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Legume consumption and sustainability – The minority goes green

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ABSTRACT

The current food systems and the dominating dietary patterns in most EU countries contribute to climate change and are not sustainable. Legumes have the potential to make consumption patterns more sustainable, especially if they come from local or organic production systems. Yet, legume consumption in Germany is low. Thus, this study aimed to increase legume consumption, understand consumer preferences for organic and local production in relation to the processing level, and provide marketing recommendations for different target groups. An online survey including an information display matrix was conducted with 1300 participants from Germany. Preferences for locally and organically produced lentils were identified by search depth and order and a multinomial logistic regression analysis. A latent class cluster analysis (LCA) identified five consumer segments relevant to legume consumption based on psychographics. Results showed a preference for local and organic lentils, regardless of the processing level of the product. Of the five consumer segments, two segments (accounting for 55 %) were rather price-sensitive with a low legume and high meat consumption. Another two segments (23 %) were sustainably-oriented and one segment had a strong preference for cooking. Concluding, there is a potential to market local and organic legumes, however, only for the sustainably-oriented consumers. Hence, for now, legumes remain a niche product in Germany. For a significant increase in legume consumption, also consumers' awareness has to increase: for the environment, health, and the environmental impact of meat consumption.

1. Introduction

As the effects of climate change become increasingly evident in Europe (Vautard et al., 2020), not only people's awareness of their personal impact on the environment increases (Röös et al., 2022; Schaffner et al., 2015), but also the EU commission's ambitions to promote sustainable food systems strengthen (European Commission, 2019, 2020). The current food systems as well as the dominating dietary patterns in most EU countries contribute to climate change and are far from being sustainable (Fischer et al., 2023; Springmann, 2023). To make food systems more sustainable, the German Ministry of Agriculture promotes the production and consumption of legumes in general and of local and organic legumes in particular (BMEL, 2020; DGE, 2024a). Legumes potentially extend crop rotation, increase biodiversity, and are able to fix atmospheric nitrogen which makes synthetic nitrogen fertilisers unnecessary. Legumes can be grown in dry areas (Stagnari et al., 2017; Warne et al., 2019), making them suitable for local and organic production in Germany as climate change continues. Moreover, sourcing organic products locally can be more sustainable due to short transportation distances (Chiriacò et al., 2022; Stein & Santini, 2022). Humans benefit of legumes through a high protein content and essential amino acids (Heine et al., 2018). Legumes can further cover a broad range of consumer preferences: as convenience products in the form of meat alternatives and as a natural and healthy food in the form of raw or minimally processed products. Hence, they have the potential to serve diverse consumer needs and make consumption patterns more sustainable in the long run. However, with less than 38 g per week, legume consumption in Germany is low (BMEL, 2024) and even below the recommendations which are about 125 g per week (DGE, 2024b). Against this background, the overall objective of this study is to investigate consumers' preferences for legume consumption and provide marketing recommendations for different target groups.

Reviewing the literature, consumer perception of legume products depends on the specific consumption purpose, that is, being a plant-based and healthy protein source or a meat substitute. If legume products are investigated as a plant-based protein source, but not as a meat-resembling substitute, consumers have a rather positive perception (Faber et al., 2022). Legumes as meat-substitutes have a rather negative image, as they are also perceived as less natural when compared to animal-based products (Hartmann et al., 2022). Consumers' perception

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of the healthiness of meat substitutes has been found to be inconsistent across dietary groups and within individuals. While a meat-free product is seen as healthy, the high processing level of a meat-free product is perceived as rather unhealthy (Kerslake et al., 2022). Moreover, taste expectations seem to override the health aspect (Michel et al., 2021) and negative taste expectations and negative attitudes towards vegetarian and vegan diets hinder the reduction of meat consumption and the increase of legume consumption (Michel et al., 2021). Thus, consumers' perceptions of legumes differ depending on the consumption purpose. Therefore, this study considers legumes as a plant-based protein source that can, but does not have to, serve as a meat substitute. In order to better understand consumers' legume consumption in general, the first research question asks: What are consumers' motivations to consume and what do they know about legumes?

Regarding the organic and local production of legumes, consumers' perspectives seem similar to other organic or local food products. Consumers assume products with an organic label to be more environmentally friendly, no matter if they are plant- or animal-based (Hartmann et al., 2022). They are willing to pay a price premium for organic lentils if they have an organic label, or if they display the local origin or both (Marette, 2021; Paffarini et al., 2021). Similarly, information on local origin, in this case Denmark versus elsewhere, increases people's willingness to try and willingness to pay for hummus made from different pulse varieties (Andersen et al., 2022).

Consumers' perception of organic and local production is also closely linked to the processing level of products: local origin seems to be more important for unprocessed products, e.g. tomatoes compared to processed products, e.g. ketchup (Meyerding et al., 2019). Compared to local foods, preferences for processed organic products are heterogeneous: some consumers appreciate convenient and higher processed organic products, while others prefer fresh organic products with minimal processing (Hueppe & Zander, 2021). Moreover, consumers state that organic products should undergo only a few processing steps and remain as "natural" as possible, while other consumers also value higher processing and convenience levels (Hueppe & Zander, 2021). In regard to legumes, consumers who already replace meat with legumes emphasise convenience and low processing levels to be important (Henn, Olsen, et al., 2022). Thus, literature shows that products with different processing levels (Figueira et al., 2019; Lemken et al., 2017, 2019; Röös et al., 2022) and preferences for organic or local production (Marette, 2021; Paffarini et al., 2021; Siegrist & Hartmann, 2019) have been investigated but rarely have they been combined. Therefore, this study aims to understand consumer preferences for organic and local production in relation to the processing level of legume products. Thereof follows the second research question: Do consumers prefer organically and/or locally produced legumes and how are the preferences for local and/or organic legumes influenced by the processing level of the product?

Besides the consumption purpose, personal values and attitudes towards health and the environment influence the consumption of legumes (Henn et al., 2023; Lemken et al., 2017; Marette & Roosen, 2022). For example, when comparing dried lentils with lentil pasta in Europe, 25 %–42 % of respondents state an increased purchase intent after reading the information on nutritional or environmental benefits of lentils. In France and Germany, information on environmental benefits often has a greater impact on purchase intention than the nutritional information, especially for lentil pasta (Marette & Roosen, 2022). Yet, for legume pasta, a mix of environmental and health claims increases willingness to pay (WTP) the most (Lemken et al., 2017). When combined with blind tastings, additional information on environmental and health benefits increases WTP for different bean and pea spreads only if respondents also like the taste of the bean or pea spread (Henn et al., 2023).

Moreover, health and environmental values also play an important role when investigating consumers' willingness to substitute meat. Consumers' perceptions of the environmental and health impact of food products have a significant influence on whether consumers change their meat and legume consumption or not (Henn, Olsen, et al., 2022; Röös et al., 2022). Consumers do not always assess the environmental and health impact of products correctly and sometimes come to false conclusions by e.g. overestimating the environmental friendliness and healthiness of meat products and underestimate the one of meat substitutes. This resulted in beef entrecote being perceived as much more environmentally friendly than a pea protein burger or silken tofu (Hartmann et al., 2022). Reasons were a lack of knowledge regarding the huge environmental impact of beef production and an overestimation of the impact of organic production or country of origin (Hartmann et al., 2022).

