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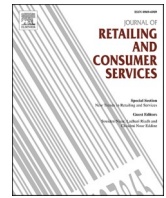
My style, my food, my waste! Consumer food waste-related lifestyle segments

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ABSTRACT

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

1. Introduction

1.1. Food waste as a sustainability issue

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

However, the mounting body of literature on food waste drivers in the supply chain and consumer behaviour underlines that only at a first glance, food waste appears as a 'no-brainer': food loss and waste are caused by a diversity of factors across various supply chain stages and deriving from multiple policies (Garrone et al., 2014; Priefer et al., 2016), supply chain stakeholders (Eriksson et al., 2017; Gruber et al., 2016; Hooge et al., 2018), or individual consumer goals (Aschemann-Witzel et al., 2015; Aschemann-Witzel, 2016; Hebrok and Boks, 2017; Quested et al., 2013; Schanes et al., 2018). There are quite a lot of

trade-offs between avoiding food waste on the one hand, and achieving other food-related goals on the other hand, as, for example, food safety and healthy eating (van Boxstael et al., 2014; Watson and Meah, 2012), providing enjoyable meals that signal appreciation and care (Aschemann-Witzel et al., 2019; Graham-Rowe et al., 2014; Visschers et al., 2016), or the convenience of preparing food and being flexible and spontaneous in meal planning (Romani et al., 2018; Stefan et al., 2013).

1.2. Food marketing and food waste

Food marketing is among the factors that influence food waste (Aschemann-Witzel et al., 2015; Cicatiello et al., 2016; Cicatiello et al., 2017; Teller et al., 2018). Food marketing considerations determine the assortment breadth of food products in supermarkets, the degree to which cosmetic specifications are applied to the fruit and vegetables sourced from suppliers (Hooge et al., 2018; Loebnitz et al., 2015) or the type of take-back agreements chosen (Eriksson et al., 2017), the pricing strategies applied to different unit sizes or on running price promotions (Le Borgne et al., 2018; Tsalis, 2020), and the communication of products, offers, or activities to avoid food waste (Kulikovskaja and Aschemann-Witzel, 2017; Louis and Lombart, 2018; Young et al., 2018), to name just a few. Food waste at the retail stage has been found to be underestimated (Cicatiello and Franco, 2020). Much critique about supply chains and retailers causing food waste has been voiced (Devin

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and Richards, 2016; Stuart, 2009). In the light of this critique, tackling food waste has become one of the issues that retailers address in their corporate sustainability strategies (Aschemann-Witzel et al., 2016; Evans et al., 2017b).

In developing tactical approaches to avoiding and reducing food waste in the interaction between the retailer and the consumer, some core elements of marketing become particularly relevant: consumer segmentation, targeting, and positioning (Grunert, 2019). Having in mind that extensive consumer research has shown that complex drivers of food waste interact and affect consumers, it is apparent that there are no one-fits-it-all approaches. Thus, reconsidering the impact of food marketing action on the extent of waste, and why consumers waste food or not, includes thinking of diverse types of consumers among the customer base. An established theory applied to segmenting consumers in the food area is food-related lifestyle (Grunert, 2019). The food-related lifestyle measure acknowledges that consumers differ in their underlying values (Schwartz, 1992; Schwartz and Bardi, 2001) and that they express different opinions, practices and behaviours across different interactions with food in their lives (Brunsø et al., 2004; Scholderer et al., 2004). To date, few research studies have explored segments of consumers both with regard to lifestyle and food waste (Delley and Brunner, 2017; Gaiani et al., 2018; Mallinson et al., 2016). A range of studies have segmented consumers with regard to food waste (Di Talia et al., 2019; Richter, 2017), but these studies did so within a single country.

