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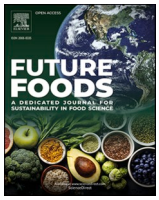

Influence of packaging, husbandry, feeding practices, and price transparency on consumer segments preferences for milk in Germany: A conjoint and latent class analysis

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ABSTRACT

Despite a slight decline in average consumption in recent years, milk remains a significant component of diets in Western countries, including Germany. Concurrently, there has been growing awareness of the impact of food choices on climate, environment, and animal welfare. This study examines how various attributes of milk—such as packaging, husbandry practices, feeding methods, price, and price transparency—affect consumer decisions, using fresh milk as a case study.

We conducted a choice experiment with 250 participants, who selected from product alternatives varying in price, milk features, cow husbandry and feeding practices, packaging types, and labels. Contrary to previous studies, which identified price as a primary decision criterion, our findings indicate that price was secondary for most participants, except for a specific segment.

Label influence was minimal, while packaging had a significant impact on consumer choices. Interestingly, most respondents preferred glass packaging, despite its potential environmental drawbacks, suggesting a need to explore whether this preference is based on misconceptions about its environmental benefits.

The type of husbandry emerged as the most influential factor in consumer decisions. In terms of animal welfare, there was a strong preference for pasture milk, particularly for "Year-round grazing with mother-bonded calf rearing." This preference not only explains the marketing trend towards pasture milk but also presents an opportunity for sustainable farms to differentiate themselves and attract customers amidst a decline in pasture-based milk production.

1. Introduction

Consumer preferences and attitudes towards milk and dairy products in western societies including Germany are shaped by various factors including animal welfare, product labels, price, fat content, and packaging (Hansen et al., 2023; Schiano et al., 2020; Yue et al., 2024).

Milk was chosen for this study because fresh milk products are the most popular dairy products in Germany, following yogurt and ultra-high-temperature (UHT) milk (VuMA Arbeitsgemeinschaft, 2022). Over the past 20 years, Germany has experienced a slight decline in per capita milk consumption, now at 48.67 kg per capita per year, equivalent to one liter per week (Statistisches Bundesamt, 2022). According to the Nutrition Report 2022 by the German Federal Ministry of Food and Agriculture (BMEL), 61 % of respondents indicated that dairy products are consumed daily (BMEL, 2022) making milk one of the key foods in a German diet.

Animal welfare is a significant concern for German consumers. Studies show that consumers are increasingly concerned about the ethical treatment of animals, influencing their purchasing decisions (Gorton et al., 2023; Alonso et al., 2020). Stampa et al. (2020) found that German consumers are willing to pay a premium for dairy products labeled as being produced under high animal welfare standards. This trend is supported by the growing popularity of organic and free-range dairy products, which are perceived to ensure better animal husbandry practices (Langer et al., 2023; Kühl et al., 2019). While on the other hand the Nutrition Report 2022 of the BMEL surveyed that 66 % of respondents attach importance to species-appropriate animal husbandry (BMEL, 2022). In the context of animal foods, factors such as animal welfare play an important role for consumers. "German consumers, for example, rate animal-welfare aspects very highly, with 61 % feeling that

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it is important to protect farm animal welfare" (Bozzo et al., 2019, p. 290). Additionally, referring to Kühl et al. (2016), the importance of pasture-raised milk increased, while the pasture milk label also led to commodity stream separation. In doing so, it takes advantage of the abundant pasture milk and diverts some of its volume into commodities. This shows that marketers have recognized the potential of animal-welfare-friendly products. For example, dairies have not yet joined this label, and there is enough pasture milk on the market to serve milk in this segment; there is no incentive for farmers to produce more milk under these husbandry conditions. The authors concluded that if large cheese market segments do not participate in pasture milk labelling, there is no need for dairies to push their growing operations towards pasture milk (Kühl et al., 2016). It remains an open question whether consumers are always aware that the term pasture milk is not legally protected. According to the Higher Regional Court in Nuremberg, this is not a misleading term as long as the cows are in the pasture for at least 6 h a day, 120 days a year (OLG Nürnberg, 2017). Therefore, a special focus of the present study is on animal welfare cues. With reference to the product "Jahreszeitenmilch" of "de Ökomelkburen", characteristics such as "Year-round grazing with mother-bonded calf rearing" and predominant feeding by grazing on pasture were investigated as animal welfare cues in the present study. Products with these characteristics represent a niche within the already small organic milk market, comprising only 4 % (Agrarmarkt Informations-Gesellschaft mbH, 2021) of the total German milk market.