Besides environmental and health aspects, cooking experience also seems to have an effect on consumers' diet. Good cooking skills help to make healthier food choices (Hartmann et al., 2013) and are related to a higher motivation and openness to alternative cooking methods, including plant-based protein dishes (Nguyen et al., 2022). A lack of knowledge and lack of time for legume preparation (Henn, Goddyn, et al., 2022), Henn, Goddyn, et al., 2022s well as lengthy cooking requirements (Melendrez-Ruiz et al., 2020) decrease interest in legume consumption.

Summing up, environmental values, interest in a healthy diet, and cooking involvement are expected to have a positive correlation with legume consumption and are closely linked with meat reduction. However, consumers' perceptions are diverse and hence, consumer segments will be built to provide target group-specific marketing recommendations. Therefore, the third research question asks: Which legume consumer segments exist based on the concepts of green values, interest in a healthy diet, cooking involvement, and favouring reduced meat consumption?

2. Methods

A quantitative online survey with an information display matrix (IDM) and a standardised questionnaire was used to assess consumers' preferences for organic and local origin of lentil products as well as the influence of the processing level on the preferences. In this study, legumes refer to green beans, kidney beans, peas, chickpeas, lentils, lupines, soy beans, and peanuts. In the context of the second research question, it is important to mention that "processing level" is understood from a lay person's perspective, referring more to the level of convenience while preparing a lentil burger patty than the actual processing level as defined from a food technology perspective.

2.1. Data collection and cleaning

Data collection took place in July 2023 via an online access panel. 1500 participants were recruited based on the following criteria: being at least partly responsible for grocery shopping; buying at least sometimes organic food; consuming green beans, kidney beans, peas, lupines, chickpeas, lentils, peanuts, or soy beans at least every 2–3 months; residence in Hesse, Germany as research funds were intended for Hesse; People working in market research were excluded. The questionnaire was pretested by six other researchers and five lay people for understandability.

A total of 2236 panel members were contacted by the market research agency. Of these, 640 participants were screened out due to not fulfilling recruitment criteria or failing the attention check. Another 276 participants were excluded due to data quality issues: Participants whose response time was less than half the median – under 6.02 min –, who did not tick any of the boxes in the IDM, but merely made a product choice, or who had an unusually long processing time for the IDM task. In addition, selected statements were checked for internal consistency. This resulted in a final sample of 1320 participants. The average response time was just below 19 min.

The sample is representative for the German population in terms of

gender, income, and age with minor deviations in the youngest and eldest age group (Table 1) (Destatis, 2018, 2023, 2024). The youngest age group is underrepresented by 9 % while the eldest group is overrepresented by 8 %. Only education deviates from the German population (Destatis, 2019): people graduating from secondary school are clearly underrepresented while people who graduated from high school are clearly overrepresented in the sample. The sample consists of fairly regular legume consumers: 76 % state to consume legumes at least every two weeks (Table 1).

2.2. Information display matrix (IDM)

The IDM is an indirect method for tracking consumers' information search processes (Klink et al., 2015; Langen, 2013; Schleenbecker & Hamm, 2015; Zander & Hamm, 2012) and is also used to investigate consumer preferences and their product choice (Zander & Hamm, 2010; Zander & Schleenbecker, 2018). The basic structure of an IDM is a matrix with product alternatives in columns and product attributes in rows. The underlying assumption is that the first requested attribute is the most important one (Aschemann-Witzel & Hamm, 2011; Zander & Schleenbecker, 2018). By tracking the process of information acquisition, the IDM allows to identify the importance of each product attribute (Zander & Schleenbecker, 2018). As the IDM investigates consumers' preferences indirectly, the social desirability bias is reduced compared to a direct inquiry (Zander & Hamm, 2010). The IDM was sometimes criticised for a lack of external validity due to its structured design which is quite different from a real shopping situation in the supermarket (Aschemann-Witzel & Hamm, 2011). With the increasing use of the internet, people get more used to information presented in a structured design, similar to an IDM matrix; e.g. in price comparisons, test reports, or online shops (Zander & Schleenbecker, 2018), which leads to higher external validity.

Table 1
Summary statistics of the sample (N = 1320).

Criterion	Characteristic	Share of sample	German population
[1]Gender	Female	54 %	51 %
	Male	46 %	49 %
	Non-binary	0.2 %	n.s.
[2]Age	18–29 years	9 %	18 %
	30–39 years	19 %	18 %
	40–49 years	19 %	17 %
	50–59 years	25 %	27 %
	60–75 years	28 %	20 %
[3]Education	Still ongoing education	0.5 %	4 %
	Secondary school	38 %	59 %
	High school	62 %	33 %
	No graduation	0.1 %	4 %
[4]Monthly net income	Less than 1300 €	8 %	13 %
	1300 € < 2000 €	10 %	16 %
	2000 € < 2600 €	14 %	14 %
	2600 € < 3600 €	19 %	18 %
	3600 € < 5000 €	23 %	17 %
	5000 € or more	14 %	22 %
	Prefer not to say	12 %	n.s.
[5]Legume consumption	Every 2–3 months	11 %	less than 38 g per week
	Once per month	14 %	
	Every two weeks	27 %	
	Once per week	31 %	
	More than once per week	18 %	

Own data and [1]Destatis (2024), [2]Destatis (2023), [3]Destatis (2019), [4]Destatis (2018), [5]BMEL (2024).

2.2.1. Experimental design

In this study, the IDM was used to investigate consumers' preferences for organic production of lentils, local origin of lentils, local place of processing, and price. Three IDMs were designed for three lentil products which were to present the different processing levels: canned lentils (little processed), a ready-mix for lentil burger patties (medium processed), and a ready-to-eat lentil burger patty (highly processed) (Fig. 1).

Each IDM had six product alternatives (columns) and four product attributes (rows) (Table 2). Each attribute had two levels, except price, which had four. The four price levels[1] aimed to reflect the amount of information provided. The amount of information was dependent on the combination of the attributes organic production, local origin of lentils, or local place of processing within the product alternatives (Table 2).

The experiment followed the structure of a between-subjects design, that is each participant could freely choose one of the three lentil products (Fig. 1) to then get the IDM for the chosen lentil product. The participants got the picture of the chosen product in combination with the IDM table with the four product attributes and six product alternatives as described in Table 2, with the information in the fields initially covered (Fig. 2).

In order to uncover the information, participants had to click on the respective field. The number of fields to be opened was limited to force participants to focus on the most important attributes, also resembling the shopping situation in a supermarket, where time is often constrained. Thus, from the possible 24 fields, a maximum number of 15 fields, equalling 62.5 % of the matrix, could be opened. The fields remained open, and participants could then choose one of the six product alternatives by clicking on the shopping cart. To avoid systematic sequence effects, the order of the product attributes and alternatives was randomised.