1.3. Research objective

On this backdrop, the present research developed a food-related lifestyle measure applied to the issue of food waste. Food waste as caused by a diversity of individual and context-related factors (Asche-mann-Witzel et al., 2015; Boulet et al., 2020) calls for an understanding of food waste in the context of the lifestyles that consumers lead. We thus expand an established food-related lifestyle measure with items relevant for food waste and apply it to food waste related variables. A cluster analysis was conducted with the goal of determining segments of consumers in survey data from five Northern and Western European countries. In each country, five clusters were determined and described. By comparing the patterns of a food (waste)-related lifestyle and differences in a range of food waste-related variables and socio-demographics across the countries, we aimed to develop recommendations for food marketing and social marketing approaches for different consumer segments that emerge as common across countries. Food marketers and NGO's working on food waste reductions can use these recommendations in order to target distinct consumer-citizen segments in responsible marketing practices and social marketing aiming to reduce food waste. The study thus makes an essential contribution to the understanding of the relationships between food-related lifestyles and food waste drivers such as awareness and behaviours. It contributes to developing responsible food marketing actions and policies against food waste.

2. Material and methods

2.1. Sample

Consumers from five European countries – Denmark, Germany, Norway, Sweden, and the Netherlands – were surveyed. These countries represent northern and western countries of Europe, being relatively similar in lifestyle, eating habits and cultural issues, for instance, when compared to the Mediterranean countries. With this selection we aimed to avoid creating consumer segments solely on the basis of cultural differences. At the same time, it is currently unknown whether cultural similarities are also reflective in food wastage patterns. It is therefore important to study a variety of countries. For example, the selected countries differed in the extent to which food waste had received

societal and social media attention at the time of the study, which can affect consumer awareness. A 10-15-min long questionnaire was administered online in the summer of 2015 by an ESOMAR-certified market research agency. Quotas were applied to nationally representative online panels to achieve a sample representing each country's population in terms of gender, age, region of residence, as well as income and education (see Table 1). In total, 4303 respondents filled out the survey, resulting in at least 850 respondents per country.

2.2. Food (waste)-related lifestyle

The measure of consumers' food-related lifestyle (FRL) originally consisted of 69 statements measured on a 7-point Likert scale (Brunsø et al., 2004; Brunsø and Grunert, 1995; Scholderer et al., 2004). The scale contains five sub-scales: 1) purchasing motives, 2) quality aspects, 3) consumption situations, 4) ways of shopping, and 5) cooking methods, and are called 'aspects'. Each aspect has a number of dimensions. The measure has been widely applied (Grunert, 2019) and validated across countries (Grunert et al., 2011; Huang et al., 2015) as well as in relation to different issues within the food domain (Pérez-Cueto et al., 2010; Ryan et al., 2004). With the purpose of using the FRL in connection to consumer food waste, we adapted and added items as well as shortened the measure for reasons of space. Out of the original 69 items of the FRL, 19 were retained covering all five aspects of the FRL, but omitting some of its sub-dimensions and omitting repeated items within each dimension (focusing on dimensions and items that in previous FRL studies emerged as particularly important for explaining cluster differences). The adaptations and additions were done taking point of departure in previous research of the authors (Asche-mann-Witzel et al., 2015; Aschemann-Witzel et al., 2017a) as well as following other empirical research papers on food waste (Lyndhurst, 2010; van Boxstael et al., 2014; Watson and Meah, 2012; Williams et al., 2012; WRAP, 2013) or sustainability in food (Boer et al., 2004;

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)					
Of these, share of income level range (%):	728	759	717	737	775
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

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

Chrysochou et al., 2010; Hartmann et al., 2013; Lea and Worsley, 2008). The items were pre-tested, translated to the five languages, back-translated, compared to the original text, reconciled for eventual discrepancies in meaning, compared across some of the five languages as per the research team's multilingual capabilities, and finalised. The measure finally used in the study contains 54 statements, categorized into five sub-scales: 1) purchasing and consumption motives, 2) quality aspects, 3) consumption situations, 4) ways of shopping, and 5) ways of cooking and handling food. The data and approach outlined here and an analysis of the Danish sub-sample alone have been described earlier (Aschemann-Witzel et al., 2018b). In the present paper, we present an analysis of clusters in all five countries, and a comparison across the five countries, leading to a development of profiles of consumer segments that are based on commonalities across the country analysis.

