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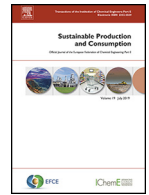
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Consumer segmentation based on Stated environmentally-friendly behavior in the food domain

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ABSTRACT

Food consumption has a large environmental impact, but the total impact of households can be reduced substantially by changing consumers' food-related decisions and behaviors. Consumers differ in their motives and willingness to behave in an environmentally-friendly manner with regard to food consumption. Therefore, it is important to identify different types of consumers in order to develop and implement tailored intervention strategies. To identify and describe the different types of food consumers based on detailed behavioral patterns, we distributed a paper-pencil questionnaire and used data of 817 Swiss households. Applying a comprehensive and differentiated approach, self-reported environmentally-friendly food behavior was assessed with regard to different domains and different types of behaviors, which subsequently served as the basis for the consumer segmentation. We also assessed behavior in the mobility and household domains as well as several personality variables and sociodemographics as descriptive measures to characterize the segments on a differentiated basis. Cluster analysis revealed six segments in regard to environmentally-friendly food consumption: *meat- and fish-eaters*, *origin-focused food savers*, *ambiguous consumers*, *food waste reducing sharers*, *renouncement averse* and *consequent pro-environmental consumers*. After a detailed description and discussion of the six consumer segments, we propose starting points for the development of segment-specific intervention and communication strategies to promote environmentally-friendly food consumption.

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1. Introduction

Food consumption accounts for a third of the total environmental impact created by households in Switzerland, in addition to mobility and housing (Jungbluth et al., 2011, 2000). At all stages of the food chain, greenhouse gasses are produced, starting from food production on farms, continuing with manufacturing, distribution, refrigeration and retailing, up to food preparation on the household level and ending with the disposal of leftovers and waste (Garnett, 2011). Intense livestock production to satisfy the high demand for meat required by Western diets causes particularly high emissions of greenhouse gasses, contributing to climate change and other harmful effects on ecosystems like water and air pollution (Godfray et al., 2018). Against this background, it is important to reduce the food-related environmental impact of house-

holds. This means that a change in people's behavior is crucial not only in the domain of housing and mobility, but also in the domain of food consumption (Whitmarsh et al., 2011).

Consumers' food choices (Verain et al., 2015) as well as other daily consumption behaviors in the food domain, such as dealing with food waste, contribute to a higher or lower ecological footprint depending on the individual decisions and actions (Thøgersen, 2014). People make decisions regarding food consumption based on different motives and in different ways. For example, some people buy organic products instead of conventional ones for health or sustainability reasons. This is not too difficult to do in Switzerland because these people do not have to renounce the products they want; they can simply choose the same food products with an organic label, even in the same supermarket where they usually buy their groceries because in developed countries, there is a dynamic growth in the market value of organic food (Bryła, 2015). Organic products are not necessarily more environmentally-friendly per se, this also depends from the assessment method and factors which are included in the analysis

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(Boone et al., 2019). However, people associate the consumption of organic products with environmentally-friendly behavior, which is why we included it in our study (Lazzarini et al., 2018; Meier et al., 2015).

Other people, however, might reduce their meat consumption, which can be a more significant change in everyday eating habits and may also require a greater willingness to actually accept this curtailment (Hartmann and Siegrist, 2017). Due to the wide variety of behaviors in the food domain and their environmental impact, it is crucial to differentiate between different types of food-related behaviors. The main focus of this paper is a comprehensive and differentiated assessment of food-related environmentally-friendly behaviors like food choice, curtailment behavior, food waste management, and sharing behavior that serve as a basis for consumer segmentation.

Consumers engage in environmentally-friendly behaviors for various underlying motivations not only regarding food choices, but also in other domains, such as housing and mobility. Consumers who show environmentally-friendly behaviors in the food domain for instance do not necessarily also behave environmentally-friendly in other domains because they could, for example, perceive the reduction of the CO₂ impact in other domains as requiring more effort or for reasons of moral compensation (Gatersleben et al., 2002), or because of moral licensing tendencies which create a negative spillover effect (Sorrell et al., 2020; Truelove et al., 2014). For the development of tailored communication and intervention strategies to increase sustainable consumption behavior, it is essential to know the specific characteristics of the different types of consumers and in which domains they behave in an environmentally-friendly manner and how and why. This allows the identification of promising starting points for strategies to promote environmentally-friendly consumption behavior. Therefore, in this segmentation study, besides environmentally-friendly food consumption, we will also consider environmentally-friendly behaviors related to mobility and housing and the various underlying drivers.

1.1. Consumer segmentation

As consumers adopt more and more diverse lifestyles in the globalized world (Verain et al., 2015), the food system becomes more complex, consumers in the Western world are faced with food choices from a plethora of offered food products (Rozin, 2007), and consumption behavior becomes more heterogeneous (Verain et al., 2015). Therefore, it is not sufficient to characterize food consumers on the basis of sociodemographic data (Diamantopoulos et al., 2003; Sarti et al., 2018), like Kihlberg and Risvik (2007), who used age as the sociodemographic variable as a basis for their segmentation. Several other studies include sociodemographics only as profiling variable (Golob and Kronegger, 2019; Verain et al., 2012). Although sociodemographics are not sufficient segmentation variables, they are valuable in further describing the identified consumer segments; sociodemographic data also limits the scope of action consumers can undertake and therefore determine to a certain extent the capability to perform a particular behavior (Sütterlin et al., 2011). Especially for policy making, behavioral and attitudinal variables are more useful as an information base than sociodemographics or values (Sütterlin et al., 2011). Personality variables, for instance, are closer to actual behavior than sociodemographics. Environmental attitudes, like assessed by the NEP scale of Dunlap and Van Liere (1984), can be antecedents of behavioral intentions, which in turn, can predict and affect actual behavior (Ajzen and Fishbein, 1980). However, research on self-reported intentions to be environmentally-friendly shows that intentions do not always result in actual sustainable behavior (Kaiser et al., 1999;

Sheth et al., 2010), although they mediate the impact of several other psycho-social variables on environmentally-friendly behavior (Bamberg and Möser, 2007). Next to attitude and behavioral control, Bamberg and Möser (2007) found that personal moral norms are a third predictor of the intention to act pro-environmental. However, personality variables are not observable constructs and are also difficult to measure (Rennhak and Opresnik, 2016). Therefore, behavioral variables are suitable for segmentation because they represent the results of the consumer's decision process (Rennhak and Opresnik, 2016). Work about theoretical frameworks of environmentally-friendly behavior has also been conducted by Vermeir et al. (2020). They suggest a theoretical framework of sustainability behaviors that consists of five components according to which consumers have to (1) value the environment positively, (2) discern a discrepancy between the desired versus the actual state of the environment, (3) opt for action to reduce the discrepancy (i.e., goal intention), (4) intend to engage in behavior that is expected to bring them closer to the desired end state (i.e., behavioral intention), and (5) act in accordance with their intention.

Previous segmentation studies about environmentally-friendly food consumption behavior have used at least one of the following variables as segmentation basis: personality characteristics like food-related lifestyle or health consciousness (Chrysosoidis and Krystallis, 2005), actual behavior like daily food purchases (Sarti et al., 2018), buying motives, cognition and food category importance (Verain et al., 2016). However, many studies referred only to the purchase of organic products (Chrysosoidis and Krystallis, 2005); they assessed food-related variables that mainly included organic attitudes and intention to buy organic (D'Souza et al., 2006; Mostafa, 2009), and they did not refer to environmentally-friendly food consumption in general. Many segmentation studies have categorized consumers into three groups ranging from "green" behavior to "non-green" behavior with the indifferent consumers in between (Gil et al., 2000; Golob and Kronegger, 2019; Saleem et al., 2018; Sarti et al., 2018). A reason for this low number of segments could be that these studies assessed sustainable food consumption mainly focused on one specific behavior, such as organic product choice, and did not assess the various types of food consumption behaviors in a comprehensive and differentiated way. Only a few segmentation studies on environment-related food consumption have used self-reported behavior as a segmentation basis, and the ones that did only considered a few behaviors without taking a comprehensive and differentiated approach, such as considering only behavior related to food waste (Delley and Brunner, 2017). Sarti et al. (2018) used expenditure data to identify different food consumer types but did not differentiate between various types of food consumption behavior and, except for sociodemographics, they did not assess additional descriptive data.