2.3. Questionnaire

The IDM was accompanied by a standardised questionnaire. Before the questionnaire started, participants gave informed consent to ensure respondents' agreement and data protection. As neither sensitive topics were investigated nor traceable personal data was collected, no ethical approval was needed. Besides socio-demographics, information on legume consumption, including knowledge, reasons for and against consumption, product groups, purchase frequency, and diet, as well as attitudes towards the environment, health interest, cooking involvement, and meat consumption were investigated and partly used to build consumer segments.

The first questions investigated consumers' familiarity with different types of legumes (adapted from Henn, Goddyn, et al., 2022), Henn, Goddyn, et al., 2022nd knowledge on ecological and nutritional characteristics of legumes. This was followed by general food purchase criteria to then ease participants into the IDM task. Therefore, they were asked which of the three lentil products, as presented in Fig. 1, they would choose, given that they want to prepare a lentil burger patty. After an open-ended question about the reason of their choice, participants got a mock IDM for yoghurt to get used to the IDM table. Once they completed the mock IDM, they saw their chosen lentil product together

[1] Prices were different for each lentil product and based on a quick inventory from the most common chains of (organic) supermarkets, discounters, and drug stores in Germany. Price levels for canned lentils were 1.60 €,1.90 €, 2.20 €, and 2.50 €; for ready-mix for patties 1.50 €, 2.00 €, 2.50 €, and 3.00 €; and for ready-to-eat patties 2.50 €, 2.75 €, 3.00 €, 3.25 €.



Fig. 1. Lentil products with three different processing levels and short descriptions of their preparation.

Table 2
Study design of the IDM with product attributes and attribute levels.

Product name	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Organic production	Yes	Yes	Yes	No information	No information	No information
Origin of lentils	No information	No information	Hesse (county)	Hesse (county)	Hesse (county)	No information
Place of processing	No information	Hesse (county)	Hesse (county)	Hesse (county)	No information	No information
Price level	II	III	IV	III	II	I
You can access information on the product alternatives (alternative 1 to alternative 6) by clicking on the fields with the mouse. When you have decided on a product alternative, select "I will buy this product". You can open 15 out of 24 fields.						
I will buy this product						

with a short explanatory text[2] followed by the IDM table for their chosen lentil product (Fig. 1).

The questionnaire continued with questions on legume consumption and purchase, and the importance of organic and local production of legumes.

Afterwards, participants attitudes were investigated on a 7-point scale with points labelled from "1 – totally disagree" via "4 – neither nor" to "7 – totally agree" with statements adapted from tested scales for green values (Haws et al., 2014), cooking involvement (Bell & Marshall, 2003), and interest in a healthy diet (Meixner & Mörl von Pfalzen, 2018; Roininen et al., 1999). Statements for favouring a reduced meat consumption were based on the scientific discourse and authors' own considerations. More details and the reliability measures are found in Table 7.

The questionnaire closed with a section on socio-demographics – age, gender, income, education –, including the share of organic food in total food consumption, meat consumption frequency, and diet.

2.4. Data analysis

For the IDM, the order and time of the mouse clicks were recorded. Search depth and the number of clicks per attribute were analysed in descriptive ways. As the preference for local and organic lentils was a core focus of the study, it was important to get a deeper insight in participants' choice of the different product alternatives. Therefore, a multinomial logistic regression was calculated across all three lentil products. The dependent variable had four categories. The first category represented respondents who either chose the alternative "organic production" or "organic production and local place of processing". The second category included respondents who chose either the alternative with "local origin" or "local origin and local place of processing". The third category included respondents who chose the alternative "organic production, local origin, and local place of processing", and the fourth category included the respondents who chose the alternative with no information. The latter served as the reference category in the analysis. Independent variables were similar to the ones used in the cluster analysis and are further described below.

Consumer segments were identified using latent class cluster analysis (LCA). LCA assumes that the data are based on a latent, not directly measurable or observable, variable that can be indirectly measured by one or more observable indicator variables. In contrast to classical methods, such as the hierarchical clustering or K-means, LCA is based on a probabilistic model, using the maximum likelihood method and other statistical measures to estimate the model's goodness of fit for n-cluster solutions (Collins & Lanza, 2010; Lemken et al., 2019; Magidson & Vermunt, 2005, pp. 1–15). The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) attempt to find the best version of the most precise mathematical model and the simplest model, i.e. the model with the fewest clusters. Other criteria provide information about the quality of the model and the clusters. The Vuong-Lo-Mendell-Rubin (VLMR) p-value indicates whether the model with c +1 clusters is significantly better than the model with c clusters, while the entropy R^2 together with the classification error indicates how well the membership of the individuals of the respective cluster can be predicted. In order to check the "local independence" of the variables, the bivariate residuals (BVR) provide information (Magidson & Vermunt, 2005, pp. 1–15). The

[2] "Having just selected a yogurt, you are now given a similar task for a lentil product. In the last questions you indicated that you would buy [chosen lentil product].Now look for the information you normally look for in the store when you want to buy [chosen lentil product]. First, read through the product information on the left-hand side. If the product information is important to you when buying, click with the mouse on one of the empty fields in the corresponding row. Specific product details or the text "no information" will now appear. The latter means that there is no information about this attribute on the packaging in the store either. In this task, you can open a maximum of 15 of the 24 fields. At the end, decide for the purchase of one product alternative.".



Ready-to-eat burger patty (2 pieces, 160 g)	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Origin of lentils						
Organic production						
Price						
Place of processing						
You can access information on the product alternatives (alternative 1 to alternative 6) by clicking on the fields with the mouse. When you have decided on a product alternative, select "I will buy this product". You can open 15 out of 24 fields.						
I will buy this product						

Fig. 2. IDM for the ready-to-eat patty as presented to the respondents.

LCA model can also include covariates to describe the latent clusters more precisely (Magidson & Vermunt, 2005, pp. 1–15).

In this study, a bias-adjusted Step-3 LCA model was calculated with the green values scale, cooking involvement, interest in healthy eating, and favouring of reduced meat consumption as the indicator variables. In order to see how the clusters responded in the IDM, the number of clicks per attribute per respondent from the IDM – summarised across the three lentil products – were included as covariates. Moreover, organic food consumption, legume consumption, meat consumption, gender, education, income, and age were also included as covariates.

For the statistical analysis, 'SPSS, version 26.0' (IBM Corp, 2019) was used, as well as 'LatentGold, version 6.0' (Vermunt & Magidson, 2021) for the latent class cluster analysis.

3. Results

To get a first overview, some descriptive results around consumers' knowledge about legumes and their consumption behaviour are displayed. Together with socio-demographics, several of these variables are later also used to describe the consumer segments.

Participants were asked about their knowledge on recognising legumes as such and their knowledge on nutritional aspects of legumes. Out of the eight presented legume types – green beans, kidney beans, peas, chickpeas, lentils, soy beans, lupines and peanuts – only the latter two were rather unfamiliar to participants. Lupines were correctly recognised as legumes by 39 %, peanuts by 29 %, all other legumes were familiar to at least 65 % of the sample. For nutritional knowledge, respondents had to judge four statements regarding their correctness. Knowledge on nutritional aspects was quite high, ranging from 56 % to 89 % for identifying the correct answers.

