g. storing fruit

475 and vegetable at different adequate temperatures in the fridge). As these consumers appear more
476 frugal in their choices, communication to this segment can make use of this motivation and
477 identity (Gatersleben et al., 2017).

478 Consumers that think and behave similarly to the segment of “*Convenience and price-oriented*
479 *low income*” in particular can be expected to purchase suboptimal food at lower prices,
480 especially when communication is appealing to a budget-saving motive (Aschemann-Witzel et
481 al., 2018a). This suggestion might raise the concern that such price-reduced food is wasted at
482 home; However, research so far does not indicate that this is the case (Aschemann-Witzel et al.,
483 2017b; Giordano et al., 2019). However, this group is the most likely to shop in stores which sole
484 purpose is to sell sub-optimal food – such as the ‘WeFood’ stores in Denmark or the ‘Last
485 Minute Market’ in Italy. Thus, the alternative suboptimal food retail chains that have emerged
486 match well with this customer segment (Aschemann-Witzel et al., 2017a).

487 In terms of the “*Uninvolved young male waster*”, these might not be interested enough in
488 savings to make use of the alternative retail chains. Given their general low concern about food
489 waste and low involvement, this group should also not be expected to make a conscious effort to
490 avoid food waste. Marketing measures that nudge via a change in choice environment
491 (Kallbekken and Sælen, 2013) – smarter packaging, changes in assortment – may be successful
492 in tackling food waste in this customer segment. Such actions do not require customers to make a
493 conscious choice for food waste avoidance.

494 The “*Established*” segment will less likely act on price and budget motives. Instead, marketing
495 actions appealing to their culinary interest, for example communication of diverse use of fruit
496 and vegetable deviating in appearance (Loebnitz et al., 2015), could be a successful avenue to
497 reduce food waste for this group, as would be communicating positively about ‘ugly fruit and

498 vegetable', given it has shown to improve the image of the store (Louis and Lombart, 2018). In
499 addition, costly but convenient services such as meal boxes delivered to the door steps could be a
500 marketing activity particularly adequate for this consumer group. A visualisation of the segments
501 with the corresponding food or social marketing actions can be found in Figure 2.

502

503 Insert Figure 2 here

504

505 **5. Conclusions**

506 Using the established food-related lifestyle measure and adapting it to the issue of food waste,
507 we identified clusters of consumers in an online survey in five Northern European countries and
508 characterised these with regard to food waste, choice of suboptimal food, food waste awareness,
509 and socio-demographics. We derived five profiles of consumers that we observe in the
510 comparison across countries, and describe these as five food consumer segments for which
511 different food marketing actions appear adequate. The study contributes to an in-depth
512 understanding of relationships between lifestyles and food waste drivers.

513 We conclude firstly, that lifestyle patterns with regard to food are linked to differences in food
514 wastage, choice of suboptimal food, and food waste awareness. That is, it is possible to use
515 lifestyle patterns that describe food and food waste related lifestyles, in order to understand
516 potential differences in the level of food waste generated in a household. Therefore, the food-
517 related lifestyle model emerges as a useful concept also for the issue of food waste. We conclude
518 secondly, that five segments of consumers with commonalities across the countries emerge.
519 Thus, common food waster profiles among consumer households appear to be observable and to
520 a certain extent generalizable in the North-western European countries.

521 Findings imply that responsible food retailers or NGO's aiming to contribute to food waste
522 avoidance as a UN sustainable development sub-goal should target different customer groups
523 with distinct commercial or social marketing approaches.

Table 1. Sample characterization per country

	DK	DE	NL	NO	SE
Sample size (n)	848	838	823	851	854
Share of gender, female (%)	51.8	51.1	51.4	50.5	50.8
Share of education level (%):					
Primary school	8.5	20.5	1.2	4.2	4.7
Secondary school / at university or in higher education	11.0	16.1	20.5	28.4	37.2
Vocational education	24.3	37.0	41.1	13.4	20.6
Undergraduate degree (BSc)	27.7	6.2	26.1	32.1	20.5
Graduate degree (MSc)	27.0	17.3	10.3	19.5	15.2
PhD	1.5	2.9	0.7	2.4	1.8
Share of age range (%):					
18-34 years old	29.5	29.1	29.6	31.8	30.8
35-49 years old	31.4	32.0	33.0	34.2	31.0
50-70 years old	39.2	38.9	37.3	34.0	38.2
Age (mean /SD), years)	45.4 (15.4)	43.9 (13.5)	44.4 (14.3)	43.9 (14.2)	45.3 (14.6)
Sample size with income information (n)	728	759	717	737	775
Of these, share of income level range (%):					
Less than half of average	22.7	27.7	27.2	21.4	16.0
Between half of average and average	19.6	35.3	28.0	32.8	26.3
Average	18.8	12.8	23.7	9.8	22.2
Between average and 1.5 times average	22.0	14.8	13.8	23.2	20.8
More than 1.5 times average	16.9	9.5	7.3	12.8	14.7