Many segmentations about environmentally-friendly behavior have not included food consumption but have focused, for instance, on choice and use of cars for individual transport (Saleem et al., 2018), ecologically-conscious consumer behavior regarding household purchases and mobility (Straughan and Roberts, 1999) or daily consumption of green products in the household, recycling and behavior related to engaging with environmental issues (Yilmazsoy et al., 2015). Other segmentations, however, focused either only on certain aspects of food consumption (Sarti et al., 2018) or only food consumption without other domains (Grunert et al., 2001). Some considered several domains (housing, mobility and food) but only assessed a few food-related behaviors (Sütterlin et al., 2011). Our study, in contrast, comprehensively covers environmentally-friendly food consumption whilst exploring how different groups of food consumers behave in other domains, such as mobility or energy consumption in the household to examine whether environmentally-friendly behaviors are trans-

ferred from one domain to another. Due to the more detailed set of behavioral variables we use, it is possible to identify a higher number of more differentiated consumer segments.

1.2. Types of environmentally-friendly food consumption

Environmentally-friendly behavior includes much more than actual purchase decisions. [Steg and Vlek \(2009\)](#) define pro-environmental behavior as behaving with as little harm to the environment as possible, or even acting with a beneficial outcome for the environment. In a broader sense, it includes all types of behavior that modify the availability of energy or resources from the environment or change both dynamics and structure of the biosphere or ecosystem ([Stern, 2000](#)). Environmentally-friendly food consumption behavior includes the reduction and replacement of animal products (meat, dairy products), the reduction of food waste ([Aschemann-Witzel, 2018](#)) and the enhanced consumption of regional and seasonal products ([Garnett, 2011](#)). Moreover, environmentally-friendly behavior does not necessarily have to be an output of caring for the environment; economic factors or social pressure can also have an impact ([Yilmazsoy et al., 2015](#)). The diverse types of behavior differ regarding effort and behavioral drivers and thereby, the willingness of the different types of consumers to show certain behaviors.

Reduction and replacement of animal products. Environmentally-friendly food consumption refers primarily to the reduction of livestock products ([Garnett, 2011](#)). Dietary changes have a huge potential to reduce greenhouse gas emissions as well as land use ([Hallström et al., 2015](#)). This means that consumers need to moderate their intake of meat and dairy products substantially. A possible environmentally-friendlier compensation for the reduction of animal proteins could be replacement products like tofu instead of meat and soy-based food items instead of dairy products ([Nijdam et al., 2012](#)).

Change in food choice. According to the method of life cycle assessment, agricultural practice, transport distances and conservation methods are also important product dimensions to consider ([Jungbluth, 2000](#); [Jungbluth et al., 2000](#)). This means that origin, transportation mode and distance, seasonality, and production method of food products play a huge role for the environmental friendliness of food items.

Reduction of food waste. Not only does the actual production of food harm the environment ([Tukker et al., 2006](#)), the impact of food waste is also significant. Around one third of all food products in developed countries is wasted ([Gustavsson et al., 2011](#)). This means that large amounts of the resources that were used for production of food are used for no purpose, and the pollution and greenhouse gas emissions caused by the production of the wasted food are also emissions in vain ([Gustavsson et al., 2011](#)). A reduction of food waste can be achieved by better planned shopping and meal preparing behavior and an optimized use of leftovers.

Consumption of suboptimal foods. Also contributing to food waste is the handling of suboptimal food. Suboptimal or imperfect foods are products that deviate from products that retailers or consumers describe as normal or optimal either on the basis of esthetic and appearance standards (weight, shape or size), on the basis of their labelled expiration date (close to or beyond the best-before date), or on the basis of their packaging (e.g., a torn wrapper, dented can), but without intrinsic quality or safety being threatened ([de Hooge et al., 2017](#)). Suboptimal food is often sorted out and discarded before it gets to the supermarkets, but sometimes the retailer will offer abnormally shaped food or items close to the best-before date for reduced prices to avoid food waste ([Aschemann-Witzel, 2018](#)). The use of suboptimal food with exceeded expiration date or with esthetic imperfections con-

tributes to the avoidance and reduction of leftovers ([Aschemann-Witzel et al., 2017](#)).

Food sharing. Another promising way to avoid food waste is to share food that is not used either on a private level or by using sharing services. Sharing services allow other consumers to participate in the use of a product by sharing (common use), lending, renting, giving away or reselling the product ([Belk, 2016](#)). The topic of sharing services is a relatively new and uninvestigated field of research.

1.3. Aim of the study

The aim of this study was to segment consumers in order to develop a typology (i.e., description) of different consumers who differ in their environmental impact in order to give a base for communication strategies and policy making. Compared to other segmentation studies, a more differentiated perspective was taken regarding food consumption behavior, which allowed identification of subdivided consumer segments and provided a detailed description. Different types of environmentally-friendly food behavior were distinguished that differ in effort and underlying motives. By describing the different types of environmentally-friendly food consumers on a detailed level, the segmentation study also considered environmentally-friendly behaviors in other consumption domains, namely housing and mobility. We used a large and differentiated set of behavioral variables to identify consumer groups and provide a detailed and distinguished description of consumers that allows identification of starting points for the development of customized measures to increase environmentally-friendly food consumption behavior. To describe the identified food consumer segments, in addition, personality variables, behaviors in the housing and mobility domain as well as sociodemographic variables were used to profile the consumer groups.

2. Methods

2.1. Participants and procedure

A paper-pencil questionnaire was distributed by mail to 2800 households in the German speaking part of Switzerland; 2500 addresses were randomly drawn from the telephone directory. This method of recruitment tends to overrepresent older participants. In order to ensure that an adequate number of people younger than 30 who might not be registered in the telephone directory was represented in the sample, an additional 300 addresses of people between 20 and 30 were obtained from a marketing service company that maintains a large database of mailing addresses. In addition to the questionnaire, the households received a cover letter informing them about the aim of the survey and ensuring anonymity. The person of the household who is mainly responsible for grocery shopping was asked to fill in the questionnaire. Data collection took place from the end of October 2018 until beginning of January 2019. In December 2018, a reminder letter accompanied by an additional exemplar of the questionnaire was sent to the households who had not yet returned the questionnaire. By the end of the data collection period, 981 completed questionnaires had been returned, a rate of 35%. Of these, 164 questionnaires had to be excluded from the analysis. Participants were excluded if they did not answer at least 50% of the items of each generated construct or variable that formed the basis for the segmentation (90 participants) or if they indicated having special medical restrictions regarding the intake of certain food items, food allergies or food intolerances that would influence consumption of meat and/or dairy products (74 participants). This resulted in a final sample size of 817 participants of whom 39% were male and 61% were female. A reason for the unbalanced gender distribution

might be that women are traditionally more responsible for grocery shopping than men (Achon et al., 2017; Flagg et al., 2013). The participants ranged in age between 20 and 94 with a mean age of 57 (SD=16); the average age of the adult population in Switzerland is approximately 49 (BFS, 2019). A comparison of the socio-demographic data of the participants compared to official statistics in Switzerland are depicted in Table A4 in the Appendix.

2.2. Measures

The questionnaire consisted of nine parts. First, the participants' knowledge about sustainable food choices was assessed. Afterwards, participants were asked how frequently they eat certain food items and what percentage of organically produced foods they buy. In the third part, food choice motives as well as food involvement were assessed. In the next section, different beliefs concerning the environmental impact of food production and consumption were measured, including awareness of consequences, personal efficacy, self-efficacy, ascribed responsibility, personal norms and response efficacy. Furthermore, participants' attitudes concerning environmentally-friendly food choices were assessed. Additionally, various behaviors and underlying motives related to housing and mobility were explored. Subsequently, the questionnaire contained several questions about the use and provision of sharing services. In the last section, sociodemographic information and participants' environmental consciousness were assessed. The basis for the segmentation was formed by 16 behavioral constructs related to environmentally-friendly food consumption, which are described in the following section. Afterwards, several descriptive variables are outlined that were used to portray the segments in more detail.