Moving on to legume consumption, the mean consumption frequency was twice a month. The three most important reasons for consuming legumes regularly were the egoistic aspects healthy diet, taste, and easy preparation (Table 3). Altruistic aspects, such as "replacement of animal-based products" and "climate friendly" were less important. The three most important barriers were also found to be egoistic reasons: cooking habit, digestive problems, a long preparation time, and meat replacements being too expensive. Compared to the drivers, the barriers were more diverse.

Table 3
Three most important reasons for and against a (more) regular legume consumption, in percent of participants.

Three most important reasons to consume legumes regularly		Three most important barriers to (more) regular legume consumption	
Healthy diet	71 %	I rarely cook and then usually prepare dishes without legumes	34 %
Taste	56 %	Digestive problems	30 %
Easy preparation	41 %	Preparation takes too long	23 %
Part of traditional dish	31 %	Meat substitutes from legumes are too expensive	21 %
Replacement of animal products (ethical reasons)	25 %	I don't know how to prepare legumes	18 %
Low price	21 %	Legumes do not taste good to me	12 %
Environmentally friendly	14 %	I don't know what the nutritional benefits of legumes are	11 %
Climate friendly	11 %	The legumes I would like to buy are not available	5 %
Curiosity for new products	9 %		
Other reason	1 %	Other reason	13 %
N	990	N	330

3.1. Preference for organic and local production of lentils (IDM)

Consumer preferences for organically and locally produced lentils were elicited by means of an IDM. As described in the methods section, three different IDMs were designed, one for each lentil product. Regarding the search depth, there was almost no difference between the three lentil products. Out of the 15 allowed clicks, respondents used about 13 clicks on average before they chose one of the six product alternatives they would buy. About 60 % used all 15 possible clicks. Respondents needed about 50 s to make a product choice (Table 4).

Taking a look at the clicks per attribute, price was the most frequently clicked attribute, followed by local origin and organic production; place of processing seemed least important. Differences across products were small (Fig. 3). Local origin seemed to become less important with increasing processing level, whereas organic production was rather similar across all products.

Another insight from the three IDMs was the choice of one of the six product alternatives. For all three lentil products, the product alternative with the most information (organic plus local production plus local processing), hence, also with the highest price level (IV), was chosen most often (Table 5). Product alternatives containing information on local origin of lentils and local processing were always chosen more frequently than the ones with organic production and place of processing. The same holds true for product alternatives with only one information: local origin of lentils was chosen more often than organic production. These findings were similar for all three lentil products and were most clearly seen in canned lentils. The product alternative with no specific information, hence, with the lowest price, was mostly chosen for the ready-to-eat lentil patty.

Diving deeper into respondents' preferences for local and organic production of lentils, the choice of the different product alternatives was further investigated. Across all three lentil products, a multinomial logistic regression was performed to create a model of the relationship between the predictor variables and membership in four groups: respondents who chose the alternatives "organic or organic + local processing", the alternatives "local origin or local origin + local processing", the alternatives "organic + local origin + local processing", or the alternative "no information" (Table 6). The fit between the model containing only the intercept and data improved with the addition of the predictor variables, Model χ^2 (36, N = 1153) = 244,183, Nagelkerke R^2 = 0.204, $p < .001$. Compared to the respondents who chose the product alternative with no additional information, results show that a higher share of organic food consumption and the importance of the local origin of legumes increases the chance of belonging to the group who chose the alternatives "organic production" or "organic production + local processing". For the group who chose the alternatives "local origin" or "local origin + local processing", the importance of the local origin of legumes increases the chance of a membership, whereas having chosen a ready-to eat-burger patty compared to canned lentils decreases chances of a membership. Finally, the results show that interest in a healthy diet, a higher share of organic food consumption, the importance of the local origin of legumes, and increasing age increases the chance of respondents to belong to the group who chose the alternative "organic + local origin + local processing". However, a low income compared to a high income decreases chances to belong to this group. All these mentioned variables are statistically significant at $p \leq .05$. All other predictor variables had no statistically significant influence (Table 6).

Table 4
Participants' information search for the three lentil products within the IDM.

Measures	Canned lentils	Ready-mix for patties	Ready-to-eat patties
Number of participants per product	521	314	485
Average number of clicks/person (from 15 possible clicks allowed)	12.9	13.2	12.4
Percent of respondents who used all 15 possible clicks	58 %	63 %	60 %
Average decision time per product	51 s.	52 s.	49 s.

3.2. Consumer segmentation based on consumers' values and attitudes

In order to segment consumers, a latent class cluster analysis was done. Therefore, four indicator variables were built: green values, interest in a healthy diet, cooking involvement, and favouring meat reduction. Each indicator variable was based on three aggregated statements (Table 7) and treated as a metric variable.

Seven models were calculated with 1–7 clusters. Looking at the different models, the 7-Cluster model would have been the statistically best fitting one, as it showed the lowest BIC, AIC, and the lowest BVR (Table 8). Looking at the cluster profile, the model with seven clusters contained one cluster with just 2 % of the sample and was therefore rejected. The 6-cluster solution revealed better statistical, but not more meaningful results than the 5-cluster solution. Following the principle of parsimony (Collins & Lanza, 2010), the 5-cluster model (Fig. 4) was chosen as the final solution as only the BVR value was slightly violated.

Cluster A had the highest values for interest in a healthy diet, green values, and cooking involvement (Fig. 4). Therefore, it was named "green and healthy hedonists", reflecting their values and their willingness to cook. Members of cluster B scored highest regarding "favouring meat reduction" and were also high in green values and health interest but much lower in cooking involvement. They were named the "sustainable pragmatics".

Members of cluster C were mainly characterised by a high level of cooking involvement, while favouring meat reduction was average. Consequently, they were named "cooking enthusiasts". Cluster D had clearly below-average values in all factors, with environment, health, and reduced meat consumption appearing particularly unimportant. They were named the "hedonic meat eaters". Cluster E was also characterised by below-average values, with clearly lower cooking involvement and little interest in healthy eating while green values and "favouring meat reduction" were close to the mean value, suggesting a certain indifference. Therefore, this cluster was named "the indifferent". Regarding the cluster sizes, "the indifferent" represent the biggest share of the sample with 34 %. The "hedonic meat eaters" and the "cooking enthusiasts" account for 21 % each, the "sustainable pragmatics" represent 16 % of the sample. The smallest cluster are the "green and healthy hedonists" with 7 %.

Several covariates were then added to the final model to further describe the cluster profiles. The values for the covariates help to describe the clusters in more detail. All covariates have a statistically significantly relationship with the clusters (Wald test, $p \leq .02$) (Table 9). Covariates for the "green and healthy hedonists" and the "sustainable pragmatics" reflect the similarities which were already visible in their indicator variables. Regarding the behaviour of these two segments in the IDM, they showed an above-average number of clicks on the attribute organic and a below-average number on the attribute price. The "green and healthy hedonists" clicked 3.6 times on organic compared to the average of 3.0 and only 2.9 times on price compared to an average number of 4.2. The "sustainable pragmatics" clicked the most – 4.1 times – on the attribute organic compared to the average of 3.0 and almost average on price: 4.1 times compared to average 4.2 times. Both segments were mainly female, had a higher education, a low meat consumption, and an above-average share of organic food in their overall food consumption (Table 9). Differences were mainly found in income where the "green and healthy hedonists" had the highest share of respondents with the highest income while the "sustainable pragmatics" had high shares in lower incomes.