525 **Note.** DK = Denmark, DE = Germany, NL = The Netherlands, NO = Norway, SE = Sweden.
526 Education levels are representative for the respective country, differences between the countries
527 originate from differences in school and education systems. Average income levels refer to
528 national statistics.

Table 2. Characterization of food waste-related measures per country

	DK	DE	NL	NO	SE
	Mean	Mean	Mean	Mean	Mean
	(SD)	(SD)	(SD)	(SD)	(SD)
Knowledge of the extent –					
% estimated world’s food waste	39.7 (18.6)	44.5 (18.6)	44.8 (18.6)	40.9 (18.0)	43.1 (18.0)
% estimated consumer food waste	30.9 (17.4)	41.5 (18.9)	43.8 (18.3)	41.1 (17.5)	41.3 (17.8)
Relative importance of food waste compared to...(Scale 1-7) –					
reducing obesity	4.1 (1.9)	5.0 (1.5)	4.8 (1.4)	4.0 (1.6)	4.2 (1.6)
reducing pollution	4.9 (1.7)	5.0 (1.5)	4.8 (1.3)	4.6 (1.6)	4.1 (1.5)
stabilizing the economy	4.5 (1.8)	5.1 (1.4)	4.7 (1.4)	4.4 (1.5)	4.2 (1.5)
Tendency to choose ‘optimal’ products –					
in the store	5.1 (1.1)	5.0 (1.4)	5.2 (1.3)	5.2 (1.1)	5.1 (1.2)
at home	3.4 (2.0)	4.5 (1.7)	3.2 (2.0)	2.9 (2.0)	3.4 (2.0)
Self-reported % food waste at home –					
% Fresh fruit and vegetables	14.5 (16.8)	14.8 (18.0)	16.9 (20.0)	14.1 (16.1)	13.7 (15.0)
% Milk and dairy	10.2 (15.0)	11.2 (17.5)	13.2 (19.3)	9.6 (14.2)	8.8 (14.5)
% Bread and other bakery products	13.9 (16.9)	14.0 (17.8)	14.6 (20.3)	13.2 (16.8)	11.6 (15.9)
% Meat and fish	7.9 (13.9)	9.2 (16.6)	11.1 (19.0)	8.1 (13.8)	6.3 (12.7)
% Prepared dishes/meals	11.5 (16.7)	16.8 (21.0)	19.0 (21.6)	15.9 (19.4)	13.8 (17.8)
% Mean self-reported food waste across all five categories	11.6 (13.3)	13.2 (16.2)	15.0 (18.3)	12.2 (13.3)	10.8 (12.7)
% Respondents reporting 0% own waste across all five categories	1.8	4.1	2.9	2.2	1.5

Note. DK = Denmark, DE = Germany, NL = The Netherlands, NO = Norway, SE = Sweden.

Table 3. Statements for food (waste)-related lifestyle (I)