2.2.1. Segmentation variables

2.2.1.1. Food choice behavior. We explored how frequently participants engage in environmentally-friendly food choice and purchase behavior. Twenty-two different behavioral patterns related to food choice and purchase behaviors were listed and participants were asked to rate on a six-point Likert scale how often they practiced the behavior. For example, participants had to indicate how often they "buy seasonal fruits and vegetables". Response options were: 1 (never), 2 (rarely), 3 (from time to time), 4 (often), 5 (almost always) and 6 (always). Of the 22 items, measuring environmentally-friendly food consumption, three items referred to food choice regarding transportation mode, transportation distance and the seasonality of food products; three referred to disposal of different product categories after the expiration date; five referred to curtailment behavior (e.g., consciously renouncing the consumption of meat) related to food products; two referred to consumption of suboptimal food (esthetic imperfections and expired food); three referred to the purchase of suboptimal food due to a short expiration date; two referred to the choice of products with organic or sustainability labels; and two referred to food choices regarding processed food. A principal component analysis was conducted with all 22 items. The analysis revealed seven factors that explained 66% of the variance (factor loadings can be found in Table A1 in the Appendix). Two of the 22 items were excluded from the analysis. The item about regional foods was excluded because the items about seasonality and regionality correlated highly and because the term "regional" was not clearly defined. The item about drinking tap water instead of mineral water was excluded to increase the reliability of the scale. For every behavioral construct, the mean of the underlying items was calculated. The seven constructs and the underlying items are presented in Table S1 in the Appendix. Cronbach's α of the constructs ranged from 0.60 to 0.80.

2.2.1.2. Food consumption frequency. In a separate section, food consumption frequency was assessed semi-quantitatively. Participants were presented with a list of food items in different product categories in compliance with the Nurses' Health Study questionnaire (Hu et al., 2016). The food items selected for this study covered a broad range of product categories and included products with a high environmental impact (Tukker et al., 2006). The chosen items included meat products (poultry, beef, pork), fish and seafood (e.g., mussels), meat replacements (e.g., tofu, quorn), cheese, cow's milk, cream cheese/yoghurt/curd, milk replacements (e.g., rice or almond drink, soy yoghurt), eggs, fruits and vegetables, cereal products (e.g., pasta, rice, bread), wine, beer, coffee and chocolate. For the food items, detailed portion sizes were indicated; for example, one portion of beef is 100–120 grams. Participants had to indicate how many portions of the respective food items they had consumed on average during the last year. The nine response options were the following: 4 or more per day, 3 per day, 2 per day, 1 per day, 5–6 per week, 2–4 per week, 1 per week, 1–3 per month, rarely/never. For the analysis, we recoded the response options to the corresponding amount of the monthly consumption of the respective food item, which is 122 portions and more per month, 92 portions per month, 61 portions per month, 31 portions per month, 24 portions per month, 13 portions per month, 4 portions per month, 1–3 portions per month and less than 1–3 portions per month.¹ We included only food items of the product categories meat, meat and dairy replacement products, and cheese and fish in the analysis because protein products, respectively their more environmentally-friendly replacement products, play a major role regarding the environmental impact of food consumption (de Vries and de Boer, 2010). Table S2 shows the means and standard deviations of the consumption frequency of the respective food items that were used for the analyses of the present study.

2.2.1.3. Food waste management. Food waste is strongly connected to sustainable eating behavior. It is comprised of the food that is wasted along the entire food supply chain, which also includes consumer households (de Hooge et al., 2017). To cover this topic, one module about the use and disposal of food items was included. Five items referred to exploitation of food before it decays; two items referred to sharing food with familiar persons; two items referred to peeling vegetables and fruits. Participants were asked to indicate on a six-point scale ranging from 1 (never) to 6 (always) how often they perform the respective behavior in self-assessment. A principal component analysis revealed three factors that explained 61% of the variance. For every construct, the mean of the underlying items was calculated. The items underlying the three behavioral constructs with the corresponding means, standard deviations and reliabilities are shown in Table S3 (for factor loadings, see Table A2 in the Appendix). It has to be taken in consideration, that self-reported data about food-waste can be taken as a proxy for actual behavior, but the amounts do not always correspond to the real situation (van Herpen, van der Lans, Holthuyzen, Nijenhuis-de Vries, and Queded, 2019).

2.2.1.4. Sharing behavior. Because it is an uninvestigated field of research, we included sharing behavior in our survey. We first provided participants with the following definition of sharing services: "Sharing services are services that allow other consumers to participate in the use of a product by sharing (common use), lending, renting, giving away or reselling the product. Sharing services are offered by companies as well as individuals and can be used by

¹ We assume that one month consists in average of 30.5 days respectively 4.4 weeks.

consumers (private persons). Every private person has the opportunity to use and offer sharing services". After reading this description, different sharing services provided by companies and private persons were listed and participants were first asked whether they had ever used one of the named sharing services. Response options were 1 (never used/made) or 2 (already used/made). As segmentation variables, only constructs referring to the willingness to offer and use sharing services for food were included. The respective items with their means, standard deviations and Cronbach's α for the willingness to use/offer respectively the experience to use/offer of the sharing services are listed in Table S4.

2.2.2. Descriptive variables

We used the variables described above as the basis for the segmentation of consumers. However, to give a more detailed description of the respective segments, further personality variables, sociodemographic and behavioral variables were included as descriptive variables.

2.2.2.1. Eating habits. Participants were asked to identify their diet style. Five different diet styles including a definition were listed as response options: omnivore (typical Western diet including meat and other animal-based food products), flexitarian (meat is eaten rarely or in reduced amounts, origin of the meat is important), pescatarian (no meat but fish/seafood), vegetarian (no meat, fish or seafood, but other animal-based foods such as dairy products or eggs) or vegan (no animal-based foods).

2.2.2.2. Percentage of purchased food from organic production. For different food categories, participants were asked to indicate the percentage of food purchased from organic production. Participants were provided with the following answer options: 0%, less than 10%, about one quarter (25%), about one third (33%), about half (50%), about two thirds (66%), about three quarters (75%) and 100%. They also had the opportunity to choose the response option, "does not apply to me", in case they did not consume the product at all. The reliabilities of the scales were excellent with Cronbach's α higher than 0.90, the respective items with their means and standard deviations are depicted in Table D1.

2.2.2.3. Food involvement. Food involvement is defined as the level of importance of food in a person's life and therefore varies strongly among individuals (Goody, 1982). In order to assess participants' involvement in food-related decisions and behaviors, participants were presented with eight statements addressing decisions, engagement, and preparation regarding food (see Table D2). The first four items were taken from the scale of Bell and Marshall (2003). The other statements were formulated by us to complement the existing scale. Participants were asked to indicate on a six-point Likert scale how closely the different statements applied to them. The scale ranged from 1 (does not apply at all) to 6 (completely applies).

2.2.2.4. Motives for food choices. Behavior in regard to food consumption can be driven by different underlying motives. The measures of Lindeman and Väänänen (2000) cover relevant food choice motives regarding ethical motives like animal welfare and environmental protection. We added one item about species-appropriate keeping and feeding of animals. In addition to these dimensions, we included several items following the Eating Motivation Survey (Renner et al., 2012) to cover social motives, liking and convenience. We did not include all of the items due to the too expensive dimensions. An overall number of 20 items were included in our questionnaire. Participants were presented with the statement, "It is important to me that the food products that I consume on a normal/typical day..." followed by 20 items that provided different

options for underlying motives regarding food choices. Participants had to rate on a six-point Likert scale how accurately these statements applied to them. The scale ranged from 1 (does not apply at all) to 6 (completely applies). According to a principal component analysis, the items constitute six different constructs of motives, which explain 74% of variance (see Table A3 in the Appendix for factor loadings). The item, "...that the production in general does not have a large negative impact on the environment", was excluded because the wording was problematic and the item was not consistent in content. The Cronbach's alphas indicate a high level of reliability. The items with respective means and standard deviations are listed in Table D3.

2.2.2.5. Mobility and housing behavior. To identify possible connections or differences between environmentally-friendly behavioral patterns in the different sectors, we included a section about environmentally-friendly behavior in the personal mobility and the housing domain. Therefore, we asked participants to indicate on a six-point scale ranging from 1 (never) to 6 (always) how often they show certain curtailment behaviors regarding both the mobility domain (4 items) and the housing domain (12 items). For the housing items, participants were provided with the response option, "Does not apply to me". When more than half of the items did not apply to a participant, he/she was excluded from the analysis of the construct about behavior in the household domain. For the housing domain, three additional items were included to assess energy efficiency behavior regarding household appliances. Participants were asked to indicate whether they take/had taken the respective energy efficiency measures (yes or no). All items were taken from Sütterlin et al. (2011). The behavioral items for the mobility and the housing domains with the respective means and standard deviations are listed in Table D4.