The "cooking enthusiasts" showed a balanced gender ratio, high education, and a slightly above-average share of organic food (45 %) in total food consumption. In line with this, the majority had a medium

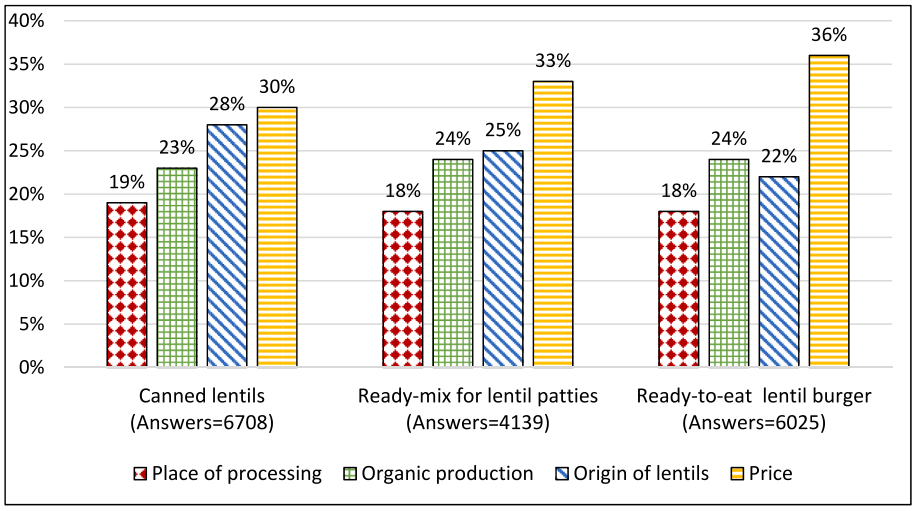


Fig. 3. IDM, clicks per attribute and product (%).

Table 5
Respondents' product choice (%) at the end of the IDM task by lentil product.

No. of information on attributes	Attributes with added value displayed[a]	Price level[b]	Canned lentils (N = 521)	Ready-mix for lentil patties (N = 321)	Ready-to-eat lentil patty (N = 485)
3	Organic, local origin, processing place	IV	32 %	26 %	26 %
2	Local origin, processing place	III	17 %	16 %	13 %
	Organic, processing place		8 %	14 %	11 %
1	Local origin	II	21 %	18 %	18 %
	Organic		10 %	14 %	15 %
No information	–	I	12 %	11 %	18 %

[a] Attributes with specific information displayed: 'organic' = yes; 'local origin' = Hesse (county); 'processing place' = Hesse (county).
[b] IV = highest price, I = lowest price.

legume and meat consumption, once a week for legumes and between 1 and 4 times a week for meat. In the IDM, members of this segment showed a high interest in the origin of lentils and place of processing: they had the highest number of clicks on the origin of lentils (3.5 compared to average 3.2) and on the place of processing (2.7 compared to average 2.4). Clicks on organic were 0.1 above average and price was below-average with 3.8 clicks compared to 4.2.

The "hedonic meat eaters" and "the indifferent" differed from the first three clusters in their below-average values in the four indicator variables. The "hedonic meat eaters" were quite the opposite of the "green and healthy hedonists": male-dominated with a lower level of education, as well as with the highest meat and the lowest legume consumption. Also, they" had an above-average share of members with the highest income but also the highest number of clicks (5.1 clicks compared to average 4.2) on the attribute price in the IDM. Clicks on the other attributes were all below average (Table 9). Looking at the covariates for "the indifferent", only few values are above the average: in the IDM, the clicks on the attribute price (4.3 times compared to 4.2) and further a low legume consumption, a medium-high meat consumption, and the lowest income group and the almost highest income group.

Age showed a statistically significant association with all segments. However, the range is narrow with the "sustainable pragmatics" being the oldest with 52 years and the "indifferent" being the youngest with 47 years.

4. Discussion and conclusion

This study focussed on consumer preferences for organic and local legumes, considering different degrees of processing, and on building consumer segments for targeted marketing recommendations. The first part of the discussion focusses on legume consumption patterns, whereas the second part discusses the preferences for local and organic legumes. The third section of the discussion focusses on legume consumer segments based on psychographic concepts.

4.1. Legume consumption and their drivers and barriers

Answering the first research question, "What are consumers' motivations to consume and what do they know about legumes?", the findings of this study regarding legume consumption are corroborated by other researchers. For example, the familiarity of participants with legumes was rather high, while the mean consumption frequency was rather low. This was also found by Henn, Goddyn, et al. (2022) and Lemken et al. (2019). In contrast to findings of Figueira et al. (2019), participants in this study were well informed on nutritional characteristics of legumes. This is also reflected in the drivers for legume consumption: The majority of the participants consumed legumes mainly out of egoistic rather than sustainability reasons, that is health and taste, which was also found by Henn, Goddyn, et al. (2022) and Kwasny et al. (2022). Another explanation for this may be the characteristics of the study sample. As a selection criterion was the consumption of legumes at least every 2–3 months, the sample potentially consists of consumers who like the taste of legumes and might be more familiar and well-informed compared to a sample also including non-legume consumers. Concerning the main barriers – digestive problems and the preparation of legumes not fitting the lifestyle of several respondents – this study's results are also similar to findings by Henn, Goddyn, et al. (2022). In contrast to Henn, Goddyn, et al. (2022), negative sensory expectations were not found to be a barrier in this study: only 12 % disliked the taste of legumes. Hence, supporting consumers with recipes to improve legume cooking skills potentially increases legume consumption.

Table 6
Multinomial logistic regression for the choice of different product alternatives across all three lentil products.