Labels and certifications play a crucial role in shaping consumer attitudes towards dairy products (Schütz et al., 2023). Labels indicating organic production, animal welfare standards, and environmental sustainability significantly influence purchasing behavior. A study by Meyerding and Merz (2018) revealed that trust in labels is a critical factor, with consumers often relying on certification marks to guide their choices. The presence of multiple labels can, however, lead to confusion, emphasizing the need for clearer and more standardized labeling (Kuchler et al., 2020). In their choice experiment, Kühl et al. (2016) examined the attributes of label, price, and brand. Similar to Weinreich and Spiller (2016), they showed that complex labels do not promote trust.

Price remains a significant determinant in consumer choice. While a segment of the market is willing to pay higher prices for premium products with superior animal welfare and organic labels, the majority of consumers are price-sensitive. According to Grebitus et al. (2007), price reductions and discounts heavily influence the purchasing decisions of German consumers, often overriding other attributes of milk products such as fat content or packaging.

Fat content in milk and dairy products is another critical factor. Health-conscious consumers prefer low-fat or fat-free options, while others opt for full-fat products for their taste and perceived nutritional benefits. Research by Vargas-Bello-Pérez et al. (2020) shows a trend towards reduced-fat products, driven by increasing health awareness and dietary recommendations.

Packaging is another essential aspect of consumer preference, particularly regarding environmental impact. German consumers are increasingly concerned about plastic use and prefer products with more sustainable packaging (Bock and Meyerding, 2023; Groth et al., 2023). Issues such as recycling and microplastics have emerged as dominant, particularly in the case of plastic packaging (Nielsen et al., 2020). A study by Herrmann et al. (2022) highlighted that eco-friendly packaging significantly boosts consumer preference and willingness to pay in Germany. The shift towards environmentally friendly packaging solutions is a growing trend in the German dairy market (Macht et al., 2023).

Recent studies reflect a nuanced understanding of consumer behavior in Germany's dairy sector. For instance, a comprehensive review by Stampa et al. (2020) emphasizes the growing importance of sustainability and transparency in production processes. The study also notes a shift towards plant-based dairy alternatives, driven by environmental and health considerations. Consumer preferences and attitudes towards milk and dairy products in Germany are shaped by a complex interplay of attributes including animal welfare, labeling, price, fat content, and packaging. Recent research underscores the importance of ethical and sustainable production practices, clear labeling, and environmentally friendly packaging. Understanding these preferences is crucial for producers and retailers aiming to meet the evolving demands of German consumers.

In a survey of Belgian residents' purchasing choices, 52.5 % of consumers expressed an interest in purchasing animal-friendly milk (de Graaf et al., 2016). This includes animal welfare factors and packaging types. Discussions about packaging materials not only revolve around plastic products and their effects, but also around disposable or reusable glass packaging, as well as various composite packaging such as Tetra Pak or Elopak. Recent research has highlighted a significant and increasing interest among European consumers in the intangible aspects of products, including environmental protection, social equity, and animal welfare (Bozzo et al., 2019). The reusable bottles showed opposing trends. While dairy beverages saw a 30 % increase in 2019, the wine segment lost 11.3 % (Cayé et al., 2021). Bovensiepen et al. (2018) was able to show in their survey that the willingness for sustainable packaging is basically high among the survey participants (85 %), as is the frustration with high packaging overload. According to Bovensiepen et al. (2018), almost nine out of ten consumers in their survey would avoid packaging and would be willing to buy unpackaged food. The respondents also stated that they preferred to buy reusable packaging (Bovensiepen et al., 2018).

Against this background, the present study aimed to investigate the attributes of milk and their influence on consumer decisions. The focus is on examining ecologically beneficial factors such as animal welfare, husbandry, feeding, and packaging. On the one hand, this is observed by the specific set of attributes of the milk being chosen, and on the other hand, the attitudes of the consumers to these topics are determined. Additionally, factors such as price and price transparency were examined to determine their influence.