Statement and origin, and aspect / dimension in the F(W)RL measure	Mean/SD	Cronbach alpha or Inter-item correlation
Consumption situation / Social event	3.17/1.40	.266 **
Going out for lunch or dinner is a regular part of our eating habits. FRL	2.93/1.87	-
I often get together with friends to enjoy an easy-to-cook, casual dinner. FRL	3.40/1.66	-
Purchase and consumption motives / Security	3.34/1.31	.313 **
I only buy and eat foods which are familiar to me. FRL	3.79/1.66	-
I dislike anything that might change my eating habits. FRL	2.89/1.57	-
Purchase and consumption motives / Self-fulfilment	4.75/1.51	.602 **
I am an excellent cook. FRL	4.35/1.68	-
I enjoy being able to create meals from scratch. Developed	5.15/1.70	-
Purchase and consumption motives / Social relationships	5.27/1.23	.405 **
Over a meal one may have a lovely chat. FRL	5.66/1.36	-
When eating dinner, the most important thing is that we are together. FRL	4.87/1.57	-
Quality aspects / Credence attributes	4.40/1.31	.851; If item deleted:
It is important to me that the foods I choose are environmentally friendly. Developed	4.31/1.63	.798
I often think about food safety when choosing foods to buy. Developed	4.33/1.72	.836
I control what I eat to make sure it is healthy. Chrysochou et al. 2010	4.86/1.47	.832
I prefer to buy natural products, i.e. products without preservatives. FRL	4.81/1.60	.812
I make a point of using organic food products. FRL	3.70/1.83	.824

534 **Note.** ** $p \leq .001$. Inter-item correlations stated for dimensions with only two items, else, the
535 Cronbach alpha is given. ‘Developed’ indicates that the item is based on knowledge gained through
536 the literature review, expert interviews, focus group research, or several of these sources. ‘Inspired
537 by’ indicates that the phrasing of the statement is based on a specific research study result with the
538 reference given afterwards, items directly taken from another published study are indicated with
539 the reference, and ‘FRL’ indicates that the item originates from the original food-related lifestyle
540 measure.

Table 3. Statements for food (waste)-related lifestyle (II)

Statement and origin, and aspect / dimension in the F(W)RL measure	Mean/SD	Cronbach alpha or Inter-item correlation
Quality aspects / Price and taste	5.47/0.92	.629; If item deleted:
I compare prices between product variants in order to get the best value for money. ^{FRL}	4.87/1.61	.651
I always try to get the best quality at the best price. ^{FRL}	5.51/1.32	.478
I find taste in food products important. ^{FRL}	6.15/1.07	.543
When cooking, I first and foremost consider taste. ^{FRL}	5.35/1.27	.570
Ways of cooking and handling / Convenience	3.22/1.28	.307 **
We use a lot of ready-to-eat foods in our household. ^{FRL}	2.66/1.64	-
Frozen foods account for a large part of the food products I use in our household. ^{FRL}	3.79/1.52	-
Ways of cooking and handling / Cooking interest	4.74/1.40	.462 **
I like to have ample time in the kitchen. ^{FRL}	5.09/1.51	-
Recipes and articles on food from other culinary traditions make me experiment in the kitchen. ^{FRL}	4.40/1.78	-
Ways of cooking and handling / Norms	5.42/1.18	.631; If item deleted:
I hate it when I need to throw food in the bin. ^{inspired by Evans 2012}	5.79/1.44	.407
As long as there are still hungry people in this world, food should not be thrown away. ^{Developed}	5.35/1.63	.494
I always eat what is on my plate. ^{Developed}	5.11/1.60	.679
Ways of cooking and handling / Planning	3.87/1.49	.455 **
I always plan what we are going to eat a couple of days in advance. ^{FRL}	3.72/1.79	-
What we are going to have for supper is very often a last-minute decision. ^{FRL} (reverse)	4.02/1.69	-
Ways of shopping / Optimal choice	5.39/1.03	.525; If item deleted:
I appreciate that packaging keeps products hygienic and safe. ^{WRAP 2013}	5.22/1.37	.465
I compare product appearance to decide which fruit and vegetables to buy. ^{Van Boxstael et al. 2014}	5.51/1.38	.422
I compare date labels to select food with the longest shelf life. ^{Van Boxstael et al. 2014}	5.42/1.56	.378
Ways of shopping / Price criterion	4.50/1.58	.350 **
I frequently buy food close to the best-before date, if it is offered at a lower price. ^{Developed}	4.40/1.91	-
I look for ads in the newspaper for store specials or purchase food that is on discount. ^{FRL & inspired by Williams et al. 2012}	4.59/1.95	-