In addition to the mobility and housing behaviors, the importance of different underlying motives regarding behavior in the mentioned domains was assessed. The items were adapted from Sütterlin et al. (2011) and addressed energy-saving motives, health-related motives as well as financial motives. The items were formulated as statements and participants had to indicate on a six-point response scale ranging from 1 (does not apply at all) to 6 (completely applies) how much the statements applied to them. The items including means and standard deviations are presented in Table D4. A principal component analysis revealed three factors with two respective items for each domain: The first factor included the motives of being environmentally-friendly and saving energy (Cronbach's $\alpha=0.88$), a second factor included health-related reasons (Cronbach's $\alpha=0.81$), and economic motives constituted a third factor (Cronbach's $\alpha=0.58$). For every construct, the mean of the underlying items was calculated.

2.2.2.6. Environmental consciousness. For the assessment of participants' environmental consciousness, we included three items from the scale of van der Werff, Steg, and Keizer (2014) about environmental self-identity. Participants were asked to rate on a six-point scale with the range from 1 (does not apply at all) to 6 (completely applies) how much each item applied to them. Cronbach's α of 0.93 indicated an excellent fit. The mean of the underlying items was calculated. The items, including means and standard deviations, are depicted in Table D5.

3. Results

3.1. Clustering the food consumers

To sum up subjects with similar behavioral patterns to groups as homogenous as possible, we conducted a cluster analysis based on the above mentioned 16 segmentation variables about

environmentally-friendly behavior related to food choices and food consumption: food choice behavior concerning origin, transport and seasonality of food, curtailment behavior in the food domain, purchase of food with short expiration date, food choice behavior concerning labels, food choice behavior concerning processed food, consumption of suboptimal food regarding exceeded expiration date, consumption of suboptimal food regarding esthetic imperfections and expiration date, consumption frequency of meat, fish, replacement products and cheese, food saving behavior, sharing food with friends, peeling fruits and vegetables, willingness to use and offer food sharing services. After standardization of the variables, we conducted a hierarchical agglomerative cluster analysis in which we made use of Ward's method as linkage measure. We chose the method of hierarchical cluster analysis because we did not have a predefined number of clusters. As a proximity measure, we used the squared Euclidian distance. The number of identified clusters was indicated by the first large increase of the coefficient values (Yim and Ramdeen, 2015). In accordance with the agglomeration plot, a six-cluster solution was chosen. All clusters consisted of a large enough number of participants. Furthermore, analyses of variance revealed significant differences for the segmentation variables across all six clusters so the underlying behaviors as well as descriptive variables were able to describe the different groups sufficiently differentiated.

3.2. Characterization of the food consumer segments

We identified six consumer segments regarding environmentally-friendly food choice behavior and consumption: *meat- and fish-eaters* (19.5%), *origin-focused food savers* (18.0%), *ambiguous consumers* (28.8%), *food waste reducing sharers* (19.7%), *renouncement averse consumers* (9.0%), *consequent pro-environmental consumers* (5.0%). Table 1 presents the six consumer segments and the corresponding means of the segmentation variables representing environmentally-friendly behaviors regarding food consumption. Analyses of variance with Games-Howell post-hoc tests were conducted in order to examine how the variables used for the cluster

analysis differed from one another. In the following subchapters, the expressions of the segmentation variables are described throughout the six different segments accompanied by additional explanations of the descriptive variables.

3.2.1. Food choice behavior

The *origin-focused food savers* attached the greatest value to origin, seasonality and few transportation of food, followed by the *consequent pro-environmental consumers*. The *renouncement averse consumers* attached the least importance to these factors, also in order to avoid additional expense. The *renouncement averse consumers* also engaged by far the least in curtailment behavior regarding food consumption. Curtailment behavior in the food domain was most pronounced among the *consequent pro-environmental consumers*. The highest purchase of suboptimal food and food with short expiration date was recorded by the *food waste reducing sharers* and the *consequent pro-environmental consumers*. The *consequent pro-environmental consumers* also most often purchased food with sustainability labels and chose unprocessed foods, both contrary to the *renouncement averse consumers*. The latter group also showed a high unwillingness to choose sustainability labels. Regarding consumption of suboptimal food that has passed the expiration date (even if it is only one day), the *renouncement averse consumers* were least likely to throw away distinct food products. The most prone to early disposal of expired food were the *meat- and fish-eating food consumers* who were also reluctant to both consumption of suboptimal food with esthetic imperfections and the purchase and consumption of food with an imminent expiration date. The *consequent pro-environmental consumers* did not mind if food had esthetic imperfections or had an imminent expiration date; neither did the *food waste reducing sharers*.

3.2.2. Food consumption frequency

As literally indicated by the designation “*the meat- and fish-eaters*”, this cluster had the significantly highest consumption frequency of meat and fish products. About 70% of the persons in this segment referred to themselves as omnivores. The *meat-*

Table 1
Characterization of consumer segments with regard to segmentation variables representing environmentally-friendly food choice and consumption behavior.

	Meat- and fish-eaters (n = 159)	Origin-focused food savers (n = 147)	Ambiguous (n = 235)	Food waste reducing sharer (n = 161)	Renouncement averse (n = 74)	Consequent pro-environmental consumer (n = 41)
Food choice behavior^a						
Preference for seasonal and local food	3.7 b	4.7 d	4.4 c	4.3 c	3.0 a	4.5 dc
Engagement in food curtailment behavior	2.3 b	2.6 cd	2.5 c	2.8 d	1.7 a	4.5 e
Purchase of food with short expiration date	2.4 a	3.0 b	2.8 b	3.7 c	2.9 b	3.2 bc
Reliance on sustainability labels	3.2 b	3.4 bc	3.4 b	3.7 c	2.4 a	4.4 d
Avoidance of processed food	3.4 b	4.2 cd	4.0 cd	4.0 c	2.9 a	4.4 d
Acceptance of food with exceeded expiration date	4.5 a	5.8 c	5.7 b	5.8 bc	5.9 c	5.7 bc
Acceptance of suboptimal food	3.6 a	4.8 bc	4.6 b	5.2 c	4.6 b	5.2 c
Food consumption frequency of animal resp. replacement products^b						
Consumption of meat	25.5 d	13.7 b	14.4 bc	15.9 bc	21.8 cd	2.0 a
Consumption of replacement products	4.6 b	0.5 a	0.9 a	3.2 b	0.6 a	26.2 c
Consumption of cheese	19.0 a	18.7 a	16.9 a	21.3 a	23.1 b	17.2 a
Consumption of fish products	5.1 d	1.7 b	2.6 c	2.7 c	2.1 bc	0.9 a
Food waste management^a						
Food saving behavior	4.4 a	5.3 c	5.0 b	5.2 c	5.2 bc	5.2 bc
Share food with friends	1.7 ab	1.5 ab	1.9 bc	3.6 d	1.6 b	2.4 c
No peeling of fruits and vegetables	3.8 a	3.9 a	3.9 a	4.0 a	3.9 a	4.8 b
Willingness to share^a						
Willingness to use sharing services for food	2.0 ab	1.7 a	3.4 c	4.5 d	2.4 b	4.2 d
Willingness to offer sharing services for food	2.2 b	1.6 a	4.7 c	4.5 c	2.5 b	5.0 c

Note: Analyses of variance revealed a significant effect of food consumer segments for all segmentation variables, $p < 0.001$. Different letters indicate significant differences between particular food consumer segments, $p < 0.05$, using the Games–Howell post-hoc test. For each segmentation variable, the value of the segment with the highest score is in bold and the lowest score is underlined.

^a Higher values indicate higher engagement in the environmentally friendly behavior.

^b Higher values indicate higher consumption of the named product category, values are indicated in consumed portions per month.

Table 2
Comparison of consumer segments based on diet styles and consumption of organic products.