The attitudes of the respondents regarding animal welfare and environmentally friendly behavior were determined to examine whether and, if so, which correlations exist, and at what point other characteristics might supersede these factors in importance for the decision. The starting point of this work was the study by de Graaf et al. (2016), who investigated the factors influencing Belgian consumers to buy animal-friendly milk. They concluded that animal welfare was almost as important to the participants as price. In contrast, the majority of the participants consumed conventional milk (65.1 %) (de Graaf et al., 2016).

Germany's dairy market holds significant importance given its substantial consumption rates and the critical role of milk in the average diet. In 2022, per capita milk consumption in Germany was approximately 48.67 kg per year, demonstrating milk's pivotal role in German households (Statistisches Bundesamt, 2022). This study focuses on the milk market in Germany due to its unique consumer preferences shaped by factors such as animal welfare, packaging sustainability, and product quality (Bozzo et al., 2019; Kühl et al., 2016). Compared to Belgium, where a similar study exists, Germany presents distinct consumer behaviors influenced by the cultural emphasis on environmental sustainability and animal welfare. For instance, German consumers exhibit a strong preference for pasture-raised milk, which is less prevalent in Belgian markets (Kühl et al., 2016). Additionally, the comparison between milk and wine markets highlights an interesting contrast: while the German wine segment saw a decrease in reusable packaging, the dairy segment experienced a rise, indicating divergent consumer priorities between these two markets (Cayé et al., 2021). This focus on Germany allows for an in-depth exploration of these unique consumer behaviors and the potential implications for market strategies and policy development.

The present study aims to fill a significant gap in the existing literature by examining consumer preferences for milk attributes, with a

particular focus on packaging, husbandry practices, feeding methods, and price transparency in the German market. Previous research has indicated a growing consumer interest in the ethical and environmental aspects of food production, particularly in relation to animal welfare and sustainable practices (Martinez et al., 2024; Stampa et al., 2020; de Graaf et al., 2016). Despite this, there is a lack of comprehensive studies that simultaneously address these diverse attributes and their combined influence on consumer decision-making (Stampa et al., 2020; Alonso et al., 2020; Janssen et al., 2016). This research employs a discrete choice experiment to provide a detailed analysis of consumer preferences, incorporating insights from psychographic profiling to understand the underlying motivations behind these choices. By doing so, it not only corroborates the importance of animal welfare-friendly practices, as highlighted in previous studies (Sinclair et al., 2022; Vanhonacker et al., 2009; Boogaard et al., 2008; Cardoso et al., 2016), but also explores the relatively under-researched area of packaging preferences, particularly the environmental perceptions associated with glass packaging (Bock and Meyerding 2023; Groth et al., 2023; Weinrich et al., 2014).

In the following sections, the design of the choice experiment and data collection are described, followed by explanations of the statistical methods used, the presentation of the results, and, finally, their discussion.

2. Materials and methods

2.1. Data collection and survey design

Using a choice experiment, data were collected through an online questionnaire in Germany between July and October 2022. Participants for the study were recruited via email lists and social media platforms. Eligibility was limited to individuals who consumed milk, ascertained through an initial screening question in the survey. Participation was voluntary, could be canceled at any time, and did not contain any mandatory data to be collected. All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the HAW Hamburg (project identification code: 2021-04).

Lighthouse Studio version 9.14.0 software was used to create and host the entire survey. A total of 514 consumers participated in this survey. 264 were disqualified due to the set quotas for gender and age or because of the initial question of whether milk is consumed.

The remaining 250 completed questionnaires were included in the data analysis. Quotas were set for age and gender to ensure the representativeness of the population in Germany. Participants aged $\geq$ 18 years were eligible to participate in the study. The survey was divided into four sections. In the first section, participants were asked about their milk consumption behavior, age, and gender. To ensure valid results for consumers' choices and representativeness given the selected fresh milk product, only consumers of milk and proportionally matched participants were forwarded to the second survey section.

In the second section, a choice experiment is conducted. Twelve choice-sets were presented, each with three milk alternatives with different trait characteristics. In addition, there is always a no-choice option to allow the possibility of rejecting certain constellations. An example of a choice set is shown in Fig. 1.