Product alternatives	Organic or organic + local processing (N = 269)			Local origin or local origin + local processing (N = 393)			Organic + local origin + local processing (N = 325)		
	Regression coefficient (B)	**Sign. (p-value)**	**Odds ratio Exp(B)**	**Regression coefficient (B)**	**Sign. (p-value)**	**Odds ratio Exp(B)**	**Regression coefficient (B)**	**Sign. (p-value)**	**Odds ratio Exp(B)**
Constant	−1.785	0.015		−0.922	0.190		−4.946	0.000	
Cooking involvement	−0.020	0.420	0.980	−0.017	0.473	0.983	−0.045	0.079	0.956
Interest in healthy diet	0.024	0.480	1.024	0.036	0.254	1.037	0.108	**0.002**	1.114
Favouring meat reduction	0.051	0.081	1.052	0.025	0.365	1.025	0.048	0.109	1.049
Share of organic food	0.099	**0.001**	1.104	0.035	0.207	1.035	0.145	**0.000**	1.156
[a]Legume consumption (1x/week or more)	0.201	0.371	1.223	−0.061	0.775	0.941	0.004	0.987	1.004
[a]Local origin important	0.819	**0.005**	2.267	1.629	**0.000**	5.099	1.751	**0.000**	5.760
[a]Ready-mix for burger patties	0.425	0.129	1.529	−0.202	0.442	0.817	−0.143	0.611	0.867
[a]Ready-to-eat burger patty	0.156	0.521	1.169	−0.506	**0.024**	0.603	−0.223	0.353	0.800
Age (yrs)	0.001	0.926	1.001	−0.001	0.873	0.999	0.030	**0.000**	1.030
[a]Gender (female)	−0.185	0.389	0.831	0.184	0.361	1.203	0.121	0.576	1.128
[a]Low income 2600 € or less	−0.220	0.402	0.802	−0.406	0.102	0.666	−0.706	**0.008**	0.494
[a]Middle income 2600 € until <4200 €	−0.273	0.308	0.761	−0.421	0.095	0.657	−0.294	0.267	0.745

Reference category dependent variable = no information (neither organic nor origin nor place of processing) (N = 170).
[a] Reference categories independent variables: legume consumption = „every two weeks or less"; Local origin important = "not important"; ready mix/ready-to-eat patty = "canned lentils; gender = "male"; high income = "4200 € or more"; $R^2 = 0.190$ (Cox & Snell), 0.204 (Nagelkerke), 0.078 (McFadden); Model χ^2 (36) = 244,183, $p < .001$; N = 1157. Green values were excluded from the model due to high correlation with share of organic food (Pearson = 0.410, $p < .001$).

Table 7
Psychographic statements for the indicator variables of the LCA.

Attitudes	**Statements**	**Cronbach's alpha**
Green Values Haws et al. (2014)	A1. I am not willing to be inconvenienced in order to take actions that are more environmentally friendly. [a] A2. My purchase habits are affected by my concern for our environment A3. It is important to me that the products I use do not harm the environment A4. I do not consider the potential environmental impact of my actions when making many of my decisions (Reverse).	0.703
Cooking involvement Bell and Marshall (2003)	B1. I enjoy cooking for others and myself B2. Cooking or barbequing is not much fun (Reverse). B3. I think much about cooking each day.	0.770
Interest in healthy diet (Meixner & Mörl von Pfalzen, 2018; Roininen et al., 1999)	C1. Before I buy (new) food, I read the information on the ingredients contained. C2. I eat what I like, and I do not worry much about the healthiness of food (Reverse). C3. A healthy and balanced diet plays an important role in my life.	0.679
Favouring meat reduction	D1. To protect the environment, meat consumption should be reduced. D2. It is okay to keep animals for human consumption (Reverse). D3. Reduced meat consumption is better for one's health.	0.719

All statements were assessed on a 7-point scale with points labelled from "1 – totally disagree" via "4 – neither nor" to "7 – totally agree".
[a] Statement A1 was excluded after reliability analysis with Cronbach's alpha.

4.2. Preferences for local and organic lentil products (IDM)

Moving on to products from local and organic food systems, the second research question – "Do consumers prefer organically and/or locally produced legumes and how are the preferences for local and/or organic legumes influenced by the processing level of the product?" – is answered by discussing the results of the information display matrix (IDM). Overall, respondents had the possibility to open 62.5 % of the matrix; 60 % made use of it, the remaining respondents used less clicks. This suggests that the former possibly had an interest in gathering as much information as possible and potentially following rational or systematic search strategies. The latter may rather follow simple heuristics when choosing a product which was also found by Gigerenzer and Gaissmaier (2011) and Zander and Hamm (2012). Compared to Langen et al. (2013) and Zander and Hamm (2012), in this study the share of respondents using all information available was quite high. This may be also due to the fact that the IDM had only four attributes compared to eight attributes in the studies by Langen et al. (2013) and Zander and Hamm (2012). It might have been a motivation to get as complete a picture as possible, whereas dealing with eight attributes might foster more heuristic decisions.

Further results show that price is the most frequently clicked attribute, followed by local origin of lentils, organic production, and place of processing. Small differences can be seen regarding local origin of lentils: it becomes less important with increasing processing levels of the product while the preference for organic production remains the same. Compared to local origin of lentils, the place of processing is less important. Overall, the processing, respective convenience level has a rather small impact on the preference for local or organic lentils. This suggests that higher-order values, such as pro-environmental and health aspects, determine the preferences for legume consumption rather than specific product attributes (Scholderer & Frewer, 2003). When given a choice, consumers prefer locally and organically grown lentils, followed by just locally grown lentils over just organically grown lentils. The preference for local over organic production was also found for (young) German consumers by Brümmer and Zander (2020) as well as by Hempel and Hamm (2016).

Looking at the product choice overall, it was not the cheapest product alternative, which participants chose most often. They preferred the product alternative which was organically and locally produced and

Table 8
Model fit of latent class cluster solutions.

Model	LL	BIC(LL)	AIC(LL)	Max. BVR	Class. error	Entropy R^2
1-Cluster	−14692.16	29441.80	29400.31	283.38	0.00	1.00
2-Cluster	−14333.30	28788.76	28700.61	32.27	0.09	0.69
3-Cluster	−14209.18	28605.17	28470.35	24.80	0.15	0.64
4-Cluster	−14052.44	28356.37	28174.88	19.27	0.15	0.69
5-Cluster	**−13967.52**	**28251.20**	**28023.04**	**8.61**	**0.19**	**0.69**
6-Cluster	−13914.20	28209.23	27934.41	4.07	0.20	0.69
7-Cluster	−13854.84	28155.18	27833.68	2.57	0.21	0.69

LL = Log likelihood; Class. Error = Classification error. Each model was calculated with 7000 random start sets and 300 iterations, delivering robust results.