	Meat- and fish-eaters (n = 159)	Origin-focused food savers (n = 147)	Ambiguous (n = 235)	Food waste reducing sharer (n = 161)	Renounce-ment aversive (n = 74)	Consequent pro-environmental consumer (n = 41)
Diet style***,a						
Omnivore	66.9%	41.5%	50.4%	42.5%	81.9%	2.4%
Flexitarian	28.7%	57.8%	48.3%	55.0%	18.1%	36.6%
Pescatarian	2.5%	0.7%	0.9%	0.0%	0.0%	9.8%
Vegetarian	1.3%	0.0%	0.4%	2.5%	0.0%	46.3%
Vegan	0.6%	0.0%	0.0%	0.0%	0.0%	4.9%
Consumption of organic products^b	33.1 b	36.1 bc	38.2 bc	43.1 c	13.5 a	63.7 d

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For each descriptive variable, the value of the segment with the highest score is in bold and the lowest score is underlined. For consumption of organic products, Games–Howell post-hoc tests were performed; different letters indicate significant differences between the particular consumer segments ($p < 0.05$).

^a Percentage of respondents who follow the respective diet style is indicated.

^b Percentage of purchased organic food dependent from the food in the total is indicated.

and fish-eaters were the only segment with more males than females and showed the largest number of males in comparison to the other segments. Regarding meat consumption, *renouncement aversive consumers* recorded the second-highest consumption frequency. About 82% saw themselves as omnivores and none of them was pescatarian, vegetarian or vegan (see Table 2). Whilst the *origin-focused food savers*, the *ambiguous* as well as the *food waste reducing sharers* showed approximately the same consumption frequency of meat, the *consequent pro-environmental consumers* ate significantly less meat and fish than all other groups. As a possible compensation for this, the amount of consumed replacement products was significantly higher for the *consequent pro-environmental consumers*, whereas all other segments in turn only occasionally consumed replacement products for meat and dairy products. The cheese consumption was relatively high throughout all segments with the *renouncement aversive consumers* having the significantly highest frequency. The *consequent pro-environmental consumers* were the group that consumed the highest amounts of organically produced food throughout all analyzed product categories, whereas the *renouncement aversives* consumed the lowest amount of organic food. The corresponding means are presented in Table 2.

3.2.3. Food waste management

The *origin-focused food savers* showed the overall highest engagement in food waste management, followed by the *food waste reducing sharers* and the *consequent pro-environmental consumers* (see Table 1). Both latter segments, as well as the *renouncement aversives*, were equally engaged in using up food and planning the grocery shopping in order to save food, whereas the *meat- and fish-eaters* showed the significantly lowest food saving behavior. The *food waste reducing sharers* were by far the most active regarding the passing of surplus food to friends and acquaintances, followed by the *consequent pro-environmental consumers*. All other segments were more restrained when it came to the sharing of food with familiar persons with the lowest willingness for the *origin focused food savers*. The *consequent pro-environmental consumers* were the group who most often used of the whole fruits and vegetables (i.e., not peeling certain of these products), although the other segments also showed this behavior quite regularly.

3.2.4. Willingness to share

Willingness to both use and offer sharing services for food was highest for the *food waste reducing sharers* and the *consequent pro-environmental consumers* again, corresponding to their better food waste management mentioned earlier. While the *ambiguous food*

consumers had a moderate willingness to use food sharing services, their motivation to offer these sharing services was high. The willingness to use food sharing services of the *renouncement aversives* as well as the *meat- and fish-eaters* was rather low with the *origin-focused food savers* at the very bottom of the list and also had the lowest willingness to offer sharing services for food to people they did not know personally. Except from the *origin-focused food savers*, the general willingness to offer sharing services for food was higher than the willingness to use these services throughout the different segments.

3.2.5. Motives and behavior in the mobility and housing domain

The *consequent pro-environmental consumers* were the group that engaged most in environmentally-friendly behavior not simply regarding food choices; they also showed the highest effort regarding curtailment behavior and product choice in the household domain and in their mobility behavior. The *food waste reducing sharers* also attached importance to the choice of environmentally-friendly products in the household, whereas the *meat- and fish-eaters* showed the least environmentally-friendly behavior in the household domain both in regard to curtailment and product choice. The *renouncement aversives*, *food waste reducing sharers* and *origin-focused food savers* did not significantly differ in their environmentally-friendly behavior in the household domain, but their underlying motives did; the behavior of the *renouncement aversive consumers* was mainly driven by economic motives; simultaneously, they were the group with the significantly lowest expression of motives regarding health as well as environmental friendliness and energy efficiency. The opposite was the case for the *consequent pro-environmental consumers*. The same held true for both segments concerning their motives in the mobility domain. This corresponds to the fact that *consequent pro-environmental consumers* significantly behaved the most environmentally friendly regarding mobility, whereas the *meat- and fish-eating* and the *renouncement aversive food consumers* had the significantly least environmentally-friendly behavior regarding mobility, and the three other segments were in between those extremes. The corresponding values for each segment regarding their behavior and motives in the household and mobility domain can be extracted from Table 3.

3.2.6. Food choice motives

Regarding their food choice, the *consequent pro-environmental consumers* were mainly driven by altruistic and ethical food choice motives (i.e., animal welfare, care for the environment, avoidance of transport and packaging) as well as health consciousness, whereas egoistic motives (i.e., external effect, practicability and

Table 3
Comparison of consumer segments based on behavior and motives in the household and mobility domain.

	Meat- and fish-eaters (n = 159)	Origin-focused food savers (n = 147)	Ambiguous (n = 235)	Food waste reducing sharer (n = 161)	Renounce-ment aversive (n = 74)	Consequent pro-environmental consumer (n = 41)
Behavior in the household						
Curtailment household	4.8 a	5.2 bc	5.1 b	5.2 bc	5.0 ab	5.4 c
Product choice household	1.6 a	1.7 ab	1.7 ab	1.7 b	1.6 ab	1.7 ab
Motives in the household domain						
Environmentally friendliness and energy-efficiency	4.6 ab	4.9 c	4.9 bc	5.0 c	4.4 a	5.2 c
Health motives	4.9 ab	5.0 ab	5.0 ab	5.1 b	4.7 a	5.2 ab
Economic motives	4.2 a	3.9 ab	3.8 b	4.0 ab	4.3 a	3.6 ab
Behavior in the mobility domain						
	3.3 a	3.7 b	3.7 b	3.9 b	3.2 a	4.4 c
Motives in the mobility domain						
Motive EF and energy-efficiency mobility	4.0 b	4.4 a	4.3 ab	4.5 a	3.4 a	4.8 b
Motive health mobility	4.4 ac	4.6 cb	4.7 b	4.7 cb	3.9 a	4.8 c
Motive economics mobility	4.3 a	4.1 a	4.0 a	4.3 a	4.4 a	3.8 a

Note: Analyses of variance revealed a significant effect of food consumer segments for all descriptive variables, $p < 0.001$. Different letters indicate significant differences between particular energy consumer segments, $p < 0.05$, using the Games-Howell post-hoc test. For each descriptive variable, the value of the segment with the highest score is in bold and the lowest score is underlined.

Table 4
Comparison of consumer segments based on descriptive personality variables.