After completing the choice experiment, participants were forwarded to the third survey section. They were asked to indicate the extent to which they agreed with various statements on a five-point Likert scale (1=disagree at all, 5=agree completely). Psychographic characteristics on "Health consciousness" (Grunert et al., 1993), "Benefits of action" (Ryan and Spash, 2008), "Price consciousness" (Lichtenstein et al., 2014), "Quality aspects" (Gunarathne et al., 2017) and animal welfare were queried. For animal welfare, a more detailed distinction was made between "Prepared to kill pests", "Knowledgeable/interactive", "Atheoretical/superficial", "Empathy/-liking," and "Necessary killing" (Austin et al., 2005). This was done to discover whether, how, and to what extent values influenced the participants' choices. Likert scales were used in this study because of their effectiveness in measuring psychographic characteristics and attitudes towards various aspects related to milk consumption. Likert scales are well-suited for capturing the degree of agreement or disagreement with specific statements, allowing for a nuanced understanding of participant perspectives. Five-Point Likert scales were also used in various studies examining psychographic constructs related to food choice behavior (Bock and Meyerding, 2023; Meyerding et al., 2019; Meyerding et al., 2019, 2019; Risius et al., 2019; Meyerding et al., 2018).

In the last part of the survey, participants were asked to provide information on demographic data, such as marital status, weight, height, net disposable monthly household income (after deducting all fixed costs), average food expenditure per week, dietary pattern, and education level. This was done to examine whether these factors also influenced consumers' choices.

2.2. Design of the discrete choice-experiment

A discrete choice experiment was designed and conducted using Lighthouse software version 9.14.0 to determine consumer preferences for milk attributes. In this choice experiment, respondents were asked to choose one of three product alternatives and one non-choice option. Each alternative comprises different combinations of product attributes. The respective choice sets were randomized using Lighthouse Studio software. An example of such a choice set is shown in Fig. 1.

Consumer preferences for milk attributes vary, but several studies have identified key attributes that are important to consumers. Packaging preferences were highlighted in studies where consumers showed a preference for certain types of milk pasteurization and packaging materials (Jensen et al., 2021), with plastic and glass containers being preferred. Similarly, preferences for carton packaging were identified in the context of goat milk products (Agustina et al., 2021). The importance of packaging was also evident in the wine industry, suggesting that packaging attributes can influence consumer preferences across different food products (Loose and Szolnoki, 2012). Fat content is another significant attribute, with studies showing varying preferences for low-fat, whole, and full-fat milk options (Bir et al., 2019; Jensen et al., 2021). The fat content was also a major factor in consumer choices for minced meat products, indicating its relevance across different food categories (Koistinen et al., 2013). Husbandry and feeding practices are increasingly important to consumers, as evidenced by the willingness to pay a premium for animal welfare-friendly products (Janssen et al., 2016). This is consistent with the findings that humane handling and animal welfare aspects are significant to certain consumer segments (Bir et al., 2019). Label information, including front-of-pack (FOP) nutrition labels and organic production labels, affects consumer choices, with some segments valuing this information highly (Godden et al., 2023; Sepúlveda et al., 2022). However, the impact of labels can vary among consumer segments, with some being nudged toward healthier choices and others not (Godden et al., 2023). Price remains a critical attribute, with consumers often showing a large preference share for price (Bir et al., 2019) and being willing to pay more for certain attributes like low fat content and organic production (Koistinen et al., 2013). In summary, consumer preferences for milk attributes are multifaceted, with packaging, fat content, husbandry, feeding, label, and price all playing significant roles in influencing choices. While some attributes like price and fat content are consistently important across studies, the importance of other attributes such as packaging and labels can vary depending on the consumer segment and product context.

Therefore, fat levels and whether the milk was homogenized were included in the properties of the milk. Pasteurization is the minimum standard for milk in the market and is, therefore, included in the attributes. In addition, attributes such as "Feeding," and "Husbandry" were

Fig. 1. Example of a choice-set-.

included to investigate the influence of animal welfare factors on the product decision in line with the constructs described above. The most common milk "Packaging" and "Label" variants found were also included. As was "Price" and "Price transparency" to discover how those potentially play a role for consumers. In particular, regarding "price transparency", whether there might be a special benefit from a consumer's point of view, should be investigated.