2.3. Self-reported food waste, suboptimal food choices, and food waste awareness

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

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

The questionnaire also addressed respondents' knowledge on the extent of food waste as well as the respondents' opinion on how important it is to address food waste. We measured the importance of food waste compared to other pressing societal issues to avoid response

bias and to motivate respondents to put the issue of food waste in perspective with other societal issues when answering this item. The items 'According to what you have heard or would guess: how much of … the world's food do you think is wasted (in % across the global food supply chain)?/ … the foods in households are wasted (in % of the food bought)?' and 'How important is it to reduce food waste in comparison to … reducing obesity in our society?/ … reducing environmental pollution in our society?/ … stabilizing the economy in our society?' were answered on a 7-point scale ranging from 'much less important' to 'much more important'. The self-reported food waste, suboptimal food choices, and food waste awareness data is characterized in Table 2.

2.4. Analysis

To address common method variance, we used a variety of scale types, multiple items for the sub-scale of the food (waste)-related lifestyle measure and randomized the sequence of all items (Chang et al., 2010; Fuller et al., 2016). The data was analysed for each country separately, but in the same manner to allow for a discussion of findings across countries. As a first step, exploratory factor analysis (principal component analysis with Varimax rotation) was applied to each of the theoretically derived sub-scales (the five 'aspects') of the lifestyle measure (similar to Huang et al., 2015). We then inspected factor loadings of the dimensions within each aspect. We kept items when they loaded with at least 0.4 on the expected factor as well as unequivocally on that factor (at least 0.25 more than on another) (Tabachnik and Fidell, 2007), when this held in at least four of the five countries. We retained lifestyle dimensions when they contained at least two items and were sufficiently reliable (Cronbach alpha of at least 0.5, Huang et al., 2015; Kaiser,

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

	DK	DE	NL	NO	SE
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (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.

1974), or, in case of only two items in the dimension, were significantly correlated (Tabachnik and Fidell, 2007). At the end of this process, 31 items were kept that reflected five aspects and pertained to 12 lifestyle dimensions (see Table 3).

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

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

Table 3a
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

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

Table 3b
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	–

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

3. Results

In the following, the clusters of each country are characterized. The numbering of the clusters follows the numbers in the Table 4. We particularly point to where clusters are significantly different from other clusters (comparisons such as 'least/most likely' refer to comparisons

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

Dimension	Mean	1 (208n)	2 (236n)	3 (151n)	4 (153n)	5 (90n)
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]

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 b
Characterization of food(waste)-related lifestyle segments, The Netherlands.

Dimension	Mean	1 (115n)	2 (191n)	3 (200n)	4 (130n)	5 (187n)
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]

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: $p < .001$.

with the other four clusters). Subsequently, we outline which commonalities emerge, that is, what kind of profiles appear to be similar across the countries, and based on these observations, we derive five segments of consumers.

3.1. Cluster characterization per country

In **Germany**, cluster 1 emerged as rather involved with food (judging by the significantly higher means across most dimensions); this cluster is also the one most likely assessing meals as a social event. It includes more younger respondents. Cluster 2 is moderately involved with food (with relatively high means across various statements), and it emerged that this cluster least likely chooses convenience food and most likely plans meals. The cluster majorly consists of females and of respondents with higher incomes, and they report the least food waste. Cluster 3 shows the highest share of low-income respondents, and is least likely to choose the optimal food first at home (although only statistically significant when compared to cluster 4). As a characterization of cluster 3, it appears that the dimension of price has a high relevance (as can be seen in the dimensions price-quality relation and price as a criterion).

Clusters 1 to 3 assess the issue of food waste as important, while clusters 4 and 5 do so to a lesser extent. Cluster 4 is characterized by being least normative in avoiding food waste and most likely to choose the optimal product at home (compared to cluster 3). The cluster is further characterized by self-reporting most food waste, and by respondents who are more likely younger and male. Lastly, cluster 5 emerged as rather uninvolved with food (judging by the significantly lower means across most dimensions).