	Meat- and fish-eaters (n = 159)	Origin-focused food savers (n = 147)	Ambiguous (n = 235)	Food waste reducing sharer (n = 161)	Renounce-ment aversive (n = 74)	Consequent pro-environmental consumer (n = 41)
Food choice motives						
Motive animal welfare	4.8 bc	5.0 bc	5.1 bd	5.3 ced	4.3 a	5.7 e
Motive environment	4.5 ab	4.9 bc	4.9 c	5.0 c	4.1 a	5.6 d
Motive transport and packaging	4.5 c	5.1 c	4.9 c	5.0 c	4.0 a	5.2 c
Motive health	4.8 a	5.0 abc	5.0 a	5.1 b	4.5 a	5.4 c
Motive external effect	3.1 b	3.0 b	2.8 b	2.9 b	2.8 b	1.8 a
Motive practical	3.7 a	3.6 a	3.5 a	3.6 a	3.7 a	3.4 a
Motive taste	5.3 abc	5.4 bc	5.2 ab	5.4 c	5.4 abc	5.0 a
Environmental consciousness						
	4.1 ab	4.7 cd	4.4 b	4.4 bc	3.7 a	5.0 d

Note: For each descriptive variable, the value of the segment with the highest score is in bold and the lowest score is underlined. Games-Howell post-hoc tests were performed; different letters indicate significant differences between the particular consumer segments ($p < 0.05$).

taste) were the least pronounced (see Table 4). Again, in opposition to that, the *renouncement aversive food consumers* showed the highest expression of egoistic food choice motives. Practicability and the external effect of food choices, however, did not differ significantly between the *renouncement aversives*, the *food waste reducing sharers*, the *ambiguous consumers*, the *origin-focused food savers* and the *meat- and fish-eating food consumers*. Taste was quite an important motive for all segments, although lowest rated from the *consequent pro-environmental consumers* and highest from the *food waste reducing sharers*. The *pro-environmental consumers* were the most likely to make compromises concerning comfort restrictions and higher prices of environmentally-friendly food products. The respective expressions of the personality variables, food choice motives, beliefs and attitudes were accordingly reflected by the participants' self-assessed environmental consciousness. The *consequent pro-environmental consumers* saw themselves as the most environmentally conscious, the *renouncement aversive food consumers* as the least environmentally conscious, followed by the *meat- and fish-eaters*, whereas the *origin-focused food savers*, the *ambiguous* and the *food waste reducing sharers* were somewhere in between.

3.3. Short descriptions of the different consumer segments

All six consumer segments are briefly summarized regarding their most prominent characteristics. For this, the segmentation variables were used as well as the descriptive variables that have already been mentioned in Chapter 3.2. Additionally, food involve-

ment and sociodemographic variables were used to describe the single segments. These additional variables with their corresponding means are depicted in Table 5.

3.3.1. Meat- and fish-eating food consumers

The *meat- and fish-eating food consumers* (19.5%) are characterized by their high consumption of meat and fish on an almost-daily basis, they are the group that attaches the second least importance to animal welfare as a food choice motive, and the same holds true for health. Furthermore, they are the least likely to consume or purchase suboptimal food both regarding their visual appearance and their expiration date and engage less in food saving. The mostly male group had the lowest food involvement, which also results in the fact that food choices mainly must be practical. This cluster showed both the highest and lowest monthly income compared to the other clusters. The external effect of the group's food choices was not strongly pronounced, but highest compared to all other clusters, and they are least engaged in environmentally-friendly behavior in the household domain both regarding curtailment and product choice.

3.3.2. Origin-focused food savers

The *origin-focused food savers* (18%) endeavored to take transportation distance, origin of products and seasonality into account when purchasing food; concerns about transport and packaging were next to the importance of taste one of the main drivers for their food choices. This segment highly rejected every kind of sharing behavior, independent of whether food was shared with friends

Table 5

Comparison of consumer segments based on knowledge about sustainable food consumption, food involvement and sociodemographics.

	Meat- and fish-eaters (n = 159)	Origin-focused food savers (n = 147)	Ambiguous (n = 235)	Food waste reducing sharer (n = 161)	Renounce-ment aversive (n = 74)	Consequent pro-environmental consumer (n = 41)
Food involvement***	4.1 a	4.5 b	4.4 ab	4.6 b	4.2 ab	4.5 ab
Sociodemographics						
Age in years ***	55.0	64.9	57.8	51.5	59.5	49.1
Gender ***						
Male	50.9%	42.9%	38.3%	25.5%	44.4%	22.0%
Female	48.4%	59.1%	61.5%	74.5%	55.6%	78.0%
Education *						
Obligatory school	7.6%	8.8%	3.4%	8.1%	8.1%	2.5%
Secondary school	41.8%	39.5%	40.9%	39.1%	43.2%	15.0%
Vocational college	5.1%	8.2%	7.7%	8.7%	6.8%	10.0%
Higher vocational college	20.9%	25.9%	20.0%	19.3%	14.9%	32.5%
University of applied sciences	10.8%	9.5%	15.3%	14.3%	12.2%	27.5%
University	13.9%	8.2%	12.8%	10.6%	14.9%	12.5%
Income class in% *						
Less than 3000 CHF	9.9%	7.9%	5.6%	7.6%	5.7%	4.9%
3000–5000 CHF	18.4%	23.0%	17.7%	17.8%	30.0%	14.6%
5001–7000 CHF	21.1%	28.8%	23.8%	26.8%	31.4%	34.1%
7001–9000 CHF	17.8%	19.4%	20.8%	26.1%	14.3%	22.0%
9001–11,000 CHF	15.1%	10.8%	15.2%	14.0%	11.4%	14.6%
More than 11,000 CHF	17.8%	10.1%	16.9%	7.6%	7.1%	9.8%
Number of persons in the household	2.4	2.22	2.49	2.64	2.51	2.51
Number of children in the household	1.4	1.27	1.45	1.58	1.46	1.39
Place of living						
City	22.0%	12.2%	13.2%	10.0%	9.5%	20.0%
Suburbs	30.2%	28.6%	31.9%	34.4%	39.2%	47.5%
Countryside	47.8%	59.2%	54.9%	55.6%	51.4%	32.5%

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Analyses of variance revealed a significant effect of food consumer segments for all descriptive variables, $p < 0.05$. Games–Howell post-hoc tests were performed for food involvement; different letters indicate significant differences between the particular consumer segments ($p < 0.05$).

or with strangers, and they were also least willing to use sharing services. Age was the highest in mean whereas the level of education was the lowest. Nevertheless, environmental consciousness was pronounced in this cluster.

3.3.3. Ambiguous food consumers

The *ambiguous food consumers* constituted the largest segment (28.8%). They were not very consequent in conducting any kind of strictly environmentally-friendly behavior in any of the discussed domains although they attached importance to animal welfare and the environment when making food choices. With a relatively high monthly income, they did not evaluate economic motives as most important for their behavior. They were rather ambiguous in their environmentally-friendly behavioral engagement, and their environmental consciousness was not especially high compared to the other clusters.

3.3.4. Food waste reducing sharer

The *food waste reducing sharers* (19.7%) made the greatest effort to avoid food waste. They were a relatively young group that most frequently purchased food with a short expiration date, engaged most in food saving actions and shared food with friends as well as making use of food sharing services. The *food waste reducing sharers* cared much about animal welfare, the environment and the transportation, origin and packaging of food. They were highly involved in questions concerning food preparation and taste was an important motive for food choices to them.

3.3.5. Renouncement aversive food consumers

The *renouncement aversive food consumers* (9%) engaged the least in all behaviors regarding environmentally-friendly food consumption both in connection to food choice and curtailment behavior, reflecting their low motivation to behave environmentally-friendly for ethical reasons. They were not very open-minded regarding sharing services but nevertheless tried to avoid food waste. Their behavior was driven by egoistic motives, and they also had a

rather low environmental consciousness. The mainly omnivorous group had a rather low income, resulting also in the lowest engagement for environmentally-friendly behavior in both the household and mobility domain and a strong focus on economic motives.

3.3.6. Consequent pro-environmental food consumers

The *consequent pro-environmental consumers* (5%) regularly stood up for environmentally-friendly behavior regarding both food choice and curtailment behavior in the food domain. They consumed replacement products more often than meat and fish and engaged in food saving behavior also by a high willingness to offer food sharing services. The mostly female group was highly educated with a middle income. Almost half of the segment followed a vegetarian or even vegan diet, and their food choices were driven by a high importance of ethical motives whereas egoistic motives were neglected. This segment was also most engaged in environmentally-friendly behavior regarding household and mobility. Their behavior in these domains was less driven by economic motives, but health reasons and environmental protection played a significant role, and they had a high environmental consciousness.