The typical price range for milk in a German grocery store varies depending on the type of milk and its packaging. As of recent data, the price for a liter of conventional pasteurized milk ranges from €0.75 to €1.20. Organic milk tends to be more expensive, generally priced between €1.10 and €1.60 per liter. For premium milk types such as pasture-raised or specialty brands, the price can go up to €2.00 or more per liter (BLE, 2024; Statista, 2024; Destatis, 2024). The price range in the present study is form €1.19 to €2.39 because we focus on fresh milk with external quality cues.

The attributes and levels used in the choice-experiment are listed in Table 1. With milk, a variety of different product types exist, including fresh milk, extrended shelf-life (ESL), ultra-high temperature (UHT), and sterile milk. Fresh milk was used for this study. Fresh milk refers to pasteurized milk. This indicated that the milk was heated to 71–75 °C for 15–30 s.

In this survey, different variants of pasteurized and homogenized milk or, in one case, non- homogenized milk were investigated regarding their attributes "Features" of the milk, "Packaging," "Husbandry" and "Feeding" of the animals, "Label," "Price" and "Price transparency." The model used in this study was a fresh milk variety produced in a traditional dairy in northern Germany. Since longer-life milk varieties were left out, the shelf-life characteristics were also omitted, as all pasteurized fresh milk products have a comparable shelf life of a maximum of 10 days (refrigerated, unopened).

The combinations that were excluded were the two stable housing forms in combination with pasture as the feeding form. For year-round grazing, all other feeding forms were excluded, except pasture. In Table 2, prohibited combination pairs can be observed.

We designed the choice experiment with 12 random tasks, no fixed tasks, and three concepts per task. The response type was discrete choice, and a traditional none option was included. The random task generation method used was balanced overlap, which strikes a middle ground between random and complete enumeration strategies. This method allows for roughly half the overlap compared to the random method and tracks the co-occurrences of all pairs of attribute levels. It employs a relaxed standard relative to the complete enumeration strategy to permit level overlap within the same task, without allowing duplicate concepts within the same task. The heuristic design algorithm that generated the design adheres to the following principles: 1. Minimal overlap: Each attribute level is shown as few times as possible in a single task. If an attribute's number of levels equals the number of product concepts in a task, each level is shown exactly once. 2. Level balance: Each level of an attribute is shown approximately an equal number of times. 3. Orthogonality: Attribute levels are chosen independently of other attribute levels, enabling the measurement of each attribute level's effect (utility) independently of all other effects (Sawtooth Software, 2024).

Table 1
Attributes and levels used in the choice experiment.

Attributes	Levels
Packaging features	FSC certified, Glass disposable, Elopak, Glass reusable, Plastic 0.5 % fat pasteurized + homogenized, 1.5 % fat pasteurized + homogenized, 1.8 % fat pasteurized + homogenized, 3.5 % fat pasteurized + homogenized, whole milk with natural fat content: min. 3.5 % fat (mostly between 3.8 to 4.2 % fat) pasteurized & not homogenized
Husbandry	Loose housing, Seasonal grazing, Year-round grazing, Tethering, Year-round grazing with mother-bonded calf rearing.
Feeding	Mainly pasture, Mainly hay, Mainly concentrates local, Mainly concentrates global, Mainly grass silage
Label	„Bioland" (organic agriculture), EU/DE-Bio (European/German organic, „Regionalwert AG" (regional value stock corporation), „Ohne Gentechnik" (without genetic technology), „Geprüfte Qualität Schleswig-Holstein" (proved quality Schleswig-Holstein)
Price	€1.19, €1.49, €1.79, €2.19, €2.39
Price transparency	Yes, No

Table 2
Prohibited pairs of attribute levels in the choice-experiment.

Husbandry Feeding	Loose housing	Seasonal Pasture	Year-round grazing	Tethering	Year-round grazing with mother-bonded calf rearing calf
Mainly pasture	X			X	
Mainly hay			X		X
Mainly concentrated feed local			X		X
Mainly concentrated feed global			X		X
Mainly grass silage			X		X

2.3. Statistical methods: hierarchical bayes model, latent class analysis and segment profiling

In the evaluation, the data were first analyzed in Lighthouse Studio (version 9.14.0) using the hierarchical Bayes model. This method is used to determine the part-worth utilities of the individual attribute levels, as shown in Table 1. These were determined for each individual survey participant and on average per attribute level for the entire sample.