In the **Netherlands**, cluster 1 is rather uninvolved with food, and the cluster is most likely to choose the optimal product first at home (although only statistically significant when compared to cluster 3). Cluster 2 also appears rather uninvolved with food and more likely chooses convenience food (jointly with cluster 4). Cluster 2 assesses food waste low in importance (similar to cluster 1) and reports most food waste (jointly with cluster 4, but only statistically different from clusters 3 and 5), and has the highest share of younger respondents. Cluster 3 is somewhat involved with food and the least likely of all to choose convenience food; moreover, this cluster counts most females, they report less food waste (jointly with cluster 5), and has a lower likelihood to choose the optimal product at home (although only statistically different

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

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

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

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

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: $p < .001$.

when compared to cluster 1). Cluster 4 encompasses respondents involved with food, and this cluster is also the one most likely to assess meals as a social event and to assess food waste as an important topic. Together with cluster 2, they report more food waste. There are fewer low income respondents in this cluster. Cluster 5, finally, is most likely to plan meals compared to the other clusters, reports less food waste (jointly with cluster 3), and includes more of the lower income group.

Among the **Danish** respondents, cluster 1 emerged as involved with food and regards food waste as more important compared to the other clusters; together with cluster 2, cluster 1 is more likely to assess meals as a social event. Cluster 2 is rather uninvolved with food – apart from the social event aspect of it – and includes most of the lower income respondents (although not statistically different from clusters 4 and 5) as well as the older age group (together with cluster 4). Cluster 3 is most likely to choose convenience food and appears to attach somewhat more importance to price (as can be seen in the price dimension as a criterion). This cluster is less likely to choose the optimal products at home (together with cluster 4, but not statistically different from 1). Cluster 4, in turn, is moderately involved with food, but is most likely to plan meals of all clusters. They also report the least food waste, are less likely to choose the optimal products (as cluster 3), and tend to be of older age.

Cluster 5 is uninvolved with food, assesses food waste as least important compared to the other clusters, and reports the highest food waste of all clusters. Cluster 5 consists mostly of men and younger respondents, and this cluster tends to choose the optimal products.

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

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

Dimension	Mean	1 (161n)	2 (164n)	3 (199n)	4 (161n)	5 (166n)
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]

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: $p < .001$.

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

This group gives highest importance to price in the price-quality relation and has the highest share of low income (only significantly different from cluster 1, though).

3.2. Commonalities across countries

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

Firstly, a profile repeatedly surfacing is that of the food-uninvolved, young, male respondents who assesses food waste as relatively less important. They self-report food waste considerably more than others, and they often choose the optimal food item first, before usage of the sub-optimal food. We call this segment the *"Uninvolved young male waster"* for the purpose of distinction. The segment is particularly apparent in cluster 3 in Sweden, cluster 2 in Norway, cluster 5 in Denmark, cluster 4 in Germany, and cluster 2 in the Netherlands.

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

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

A fourth profile is characterized by high involvement with food and high importance given to the issue of food waste, a higher tendency to use meals as social events, and sometimes being less likely to plan meals or to care about prices. This group frequently consists of young or female respondents, We call this segment the *"Young foodie"*. Relative to the other segments in each country, consumers in this group tend to report relatively high levels of food waste. It can be seen in cluster 3 in Norway, cluster 1 in Germany, cluster 4 in the Netherlands, but this group does not emerge clearly in Denmark and Sweden.