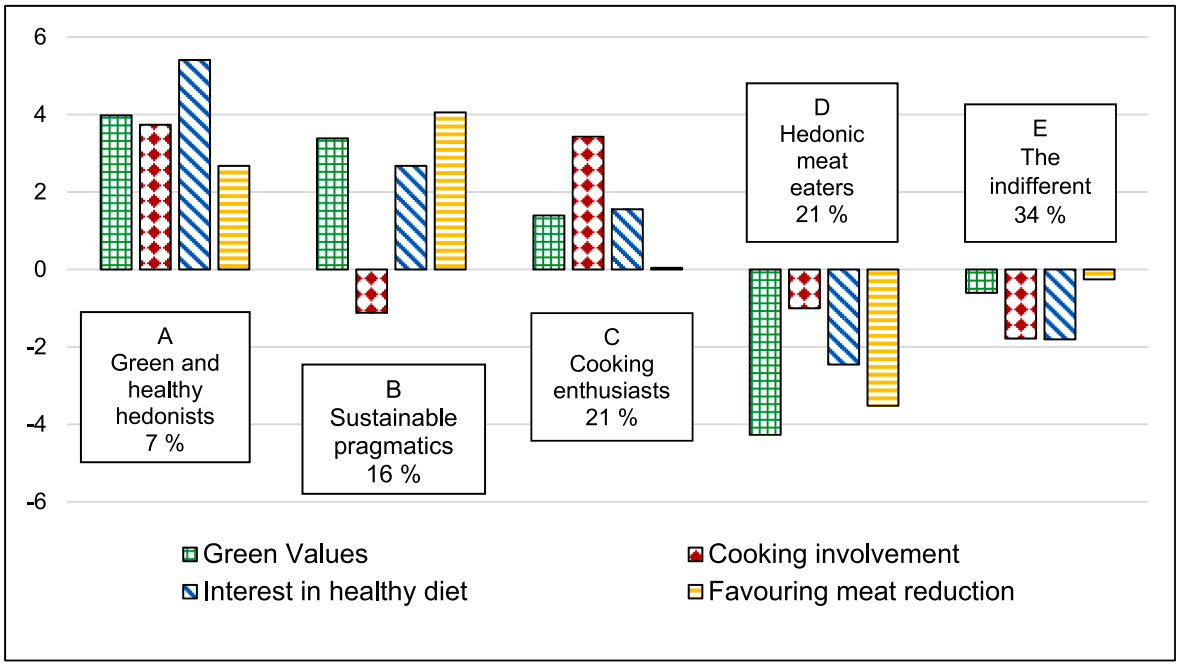


Fig. 4. Five consumer segments based on four indicator variables (N = 1320).[31]

processed despite the highest price. Thus, organic and local production and processing were more important than price when choosing a lentil product, as was also found by Schleenbecker and Hamm (2015). Also, Marette (2021) found similar preferences: participants had a higher WTP for organically and locally produced lentils compared to non-organic and non-local lentils. Price was only relatively more important for the ready-to-eat burger patty, which was reflected by the highest share of participants who choose the cheapest product alternative. Reasons might be these respondents' generally low preference for organic and local production and processing.

The multinomial logistic regression showed that respondents who chose the product alternative which was organically and locally produced and processed also had an interest in healthy eating, were more likely of higher age, and more often belonging to the highest income group. This could also explain why the high price of this product alternative was not a barrier to choosing it. However, as the sample showed an overrepresentation of respondents with a high level of education which is correlated with higher incomes (r_s (1318) = 0.203, $p < .001$) as well as the fact that it was a hypothetical buying decision, might also have contributed to the frequent choice of this product alternative. Besides the importance of local origin of lentils, respondents who chose the product alternative with local production and processing seemed to prefer less processed products as choosing a ready-to-eat burger patty had a negative influence on the membership compared to canned lentils. For the respondents who belonged to the group of choosing organically produced lentils or organically produced and locally processed lentils, a high share of organic food and the importance of local production of lentils increased chances of a membership, suggesting that overall preferences for organic and local production seem to be decisive rather than socio-demographic aspects or legume consumption frequency.

4.3. Consumer segments

Five consumer segments were built using a latent class cluster analysis (LCA). LCA is a probability-based method that has the advantage that the number of clusters can be decided by statistical means and it assigns a probability for class membership. Following, each individual then contributes to the class mean of a class 'k' with a weight that corresponds to its probability of belonging to this class 'k'. In contrast, in the K-means method, only a probability of 0 or 1 can be assumed. The effects of misclassification, which can occur with both methods, lead in case of the K-means method to a distortion of the class averages and can therefore result in further misclassifications (Magidson & Vermunt, 2005, pp. 1–15). As legume consumption has been known to be low and a niche topic to consumers, it was decided to define consumer segments by psychographic attitudes related to sustainable consumption rather than by legume consumption frequency. As LCA allows to uncover latent structures it was seen fitting when aiming to build consumer segments based on attitudes regarding the environment, health, cooking involvement, and reduced meat consumption. Therefore, the third research question "Which legume consumer segments exist based on the concepts of 'green values', 'interest in a healthy diet', 'cooking

Table 9
Covariate profile for the five clusters.

Covariates		Cluster					Mean	Wald (p-value)
		A 7 %	B 16 %	C 21 %	D 21 %	E 34 %		
IDM clicks organic	Min. 0 clicks – max. 6 clicks (mean)	**3.6**	**4.1**	3.1	2.1	3.0	3.0	81.802 (<0.0001)
IDM clicks origin of lentils		3.1	**3.3**	**3.5**	2.8	3.2	3.2	13.4607 (0.0092)
IDM clicks place of processing		2.1	2.2	**2.7**	2.1	2.4	2.4	11.6372 (0.02)
IDM clicks price		2.9	4.1	3.8	**5.1**	**4.3**	4.2	63.9144 (<0.0001)
Organic food consumption	% of total food consumption	**60%**	**50%**	**45%**	25%	35%	40%	342.0285 (<0.0001)
Legume consumption	1 x per month and less	10%	14%	8%	**37%**	**36%**	25%	137.3125 (<0.0001)
	Every two weeks	10%	22%	29%	**30%**	29%	27%	
	1 x per week	30%	33%	**43%**	23%	27%	31%	
	More than 1 x per week	**49%**	**31%**	20%	10%	8%	17%	
Meat consumption	Less than 1 x per week/never	**35%**	**51%**	7%	5%	17%	19%	178.3858 (<0.0001)
	1–2 x per week	**39%**	**37%**	**40%**	18%	31%	32%	
	3–4 x per week	21%	12%	**43%**	33%	**40%**	33%	
	5 x per week or more	5%	0%	11%	**44%**	12%	16%	
Gender	Male	25%	34%	47%	**63%**	45%	46%	43.956 (<0.0001)
	Female	**75%**	**66%**	53%	37%	55%	54%	
Education	Ongoing school education	0%	1%	0%	1%	1%	1%	51.582 (<0.0001)
	Secondary school	38%	30%	32%	**43%**	**42%**	38%	
	High school	**62%**	**70%**	**68%**	56%	58%	62%	
Income	<1300€	4%	**11%**	5%	6%	**10%**	8%	53.5693 (0.0099)
	1300€ - < 2000€	7%	**14%**	3%	11%	12%	10%	
	2000€ - <3100€	21%	**27%**	**27%**	24%	24%	25%	
	3100€ - < 4200€	13%	12%	**27%**	13%	**22%**	19%	
	≥4200€	**42%**	24%	26%	**35%**	21%	27%	
	No answer	13%	12%	12%	12%	12%	12%	
Age	Mean (yrs)	51	**52**	50	50	**47**	49	18,2898 (0.0011)

A = Green and healthy hedonists; B = Sustainable pragmatics; C = Cooking enthusiasts; D = Hedonic meat eaters; E = The indifferent; Numbers in **bold** are above the mean values of the sample.

involvement', and 'favouring reduced meat consumption'?" is answered with the help of the consumer segmentation. Of the five consumer segments, two are clearly sustainability oriented with regular legume and little or no meat consumption, while the majority of the sample still prefers an omnivorous diet with regular meat and rather little legume consumption.