The heterogeneity of the respondents was preserved by determining their part-worth at the individual level. The parameter distribution is determined using the "Monte Carlo Markov Chain" (Baier and Brusch, 2021). This analysis avoids the assumption of a mean tendency when individual choices are highly dispersed. This increased the predictive power of the conclusions. This was followed by a latent class analysis. Since it can be assumed that the respondents do not form a homogeneous group, the formation of smaller subgroups makes it possible to obtain more precise statements regarding individual partial benefits for specific subgroups. This is an approach for marketing and applying the results of such surveys. The analysis was based on the choices made during the choice experiment. The four consumer segments identified were profiled based on sociodemographic and psychographic data. The psychographic items were based on the constructs identified in the literature review to describe the different consumer segments and explain part-worth utilities. The constructs of "Animal welfare," "Health consciousness," "Environmental consciousness," "Price consciousness," and "Quality Aspects" were identified, based on a previous literature review. Thirty items were offered to study participants in three randomized sets.

Animal welfare was assessed by using the constructs "Prepared to kill pests", "Knowledgeable/interactive", "Atheoretical/superficial", "Empathy/liking", and "Necessary killing", taken from Austin et al. (2005). The broadest possible aspects of animal welfare were deliberately included to obtain more detailed information on consumer attitudes, possibly also on the question of which aspects play the greatest role for consumers, Grunert et al. (1993) provide the items for the construct "Health consciousness."

For "Benefits of action" the items were adopted from Ryan and Spash (2008). They were able to show with their measurements that in this cluster, there is a reliable and consistent measurement of the respondents' attitudes towards actively environmentally conscious

behaviors. The construct "Price consciousness" was taken from Lichtenstein et al. (2014) but can also be found in Bruner II (2013, p. 345). This scale measures consumer behavior and what consumers are willing to do for lower prices. The items for "quality aspects" were taken from Gunarathne et al. (2017), mainly due to the focus of the items on regionality, traditional manufacturing processes, and manual production. These constructs were evaluated by factor analysis in SPSS the Statistical Package for the Social Sciences (SPSS).

3. Results

3.1. Sample description

A total of 250 consumers participated in this survey. Of these, 127 (50.8 %) were female and 123 (49.2 %) were male. The average age was 49.2 years. Participants were a minimum of 18 years old and a maximum of 88 years old. Quotas were set for age and sex distribution to ensure the representativeness of the population in Germany. Demographic data on education, diet, marital status, disposable household income, and expenditure on food were collected (Table 3).

The sample was not representative of household income. A disproportionately high number of respondents had incomes of up to €1000 or €1000–2000. The majority (52 %) had a monthly net household income of up to 1000. Across the entirety of participants, the average household income was €1502. Average food expenditure amounted to €163. Regarding marital status, we observe an approximate distribution in Germany, as in our sample. Only divorcees were slightly underrepresented. In terms of education, we see an overrepresentation in our sample in terms of university or college degrees compared to the overall population (18.5 %, Statistisches Bundesamt, 2020). In our survey, 6.8 % of participants described themselves as vegetarians. This roughly corresponds to the sources, which provide values of 9.5 % (IfD Allensbach, 2022) and 4.4 % (Veganz Group AG, 2020). The proportion of flexitarians also approximately corresponded to the data from the survey by Veganz (29.1 %; 25.8 %). Little information is available on omnivorous nutrition in Germany. In the Veganz survey, 58.4 % of the participants stated that they consumed an omnivorous diet (Veganz Group AG, 2020). This allowed us to conclude that there was a slight overrepresentation among the survey participants. Height and weight data were also collected. However, they did not show any special features and approximated a normal distribution. Therefore, the mean values and ranges are not presented here, as they do not offer any added value.

Table 3
Summary of the demographic data of the sample.