4. Discussion, Limitations and implications

The aim of our study was to identify different segments of food consumers based on environmentally-friendly behavior in the food domain. In comparison to other studies, we took a more comprehensive and differentiated perspective regarding different food consumption behaviors, which allowed us to identify very detailed and subdivided consumer segments. Based on food choice behavior, food consumption frequency of animal replacement products, food waste management and willingness to share, we identified six consumer segments: *meat- and fish-eaters* (19.5%), *origin-focused food savers* (18%), *ambiguous consumers* (28.8%), *food waste reducing sharers* (19.7%), *renouncement aversives* (9%) and *consequent pro-environmental consumers* (5%). It has to be mentioned,

that we used self-reported data for measuring all types of behavior. The general limitation when working with self-reported data is that people tend to respond in a way that they assume to be socially desirable (van de Mortel, 2008). The consequence of this social desirability bias is that individuals either deny behaving in a socially undesirable way or state exaggerations of behavior they evaluate as socially desirable by, for example, indicating a higher purchase of products with sustainability labels than they actually do (Baudry et al., 2015). Also, self-reported data reflects a person's beliefs and perception of their own behavior and is not completely objective. Therefore, self-reported measures regarding environmentally-friendly behavior cannot be put on a level with actual behavior (Gatersleben et al., 2002). To gather data about the actual behavior of persons, however, involves considerable time and effort which was out of scope for this study project. To fulfill the aim of our study, that is, to describe environmentally-friendly consumers in a comprehensive way, self-reported data as a proxy for real behavior was a meaningful method. Most of the constructs have a good internal consistency which is shown by a high Cronbach's α . Nevertheless, Cronbach's α is rather low for certain constructs and we cannot rule out that this may have influenced the results.

Like other studies, we also identified one consumer segment that behaves the most environmentally-friendly in almost all aspects of food consumption but also in the two other investigated domains of mobility and housing. Titled as "the green" (Yilmazsoy et al., 2015) or "conscious" (Verain et al., 2016) consumer segment in previous studies, the behavior matches with our group of the *consequent pro-environmental consumer*; they practice green behavior on a regular and daily basis and have strong positive attitudes towards the environment (Yilmazsoy et al., 2015), sustainability labels, regional origin of the food products, their environmental friendliness is crucial to them (Verain et al., 2016) and ethnocentrism is an important value for them (Bryła, 2019). Due to strong concerns about the environment, they behave in an environmentally-friendly manner throughout all domains which might also be promoted by a positive spillover effect (Penz et al., 2019). They engage not only in easier feasible behaviors like buying organic products, but also restrict themselves for instance through renouncing meat, which is considered a greater restriction in general (Hartmann and Siegrist, 2017). This consumer segment consists of the fewest members in comparison to the other five groups, which was also found for similar groups in other segmentation studies (Sarti et al., 2018; Verain et al., 2016). Also, it is the segment with the lowest age on average. Research shows that younger persons are more receptive to environmental concerns (Straughan and Roberts, 1999). This correlation could be rooted in the fact that persons who grew up in a time when environmental issues were a striking topic might be more sensitive to these topics (Straughan and Roberts, 1999). It does not seem necessary to drive the *consequent pro-environmental consumers* towards an even more sustainable way of living, whereas it would be desirable to increase the number of persons who behave as outstandingly environmentally-friendly as this consumer segment does. Furthermore, it is important to show the *consequent pro-environmental consumers* that it is worth it for them to continue with their environmentally-friendly behavior and not to feel resigned because they might have the feeling that their own behavior and efforts do not contribute to an improvement of the overall environmental situation. This could, for instance, be achieved by regularly providing them with information about the situation regarding environmentally-friendly consumer behavior, related problems and possible solutions.

The complete opposite of the *consequent pro-environmental consumers* are the *renouncement aversive consumers*, labelled "the least green segment" in other studies (Yilmazsoy et al., 2015). Their low

engagement in environmentally-friendly behavior not only concerns food-related behavior, but also household and mobility. Regarding food consumption, it is especially noticeable that this consumer group behaves the least environmentally-friendly in almost all categories of food choice behavior in terms of neither choosing environmentally-friendly products (sustainability labels, seasonal products, etc.), nor being willed to accept curtailment of behaviors, such as reduced intake of dairy products or meat. However, they interestingly do purchase and consume food products with short or even exceeded expiration date. The motive behind that could be financial savings because that is also the most important driver for their behavior in the household and mobility domains. To further increase environmentally-friendly behavior, their already "green" behavior regarding the avoidance of food waste when it comes to expiration dates could be positively recognized and thereby emphasized that environmentally-friendly behavior does not necessarily have to be difficult and can be easily integrated into everyday life. It could also be pointed out that the willingness to buy sub-optimal food and avoid food waste simultaneously to the financial savings supports the environment and does not require too much effort. Their comparatively high consumption of processed food can be explained by the high importance of practicality they attach to their food choices. Accordingly, their attachment of value to health and the environment are lowest compared to all other segments in all three investigated domains. It might be hard to call their attention to environmental issues in trying to change their behavior. For the *renouncement aversive consumers*, one starting point could be to focus on the highly important economic aspects; that is, reducing meat consumption could come along with monetary savings. For this mostly omnivore consumer segment, saving money could be an incentive for the reduction of meat consumption, which is evidently a motive for persons to adopt a vegetarian diet (Mullee et al., 2017). Also, this segment regularly consumes processed food and has low food involvement. Limited cooking skills as well as only few vegetarian options when purchasing ready-to-eat meals also impedes lower meat intake (Mullee et al., 2017). A general increase in food involvement might therefore lead to more appreciation of food and promote the affinity for vegetarian dishes. However, it might also just be the case that this second smallest consumer segment is just not interested in environmental issues or cutting personal convenience. It is a challenge to raise their environmental consciousness and make them aware of the issues regarding climate change and the necessary adaptations regarding individual behavior at all.

The *meat- and fish-eaters* showed the least environmentally-friendly behavior in the housing domain as well as the lowest food involvement of all the groups. This means they enjoy less engaging in preparing meals themselves and do not deal with questions regarding food in particular. This is reflected by the fact that they eat out and also consume processed food more regularly. This might, inter alia, support the pattern of eating meat on a very high level because most of the ready meals that can be purchased in the supermarkets contain meat, whereas the offer of vegetarian and vegan options is limited (Alford and Corrieri, 2018). Convenience food is not considered the healthiest meals in general (Olsen et al., 2012), which supports the fact that health concerns are not a popular food choice motive for the *meat- and fish-eaters*. They might not be aware or simply do not care about the negative consequences of high meat intake on health, including high blood pressure or coronary heart disease (Kontogianni et al., 2008), neither is their environmental consciousness strongly pronounced. Instead of health or biospheric motives, they attach importance to the external effect of their food choices. This could be an explanation for why they do not purchase suboptimal foods because they might fear creating a negative image because the aesthetics of food can influence self-perception, which leads to a lower will-

ingness to buy these “imperfect” products (Grewal et al., 2019). Also, suboptimal foods are perceived as less suitable for guests (de Hooge et al., 2017), which in connection to the high importance of external effects, is an additional barrier for this segment to purchase and use suboptimal food. A possible strategy to make the *meat- and fish-eaters* change their behavior could be to emphasize the social desirability of behaving in a more environmentally-friendly way (Kaaronen and Strelkovskii, 2020) because the external image they create of themselves seems to be crucial to them. Against this background, information campaigns about the positive picture of persons who reduce their food waste might also support the *meat- and fish-eaters* in improving their poor food waste management. Also, meatless meals can be extravagant and create an extraordinary image that might encourage persons of this segment with higher income. Although the sample in this study is mostly female, the group of the *meat- and fish-eaters* consists with 51% of a surprisingly high number of males. In general and in Switzerland specifically, men have higher consumption frequencies of meat (Hagmann et al., 2019). Meat intake is highly connected to masculinity (Rothgerber, 2013; Ruby and Heine, 2011; Sobal, 2005) and might also be seen as a status symbol in order to create a positive self-image (Chan and Zlatevska, 2019). In order to overcome these traditional stereotypes, De Backer et al. (2020) suggested a new form of masculinity based on other factors instead of meat intake like authenticity, domesticity and holistic self-awareness. Also, positive associations about persons who eat vegetarian meals should be pointed out in order to contradict established stereotypes (Funk et al., 2020).