545

Table 4 a. Characterization of food(waste)-related lifestyle segments, Germany

	1 (208n)	2 (236n)	3 (151n)	4 (153n)	5 (90n)
Dimension	Mean				
Meal as a social event	5.23 ^a	4.54 ^b	2.68 ^c	4.18 ^b	3.01 ^c
Security and familiarity	4.37 ^a	3.02 ^c	3.71 ^b	3.75 ^b	3.73 ^b
Self-fulfilment from cooking	5.63 ^a	5.68 ^a	4.42 ^b	4.18 ^b	2.47 ^c
Social relations via meals	5.55 ^a	5.83 ^a	4.63 ^b	4.32 ^{b,c}	4.16 ^c
Importance of credence attributes	5.52 ^a	5.48 ^a	4.51 ^b	4.17 ^{b,c}	4.04 ^c
Price-quality relation and taste	6.01 ^{a,b}	5.85 ^b	6.14 ^a	4.66 ^d	5.03 ^c
Convenience food	4.56 ^a	2.63 ^d	3.26 ^c	4.09 ^b	3.72 ^b
Norms to avoid food waste	5.90 ^a	5.93 ^a	5.87 ^{a,b}	4.50 ^c	5.59 ^b
Cooking and culinary interest	5.73 ^a	5.80 ^a	4.66 ^b	4.37 ^b	3.14 ^c
Planning meals	4.13 ^b	4.86 ^a	3.88 ^b	3.94 ^b	3.20 ^c
Optimal choice during shopping	5.82 ^a	5.64 ^a	5.54 ^a	4.65 ^b	4.88 ^b
Price as criterion for shopping behaviour	5.62 ^a	3.88 ^b	5.78 ^a	4.09 ^b	2.99 ^c
Knowledge of the extent of food waste	42.2	43.7	43.4	43.1	42.0
Relative importance	5.43 ^a	5.15 ^a	5.18 ^a	4.54 ^b	4.68 ^b
Tendency to choose 'optimal' at home	4.52 ^{a,b}	4.72 ^{a,b}	3.97 ^b	4.88 ^a	4.41 ^{a,b}
Self-reported food waste at home, %	16.2 ^{a,b}	8.3 ^c	10.2 ^b	20.9 ^a	10.9 ^{b,c}
Age mean	41.0 ^c	46.7 ^{a,b}	48.6 ^a	39.3 ^c	43.5 ^{b,c}
Females %	48.6 ^{a,b,c}	64.0 ^a	57.0 ^{a,b}	35.3 ^c	40.0 ^{b,c}
High education %	28.9	31.4	18.5	28.8	16.7
Low income %	58.1 ^{b,c}	54.0 ^c	78.4 ^a	61.4 ^{a,b}	74.4 ^{a,b}

546 **Note.** Respondents' assessment measured on a 7-point Likert disagree/agree scale. Statistical
547 test: One-way ANOVA with post-hoc Games-Howell test. Significant mean differences in group
548 comparison in the post-hoc test (with $p \leq .001$) are indicated by different superscript letters,
549 starting with a = highest mean. For all ANOVA's: $p < .001$.

550

551 **Table 4 b. Characterization of food(waste)-related lifestyle segments, The Netherlands**

	1 (115n)	2 (191n)	3 (200n)	4 (130n)	5 (187n)
<i>Dimension</i>	Mean				
Meal as a social event	2.20 ^d	3.61 ^b	3.14 ^c	4.37 ^a	2.02 ^d
Security and familiarity	3.60 ^b	3.69 ^b	2.45 ^c	4.94 ^a	3.75 ^b
Self-fulfilment from cooking	2.15 ^d	4.15 ^b	5.34 ^a	5.44 ^a	3.52 ^b
Social relations via meals	4.51 ^c	4.36 ^c	5.85 ^a	5.71 ^a	5.31 ^b
Importance of credence attributes	2.90 ^d	3.81 ^c	4.60 ^b	5.17 ^a	3.62 ^c
Price-quality relation and taste	4.29 ^c	4.50 ^c	5.75 ^a	5.89 ^a	5.44 ^b
Convenience food	3.18 ^b	3.59 ^a	2.44 ^c	3.98 ^a	2.86 ^b
Norms to avoid food waste	4.57 ^c	4.32 ^c	5.83 ^{a, b}	6.05 ^a	5.62 ^b
Cooking and culinary interest	2.43 ^c	4.38 ^b	5.91 ^a	5.65 ^a	4.11 ^b
Planning meals	2.96 ^c	3.74 ^b	3.66 ^b	4.00 ^b	4.60 ^a
Optimal choice during shopping	4.42 ^c	4.47 ^c	5.61 ^b	5.92 ^a	5.43 ^b
Price as criterion for shopping behaviour	3.68 ^c	3.98 ^c	4.46 ^b	5.36 ^a	4.92 ^a
Knowledge of the extent of food waste	46.3	43.5	44.7	44.0	43.8
Relative importance	4.47 ^{c, d}	4.30 ^d	4.98 ^{a, b}	5.25 ^a	4.75 ^{b, c}
Tendency to choose 'optimal' at home	3.70 ^a	3.53 ^{a, b}	2.60 ^b	3.21 ^{a, b}	3.10 ^{a, b}
Self-reported food waste at home, %	16.6 ^{a, b}	21.3 ^a	10.5 ^{b, c}	17.8 ^a	10.3 ^c
Age mean	46.7 ^a	38.6 ^b	47.1 ^a	44.5 ^a	46.1 ^a
Females %	47.0 ^{a, b}	41.9 ^b	61.5 ^a	52.3 ^{a, b}	52.4 ^{a, b}
High education %	32.2	36.7	43.5	43.1	30.0
Low income %	59.0 ^{a, b}	48.2 ^{a, b}	58.6 ^{a, b}	45.1 ^b	64.4 ^a