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

4. Discussion

4.1. Segments

The cluster analysis of survey data from the five Northern-Western European countries led to a five-cluster solution based on the food-related lifestyle measure adapted to the issue of food waste. Applying this five-cluster solution to each country and observing the commonality in findings, also with regard to how the clusters differ in self-reported food waste, choice of the optimal or the suboptimal food, food waste awareness, and socio-demographic characteristics, profiles of five
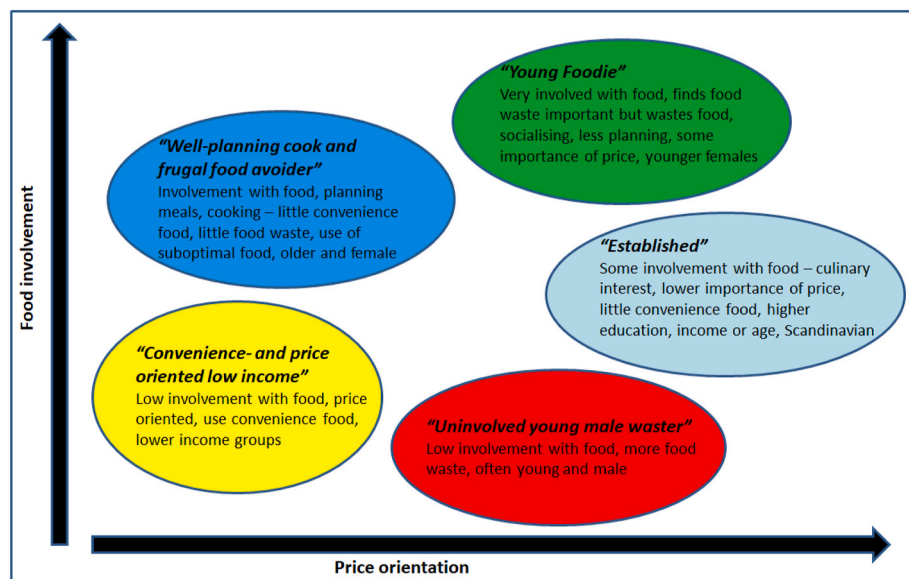
Fig. 1. Visualization of the segments and their characterization.

different consumer segments appeared.

To expand the understanding of consumer segments related to food waste, it is valuable to view the current findings in relation to the few existing European studies on food waste-related consumer segmentations. A cluster analysis study based on self-reported waste and reasons for wastage of food in Italy in the study by Gaiani et al. (2018) using a convenience sample revealed seven different segments. Gaiani et al. (2018) thereby identified a 'frugal' and often older segment, which has some correspondence to the ' … frugal food avoiders' in our study. The 'exaggerating cook' bears a certain similarity to the food-involved consumers in our study, who both report higher food wastage (Gaiani et al., 2018). A Swiss study explored consumers of a random, telephone-directory based sample with regard to food waste attitude, perceptions and behaviours (Delley et al., 2017). The sub-scales focused on aspects and measures of particular relevance for food waste, and the findings showed six clusters. The resulting 'conservative' cluster has quite some overlap with the 'Well-planning cook and frugal food avoider' in our study; both segments appear to have housewifely characteristics. A notable difference is that the 'conservative' group does not report less food waste, whereas the 'well-planning … ' group in our study does report less food waste. Delley et al. (2017) also identify a group of young men indifferent to the issue of food waste and food, which is very much in line with the 'uninvolved young male waster' in our study; but also the 'non-conscious' in another Italian sample (Di Talia et al., 2019) or the 'careless food wasters' in a German sample (Richter, 2017). The so-called 'short-termist' in the Swiss study bears some similarity to the 'convenience and price-oriented … ' in our study, given that both clusters are characterized by price orientation and lower food involvement. Third, a segmentation study on young consumers in the UK and on the relation between food waste and convenience food also applied a self-reported measure of food waste (Mallinson et al., 2016). This study identified five segments and showed that a convenience-food orientation goes hand in hand with greater food waste (Mallinson et al., 2016). This finding is only partly replicated in our study, as the group that places greatest emphasis on convenience food is not necessarily the one reporting most food waste. Finally, the analysis of the Danish sub-set of the present data has been described previously elsewhere (Aschemann-Witzel et al., 2018b); the differences in the cluster characterizations stem from the fact that the current study focuses on pinpointing commonalities across several countries.

4.2. Limitations and future research

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

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

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

Fourth, the present data were collected in 2015. It is possible that, in

line with increasing efforts in awareness-raising campaigns on food waste in Northern-Western European societies (Szulecka et al., 2019), segments might have evolved over the last years. Mapping food waste volumes, food waste awareness and food waste behaviours is a continuous research effort in a changing society, and replication studies would be required to examine the future relevance of the current findings.