The *origin focused food savers* attached the most importance to origin, transportation and seasonality of their food purchases and thereby stand out from all other consumer segments. The relatively high mean age of 65 years in this consumer segment could explain several of their behavioral patterns. First, replacement products as well as organized sharing services are quite a new trend that might be unfamiliar for the relatively older group that would prevent them from adopting them. Studies found that consumption of meat replacements negatively correlates with age (Hoek et al., 2004; Siegrist and Hartmann, 2019). Second, food choice, taste and motives to favor particular foods change with age. For example, health concerns become more important with increasing age (Drewnowski and Shultz, 2001). To increase consumption of replacement products and to further lower the intake of animal proteins, the advantages and positive impacts on personal health of plant-based diets could be emphasized, especially preventing older persons from coronary heart diseases, etc. Third, people in this group might be used to local production of foods because globalization did not allow cheap and easily accessible products from all over the world several decades ago. Also, the different dietary situation at that time might have led to a more conscious and environmentally-friendly behavior regarding emergence and use of leftover food. Therefore, regional products might be of higher importance to them because of the general belief that things were better in the past and therefore, this group appreciates regional food systems (Autio et al., 2013).

The largest segment formed by 235 participants were the *ambiguous food consumers*. They do not stand out by any particular behavior that we assessed nor do they actively reject a behavior. Similar to previous studies, they represent the majority of the population, called “the (selfless) inconsequent” (Saleem et al., 2018; Sarti et al., 2018; Sütterlin et al., 2011) or “the average” consumer (Verain et al., 2016). A possible explanation for their rather low actions regarding environmentally-friendly behaviors could be that they are not really aware of or interested in the issue of climate change. Therefore, provision of information about the environmental impact of food production could be a starting point to create awareness of the topic. Pointing out how and to what ex-

tent consumers can contribute to lowering the environmental burden of food choices and consumption behavior might be a helpful guide for them in order to increase environmentally-friendly behavior. Due to the fact that this segment is the largest one, it seems promising to implement interventions in order to enhance them to behave more environmentally-friendly.

Similarly to the *origin-focused food savers*, the *food waste reducing sharers* also aim to minimize food waste. Whereas the first group implements this goal by using up food and avoiding leftovers, the latter group actively purchases suboptimal food and food with an imminent expiration date. Also, the willingness to both offer and use sharing services is highly pronounced in younger consumers. There might even be a social component included in sharing because they not only pass or get food via official sharing platforms, but also among neighbors and friends. According to Benkler (2004), sharing is defined as a nonreciprocal pro-social behavior. The social interaction that other persons might go along with suits the *food waste reducing sharer* very well because they show the highest food involvements of all groups; this is also reflected in their avoidance of convenience products and processed foods. Higher food involvement correlates with making healthier food choices and also goes along with a more positive attitude towards organic products (Chen, 2007). Also, healthiness is often associated with sustainability (Lazzarini et al., 2016). The *food waste reducing sharers* are driven by health motives and they consume relatively high amounts of organic products. However, health is not the most important food choice motive for them; they attach huge importance to taste. Obviously, they are aware that the indicated expiration date or esthetic characteristics do not necessarily imply that the product is not edible anymore or that the taste is negatively affected, which many consumers are not aware of (de Hooge et al., 2017). Their general willingness to behave in an environmentally-friendly way in the food domain is reflected in a relatively high level of curtailment behavior as well as their choice of energy-saving products in the housing domain that is not simply driven by economic concerns. Possible starting points for interventions to guide the *food waste reducing sharers* towards more environmentally-friendly behaviors in the food domain by, for instance, reducing their meat intake, might be their high food involvement and the importance they assign to taste; they enjoy talking about food, entertain thoughts about food during the day and engage in food-related activities. These people might be more easily inspired by plant-based dishes if they fulfill their requirements of good taste. As adventuresome persons regarding new food and taste experiences, they might be more open to trying new food products like meat replacement products. Food involvement correlates negatively with food neophobia, which might also positively influence the consumption of newly developed plant-based replacement products (Caber et al., 2018).

When suggesting policy implications to improve environmentally-friendly behavior specifically for the different segments, it has to be taken into account, that segments based on consumer attitudes (i.e., the same persons) are not very steady over time, which is known from time series studies on consumer segmentation (Müller and Hamm, 2014). This means that is not advisable to focus marketing strategies and actions too narrow on the identified segments which have been identified just at one certain time, but observe the segments and adapt the measures over the time. The share of respondents of each cluster is an important factor for the success of policy measures: The group with persons who consequently behave in an extremely environmentally-friendly or not environmentally-friendly manner is very small. That the latter is small, may be good news, because it might be rather difficult to convince the latter group to change their behavior. The fact that the *ambiguous* consumers are the largest segment shows that many people, even though

the environment is not unimportant to them, do not care much for or are unaware of the importance of environmentally-friendly behavior. Those persons as well as the *meat- and fish-eaters* might be groups which are able to change the segments, if individualized interventions are implemented. The number of persons who react positively to possible constraints might be rather limited, however. Eating is one of the few areas which are not entirely externally regulated yet. This may be a challenge for the acceptance of certain measures because food and eating are important to many people who may not accept that someone prescribes them what to eat and who would therefore presumably show reactance.

When discussing the consumer segments, it needs to be considered that also contextual forces play an important role when examining environmentally-friendly consumer behavior. Sharing services, for instance, are offered mainly in the larger cities and are not that popular in rural areas yet. Those contextual factors, however, were not assessed in our questionnaire. We did not examine in what way different behaviors might be classified as spillover effects, either. It could be possible that environmentally-friendly behavior in one domain makes people behave even more environmentally-friendly in another domain (Penz et al., 2019), like the *consequent pro-environmental* do, or the other way round.

Another issue concerns the generalizability of the results. The sample for our survey originates from the German-speaking part of Switzerland. Results might differ because Switzerland is dominated by several sub-national cultures based on multilingualism and regional diversity (Ritz and Brewer, 2013). Furthermore, diet composition as well as food choices vary widely between countries and are very culture-specific (Rozin, 2007). Countries also differ in contextual forces, such as the access to environmentally-friendly food products and public transport that facilitates or impedes environmentally-friendly behavior. Therefore, the findings of our study hold true for the German-speaking part of Switzerland and are not necessarily valid for all consumers.

As a last possible limitation, the time of data collection should be mentioned. We conducted the study from end of October until January. During this period, it might have been more common to behave more energy consuming in different regards: First, the weather conditions in this period influence the choice of transportation mode, for example, increasing the likelihood for car use and lowering the willingness to ride a bicycle (Rozin, 2007; Sears et al., 2012). Second, more energy is consumed by heating during the winter period. Third, Christmas is usually a season characterized by higher consumption, and many traditional Christmas menus in Western countries include meat (Austgulen, 2013). This higher consumption level during the data collection period might result in an overestimation of the general consumption behavior. However, the tendency to misjudge consumption due to the higher saliency of these behaviors is equally likely. Thus, it should not affect the differences between the six consumer segments.

5. Conclusion

Compared to other segmentations regarding environmentally-friendly behavior that used the approach of cluster analysis, our research gives a more comprehensive and differentiated picture of environmentally-friendly behaviors regarding food consumption based on behavioral variables. Additionally, the identified clusters are further described by the respective behavioral patterns in the household and mobility domains and by personality variables. Against the background of the contribution of food production and consumption to climate change, the detailed distinction between food consumers regarding different types of environmentally-friendly behavior is crucial in order to develop targeted measures and intervention strategies to enhance environmentally-friendly consumer behavior of different consumers.

We identified one segment that behaves in an environmentally-friendly way throughout all domains, that is, food consumption, housing and mobility, and that is driven by environmental consciousness. The opposite segment constitutes the *renouncement aversive consumers* who refuse to put effort into any type of environmentally-friendly behavior. New insights were gathered regarding the four consumer segments between those two extremes. Different groups behave environmentally-friendly with regard to differing types of behaviors, whereas they lack environmentally sound behavior in others. This means that there is not only one group of consumers who behave moderately environmentally-friendly, but four sub-groups who differ in the extent and the type of behavior. Regarding practical implications, this means that when intervention strategies and communication measures are developed, these groups must be considered separately and addressed specifically. Furthermore, our results underpin the application of behavioral variables as a segmentation base instead of sociodemographics or more abstract variables, for instance general values, because these are conceptually rather distant from actual behavior regarding food consumption.

Further steps, detailed interventions, communication measures and marketing strategies should be developed based on the identified segments of this study. The efficiency of the strategies could be tested by providing them to the respective consumer segment and, based on the observed responsiveness, the most effective alternatives for each food consumer segment could be identified and implemented. This would be a further important step towards the development of tailored, effective marketing and intervention strategies in order to increase environmentally-friendly behavior, especially in the food domain.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.spc.2020.08.010.

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