552 **Note.** Respondents' assessment measured on a 7-point Likert disagree/agree scale. Statistical
 553 test: One-way ANOVA with post-hoc Games-Howell test. Significant mean differences in group
 554 comparison in the post-hoc test (with $p \leq .001$) are indicated by different superscript letters,
 555 starting with a = highest mean. For all ANOVA's: $p < .001$.

Table 4 c. Characterization of food(waste)-related lifestyle segments, Denmark

	1 (169n)	2 (189n)	3 (171n)	4 (187n)	5 (132n)
<i>Dimension</i>	Mean				
Meal as a social event	3.29 ^a	3.43 ^a	2.45 ^b	2.72 ^b	2.81 ^b
Security and familiarity	3.74 ^a	3.05 ^c	3.32 ^{b,c}	2.81 ^d	3.48 ^{a,b}
Self-fulfilment from cooking	5.86 ^a	5.13 ^b	3.35 ^c	5.82 ^a	3.29 ^c
Social relations via meals	5.87 ^a	5.25 ^b	4.92 ^b	5.77 ^a	4.08 ^c
Importance of credence attributes	5.04 ^a	4.62 ^b	3.62 ^c	5.01 ^a	3.51 ^c
Price-quality relation and taste	6.07 ^a	5.42 ^c	5.71 ^b	6.10 ^a	4.42 ^d
Convenience food	3.17 ^b	2.39 ^c	3.61 ^a	2.46 ^c	3.27 ^{a,b}
Norms to avoid food waste	5.88 ^a	4.94 ^c	5.52 ^b	5.70 ^{a,b}	4.01 ^d
Cooking and culinary interest	5.59 ^a	5.10 ^b	3.61 ^c	5.70 ^a	3.27 ^c
Planning meals	3.04 ^d	3.03 ^d	3.30 ^{b,c}	5.74 ^a	3.48 ^b
Optimal choice during shopping	5.85 ^a	5.45 ^b	5.52 ^b	5.95 ^a	4.51 ^c
Price as criterion for shopping behaviour	5.61 ^a	3.20 ^c	5.67 ^a	5.01 ^b	3.36 ^c
Knowledge of the extent of food waste	36.2	33.8	33.9	36.5	36.3
Relative importance	5.27 ^a	4.28 ^c	4.35 ^{b,c}	4.77 ^b	3.71 ^d
Tendency to choose 'optimal' at home	3.45 ^{a,b}	3.57 ^a	3.00 ^b	3.10 ^b	4.15 ^a
Self-reported food waste at home, %	11.2 ^{b,c}	12.7 ^b	9.2 ^{b,c}	8.1 ^c	18.5 ^a
Age mean	45.2 ^{a,b}	46.6 ^a	44.3 ^{a,b}	49.1 ^a	40.4 ^b
Females %	59.2 ^a	57.1 ^a	53.2 ^a	55.6 ^a	27.3 ^b
High education %	50.3 ^b	67.7 ^a	54.4 ^{a,b}	56.2 ^{a,b}	50.0 ^b
Low income %	53.2 ^a	30.5 ^b	54.4 ^a	37.3 ^{a,b}	37.2 ^{a,b}

557 **Note.** Respondents' assessment measured on a 7-point Likert disagree/agree scale. Statistical
558 test: One-way ANOVA with post-hoc Games-Howell test. Significant mean differences in group
559 comparison in the post-hoc test (with $p \leq .001$) are indicated by different superscript letters,
560 starting with a = highest mean. For all ANOVA's: $p < .001$.