Given the increasing role that online channels play in the future, it is important to study food waste factors of online marketing, which is a topic yet under-researched. For example, it would useful to study both off- and online perception of food, and to explore how motives, attitudes and practices of consumer segments differ depending on the channels used. Recent research indicates there might be a greater tendency to waste food when buying online (Ilyuk, 2018). Consumer lifestyle groups might differ in the degree to which they more or less likely waste food when shifting their purchases to online channels.

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

4.3. Food marketing actions and food waste reduction activities

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

The different segments might be approached differently when it comes to the question of how food marketing should tackle avoidance of food waste when addressing food consumers. This holds both for food marketing by retailers or non-commercial, social marketing towards food waste avoidance by non-governmental organisations (NGOs).

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

Consumers such as the *"Well-planning cooks and frugal food avoiders"* are also moderately involved and engaged, and can also be expected to be reached through information and by communication appealing to a

food waste avoidance motivation, such as when suboptimal food reduced in price is presented as avoiding food waste. In addition, though, this group can make use of even more detailed information on practices to plan meals and food handling (Stancu et al., 2016), that is, good household tips that require more advanced experience (e.g. storing fruit and vegetable at different adequate temperatures in the fridge). As these consumers appear more frugal in their choices, communication to this segment can make use of this motivation and identity (Gatersleben et al., 2017).

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

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

The *"Established"* segment will less likely act on price and budget motives. Instead, marketing actions appealing to their culinary interest, for example communication of diverse use of fruit and vegetable deviating in appearance (Loebnitz et al., 2015), could be a successful avenue to reduce food waste for this group, as would be communicating positively about 'ugly fruit and vegetable', given it has shown to improve the image of the store (Louis and Lombart, 2018). In addition, costly but convenient services such as meal boxes delivered to the door steps could be a marketing activity particularly adequate for this consumer group. A visualization of the segments with the corresponding food or social marketing actions can be found in Fig. 2.

5. Conclusions

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

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

Findings imply that responsible food retailers or NGO's aiming to contribute to food waste avoidance as a UN sustainable development
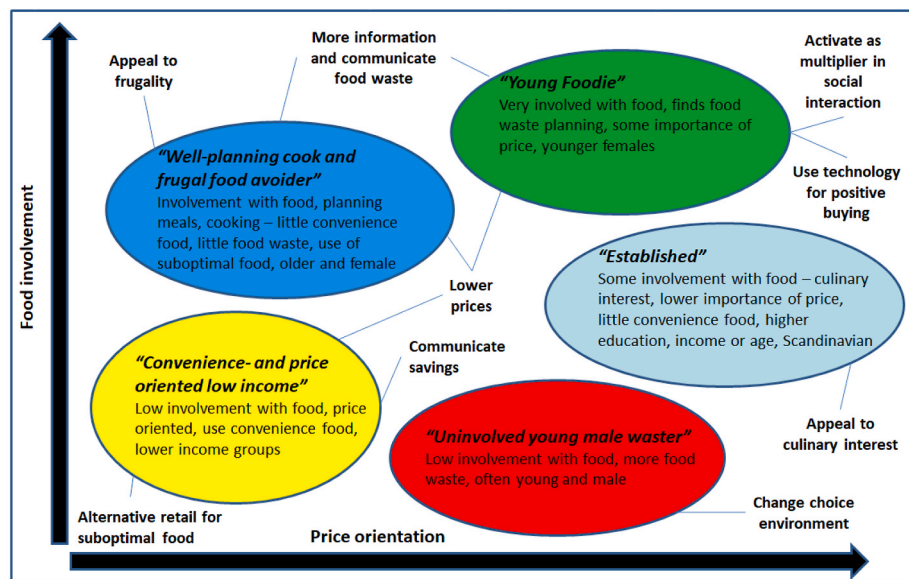
Fig. 2. Food and social marketing actions adequate for the segments.

sub-goal should target different customer groups with distinct commercial or social marketing approaches.

Author contributions

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

Declaration of competing interest

We declare no competing financial interests.

Ethics statement

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jretconser.2020.102353.

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