4.3.1. *"Hedonic meat eaters" and "the indifferent"*

"Hedonic meat eaters" and "the indifferent", who represented the majority (55 %) of the sample, have low legume and high meat consumption. Moreover, they have below-average values for the environment, interest in healthy eating, cooking involvement, and do not favour meat reduction. Their values in the indicator variables are corroborated by their behaviour in the IDM: both segments are very price-sensitive as they show above-average interest in the price whereas the interest in local and organic attributes is below or just average. Hence, it seems that the majority of consumers still values meat as a core ingredient of their daily diets and may be unaware of the negative environmental impact of meat production. The latter was also found by Hartmann and Siegrist (2017). Lemken et al. (2019), identified a large segment – "meat only" – which resembles the "hedonic meat eaters": consumers who are more frequently male and not even contemplating replacing meat with legumes. The potential to increase the legume consumption in these segments is low because of the lacking awareness and interest regarding health, environment, or the need for reduced meat consumption.

4.3.2. *"Green and healthy hedonists" and "sustainable pragmatics"*

Representing only a minority of the sample, "green and healthy hedonists" and "sustainable pragmatics" seem to follow a sustainable diet. The high consciousness for the environment, a healthy diet, and a reduced meat consumption seems to be linked to being female, having a higher education, and an above-average share of legumes in their overall food consumption. This suggests that legumes may be used as meat replacement. Onwezen (2022) found that there is often a minority of consumers with high environmental concern who already implement meat-reducing strategies. Lemken et al. (2019) identified a small cluster, "the pioneers", with consumers who were more frequently female, environmental conscious and already substituting meat with legumes. This cluster resembles the "green and healthy hedonists". The "green and healthy hedonists" and the "sustainable pragmatics" have a high organic food consumption and they were the ones who showed he highest interest in the organic attribute in the IDM, and also average or even above-average interest in the local production attribute of the IDM. The main difference between the two clusters is the interest in the price attribute of the IDM and the cooking involvement. The latter is low for the "sustainable pragmatics" and may suggest a certain pragmatism about food preparation and valuation of convenient foods while being still conscious about the environment, healthy eating, and reducing meat consumption. Regarding price, these respondents showed nearly average interest in price whereas the "green and healthy hedonists" had a clearly below-average interest in price.

Recalling the results of the product choice at the end of the IDM, the participants who mainly chose the product alternative which was organically and locally produced and processed belonged to the highest income group, had a high interest in healthy eating, a high share of organic food consumption, and a strong preference for local origin of lentils. These findings overlap with the characteristics of the "green and healthy hedonists", suggesting that they mainly chose the product alternative with most local and organic value.

Overall, these two segments show a clear potential to increase legume consumption, even more when legumes are organically and locally produced and processed.

4.3.3. *"Cooking enthusiasts"*

"Cooking enthusiasts" seem to be open to legume consumption due to hedonic reasons and possibly in order to diversify their diet. Diversifying the diet may include trying new meat-replacing legume products,

[3] Indicator variables based on the scales "green values", "interest in healthy diet", "cooking involvement", and "favouring reduced meat consumption". X-axis = values of indicator variables minus their mean value.

while a total replacement of meat is rather unlikely as meat consumption is in the medium range from one to four times a week. A similar segment was found in a study by Lemken et al. (2019): the "meat first" segment, which did not replace meat with legumes but were open to additionally consume processed legumes. "Cooking enthusiasts" seem to give importance to local origin and processing as they most frequently clicked on the local attributes in the IDM. Promoting legumes with a low processing level and from local origin may increase their legume consumption and could possibly lead to a replacement of meat in the long run. Combining these characteristics with the results from the product choice in the IDM, it is reasonable to assume that this segment often chose the product alternatives which were locally produced and processed.

4.4. Limitations

Due to the research question and design, only participants consuming at least sometimes legumes were allowed. Hence, results can only be generalised for legume consumers. Regarding the methodological approach, the IDM was done in a between-subjects-design to minimise participants' cognitive load. The results cannot be statistically compared across differently processed products. A within-subjects-design could extend the results by allowing comparisons across product and inclusion of results in a cluster analysis. As the processing level turned out to be not very influential, clicks per attribute from the IDM were collapsed over the three lentil products to then be included in the LCA to compensate for the between-subjects design. Regarding the three lentil products used in the IDM, all products exist on the German market. Canned lentils and the ready-to-eat burger patties can be found in organic and non-organic quality, whereas the ready-mix for burger patties exist only in organic quality. Thus, the ready-mix was possibly less familiar to participants than the other two products. The product pictures for the IDM were taken of real organic products. For the study, the organic labels and brands were removed, but still, participants might have recognised the products and automatically identified them as an organic product.

Concluding, regarding the consumer segmentation, the psychographics green values, interest in a healthy diet, cooking involvement, and favouring meat reduction were valuable in discovering different (sustainable) consumer segments, similar to Aschemann-Witzel et al. (2023). There is a minority of consumers with sustainable dietary patterns, having a high environmental and health awareness, high interest in organically and locally produced lentils, and a high legume consumption. The majority is still focussed on a diet with animal-based proteins which seems to go along with a high price-sensitivity, a low environmental and health awareness and a low legume consumption. The challenge remains how to increase the share of the "green and healthy hedonists" and "sustainable pragmatics" and how to approach the "cooking enthusiasts" to increase legume and decrease meat consumption. Due to their personal environmental and health values and interest in local and organic production, legumes with organic or local origin should be promoted to the "green and healthy hedonists", the "sustainable pragmatics". The "cooking enthusiasts" could be convinced with locally produced and processed legumes and further motivated with sophisticated legume recipes, appealing to their cooking skills (Boer & Aiking, 2019). Initiating a dietary change for "the indifferent" and the "hedonic meat eaters" towards more legumes remains challenging. But incentives could be set via changed menus in restaurants and canteens with reduced meat portions and more legumes (Boer & Aiking, 2019).

Overall, the goal of this study was to better understand legume consumption by examining consumers' preferences for organic and local production of lentils as well as building consumer segments to provide marketing recommendations for different target groups. There is already a share of sustainable consumers who is interested in and would consume organically and locally produced lentils. Recalling the EU's goal of increasing organic production to 30 % by 2030, legumes will also be increasingly grown organically and locally which will meet these consumers' preferences. However, there is also the majority of consumers who are price-sensitive and, until now, value a meat-based diet. For them, organic and local production of legumes is not important. These characteristics possibly also apply to non-legume consumers which were not included in this study. This suggests that for now legumes remain rather a niche product for already sustainably-oriented consumers and cooking enthusiasts. In order to reach the broad mass of consumers, it needs more awareness for the environment, for health, and for the environmental impact of meat consumption.

CRediT authorship contribution statement

Ronja Hueppe: Writing – review & editing, Writing – original draft, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Katrin Zander:** Writing – review & editing, Supervision, Software, Resources, Funding acquisition, Conceptualization.

Ethical statement

Before the questionnaire started, participants gave informed consent to ensure respondents' agreement and data protection. As traceability based on socio-demographics is not possible, no ethical approval was needed.

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Declaration of competing interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Data availability

The data that support the findings of this study are available on reasonable request from the corresponding author.

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