Table 4 d. Characterization of food(waste)-related lifestyle segments, Sweden

	1 (242n)	2 (245n)	3 (34n)	4 (170n)	5 (163n)
Dimension	Mean				
Meal as a social event	3.12 ^a	3.33 ^a	2.38 ^b	2.40 ^b	3.58 ^a
Security and familiarity	3.44	3.06	3.16	3.33	3.30
Self-fulfilment from cooking	6.10 ^a	6.00 ^a	2.99 ^d	3.73 ^c	4.26 ^b
Social relations via meals	5.70 ^a	5.50 ^{a,b}	2.78 ^d	4.69 ^c	5.06 ^{b,c}
Importance of credence attributes	5.02 ^a	5.11 ^a	2.65 ^c	3.60 ^b	3.75 ^b
Price-quality relation and taste	6.11 ^a	5.59 ^b	3.60 ^d	5.53 ^b	4.97 ^c
Convenience food	3.10 ^{b,c}	2.68 ^c	2.59 ^d	3.83 ^a	3.48 ^{a,b}
Norms to avoid food waste	6.11 ^a	5.47 ^b	3.45 ^d	5.61 ^b	4.76 ^c
Cooking and culinary interest	5.50 ^a	5.55 ^a	2.59 ^d	3.48 ^c	3.98 ^b
Planning meals	4.40 ^a	4.46 ^a	3.31 ^b	3.25 ^b	3.26 ^b
Optimal choice during shopping	5.86 ^a	5.70 ^a	4.21 ^c	5.70 ^a	5.19 ^b
Price as criterion for shopping behaviour	5.70 ^a	3.09 ^c	2.57 ^d	5.11 ^b	3.00 ^c
Knowledge of the extent of food waste	42.8 ^b	41.5 ^b	51.4 ^a	41.1 ^b	41.3 ^b
Relative importance	4.50 ^a	4.22 ^{a,b}	3.28 ^c	4.06 ^{a,b}	3.96 ^b
Tendency to choose ' optimal ' at home	2.90	3.49	4.06	3.40	4.02
Self-reported food waste at home, %	9.98 ^b	9.85 ^b	25.7 ^a	8.9 ^b	12.5 ^b
Age mean	44.2	48.0	44.8	44.7	43.6
Females %	62.0 ^a	49.4 ^{a,b}	32.4 ^b	46.5 ^{a,b}	44.8 ^{a,b}
High education %	39.3	42.0	41.2	28.3	36.8
Low income %	48.0 ^{a,b}	32.6 ^a	44.4 ^{a,b}	55.8 ^b	34.0 ^{a,b}

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Note. Respondents' assessment measured on a 7-point Likert disagree/agree scale. Statistical test: One-way ANOVA with post-hoc Games-Howell test. Significant mean differences in group comparison in the post-hoc test (with $p \leq .001$) are indicated by different superscript letters, starting with a = highest mean. For all ANOVA's: $p < .001$.

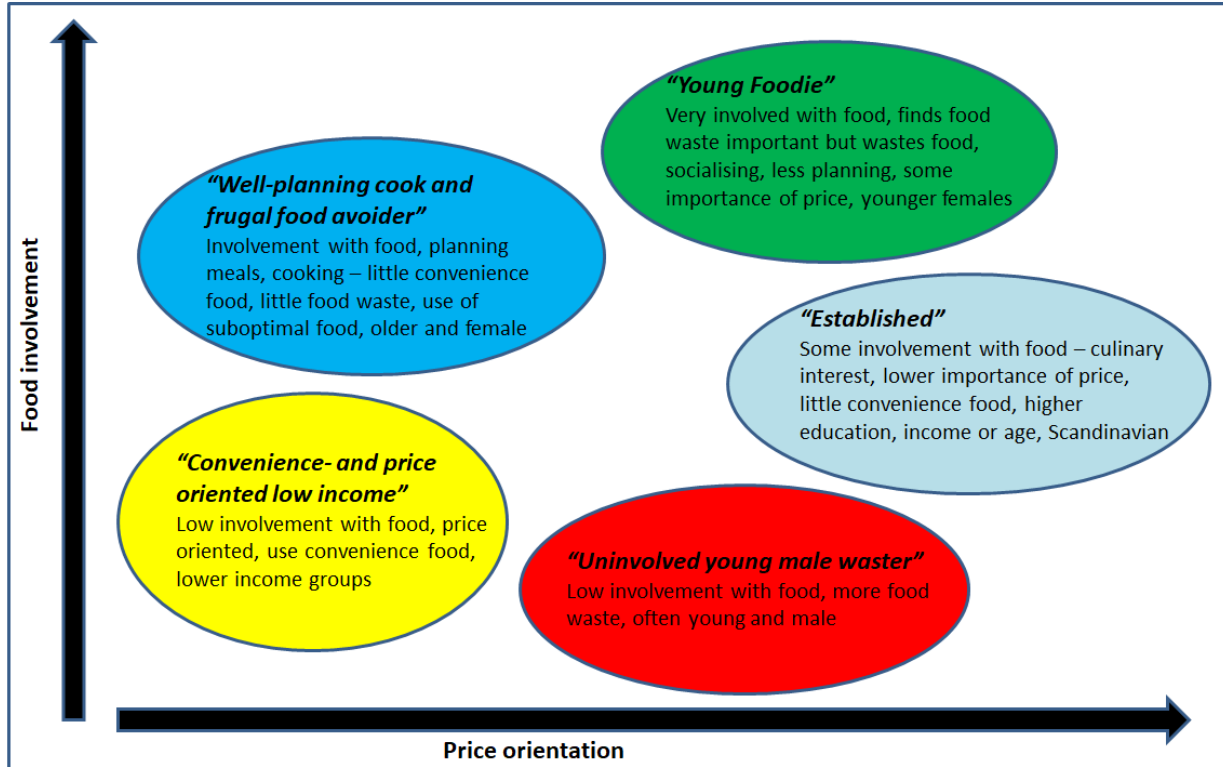
Table 4 e. Characterization of food(waste)-related lifestyle segments, Norway

	1 (161n)	2 (164n)	3 (199n)	4 (161n)	5 (166n)
<i>Dimension</i>	Mean				
Meal as a social event	2.62 ^b	2.99 ^a	2.77 ^{a, b}	2.49 ^b	2.07 ^c
Security and familiarity	2.27 ^b	3.43 ^a	2.27 ^b	3.19 ^a	3.53 ^a
Self-fulfilment from cooking	5.77 ^a	3.79 ^b	5.49 ^a	5.78 ^a	2.97 ^c
Social relations via meals	6.02 ^{a, b}	4.64 ^d	5.81 ^{b, c}	6.14 ^a	5.49 ^c
Importance of credence attributes	4.87 ^a	3.49 ^c	4.12 ^b	4.95 ^a	3.63 ^c
Price-quality relation and taste	5.23 ^d	4.47 ^e	5.48 ^b	5.71 ^a	5.96 ^c
Convenience food	2.27 ^d	3.56 ^b	3.19 ^{b, c}	2.91 ^c	4.25 ^a
Norms to avoid food waste	5.63 ^b	4.16 ^c	5.54 ^b	6.10 ^a	5.81 ^{a, b}
Cooking and culinary interest	5.44 ^a	3.69 ^b	5.30 ^a	5.40 ^a	3.16 ^c
Planning meals	4.10 ^b	3.32 ^c	2.77 ^d	5.12 ^a	3.24 ^c
Optimal choice during shopping	5.08 ^c	4.71 ^d	5.24 ^{b, c}	5.75 ^a	5.41 ^b
Price as criterion for shopping behaviour	2.96 ^d	3.07 ^d	5.61 ^b	6.02 ^a	5.14 ^c
Knowledge of the extent of food waste	39.7	41.5	41.1	42.2	40.4
Relative importance	4.53 ^{a, b}	3.85 ^c	4.25 ^{b, c}	4.69 ^a	4.32 ^{a, b}
Tendency to choose 'optimal' at home	2.67 ^b	3.80 ^a	2.62 ^b	2.77 ^b	2.91 ^{a, b}
Self-reported food waste at home, %	10.4 ^b	18.5 ^a	10.9 ^b	9.5 ^b	11.9 ^b
Age mean	46.5 ^a	40.0 ^b	42.2 ^{a, b}	44.8 ^a	46.4 ^a
Females %	57.1 ^a	34.2 ^b	54.3 ^a	60.3 ^a	46.4 ^{a, b}
High education %	64.6 ^a	43.3 ^b	56.8 ^{a, b}	59.0 ^{a, b}	45.8 ^b
Low income %	42.5 ^b	56.2 ^{a, b}	55.7 ^{a, b}	56.1 ^{a, b}	61.2 ^a

569 **Note.** Respondents' assessment measured on a 7-point Likert disagree/agree scale. Statistical
570 test: One-way ANOVA with post-hoc Games-Howell test. Significant mean differences in group
571 comparison in the post-hoc test (with $p \leq .001$) are indicated by different superscript letters,
572 starting with a = highest mean. For all ANOVA's: $p < .001$.

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Figure 1. Visualization of the segments and their characterization

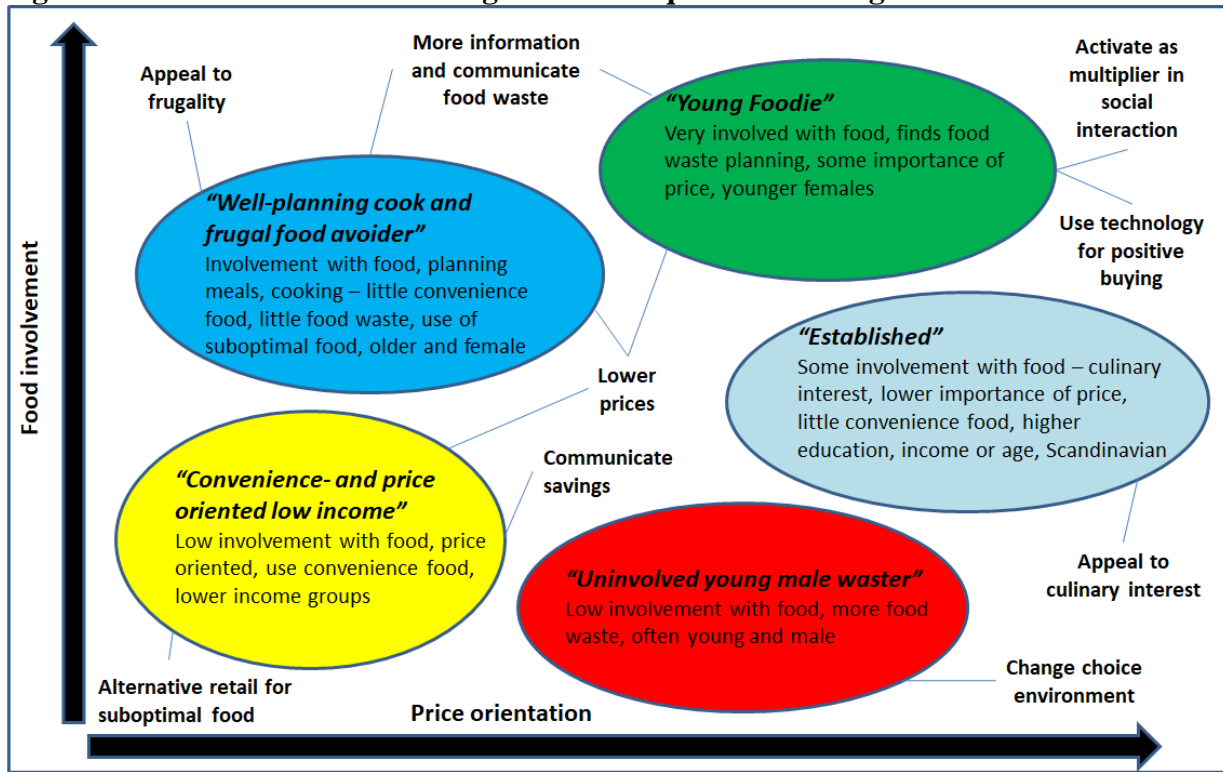


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Figure 2. Food and social marketing actions adequate for the segments



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