Variables	Description	Frequency sample	Share (%) sample	Share (%) Germany
Gender (n = 250)	Female	127	50.8	50.7[a]
	Male	123	49.2	49.3[a]
Age (ϕ=49.2, SD=18.3) (n = 250)	18–24	23	9.2	8.8[b]
	25–39	57	22.8	22.7[b]
	40–59	83	33.2	33.3[b]
	60–64	21	8.4	8.6[b]
	>65	66	26.4	26.6[b]
Marital status (n = 249)	Single	116	46.6	43.9[c]
	Married	106	42.6	41.8[c]
	Divorced	12	4.8	7.6[c]
	Widowed	15	6.0	6.7[c]
Household income in € (ϕ=1501.9, SD=1334.9) (n = 221)	0–1000	115	52.0	1.0[d]
	>1000–2000	58	26.3	9.1[d]
	>2000–3000	27	12.2	25.8[d]
	>3000	21	9.5	64.1[d]
Education (n = 249)	Secondary School	23	9.2	N.A.
	University entrance qualification	49	19.7	N.A.
	Professional degree	73	29.3	N.A.
	College/ university	104	41.8	18.5[e]
Nutrition behavior (n = 249)	Omnivore	160	64.3	58.4[f]
	Vegetarian	17	6.8	4.4[f]-9.5[g]
	Flexitarian	63	25.3	29.1[f]
	Other	9	3.6	N.A.

Note: a: Statistisches Bundesamt (Destatis), 2022; b: Statistisches Bundesamt, 2022; c: Statistisches Bundesamt, 2022; d: Bundesagentur für Arbeit, 2022; e: Statistisches Bundesamt (Destatis), 2020; f: Veganz Group AG, 2020; g: IfD Allensbach, 2022.

3.2. Results of the hierarchical Bayes model

Part-worth utilities were calculated to determine the average consumer preferences for milk with respect to the attributes of "Features," "Packaging," "Husbandry" and "Feeding," "Label," "Price," and "Price transparency." For this purpose, the data were analyzed using the Lighthouse software version 9.14.0, with the hierarchical Bayes model. The findings show the part-worth utilities of the features on average. The results are shown in Fig. 2. To ensure better comparability, the lowest part worth utilities were set to zero. This makes it easier to compare the values.

The respective part-worth utilities are shown in the bars. The higher the part worth, the higher the benefit of this attribute level for the consumer. Across the entirety of respondents, the highest part-worth utility in the attribute "Husbandry" was shown for the label "Year-round grazing with mother-bound calf rearing". In addition, very high values were obtained for the attribute level of milk with "Natural fat content" (not homogenized) and for the attribute level "Glass reusable" for the attribute "Packaging." Also, higher values were obtained for the levels "Elopak," "FSC certified" and "Glass disposable." In contrast, the "Plastic" bottle fell far behind these values. Interestingly, milk with the second price level, a price of €1.49, was the one with the highest part-worth values regarding the attribute "Price." The analysis shows that the part-worth utilities for different price points exhibit a quadratic pattern, indicating varying consumer responses at different price levels. Basically, very low values were present for the attribute "Label." The "Bioland" label (organic agriculture) still had the highest part-worth utility here. "Price transparency" had hardly any influence on our sample. However, since these are the average values of all respondents, it is important to also look at the part-worth values of different consumer groups.

3.3. Results of the latent class analysis

Four segments have been identified. To identify relevant segments and reduce consumer heterogeneity, a latent class analysis was performed. Classes were formed based on the decisions of the respondents in the experiment. The selection criteria for the latent class analysis are shown in Table 4.

Regarding the results, the formation of four consumer groups was obvious. According to Lighthouse, a Consistent Akaike Information Criterion (CAIC) should be used (Sawtooth Software Inc., 2012). Small values were preferable in this case. Likewise, the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are suitable for determining the number of groups. BIC criterion should be minimized when selecting the number of groups in a latent class analysis (Schwarz, 1978; Nylund, Asparouhov, Muthén, 2007). In Table 4, CAIC and BIC showed the lowest values among the four-groups solution. Similarly, a three-group solution was considered. However, this showed a quantitative imbalance, in which almost 75 % of the participants would have been assigned to one group. Thus, a four-group solution was preferred. The part-worth utilities for the four groups were estimated using a hierarchical Bayes approach, which preserved respondent heterogeneity by calculating individual-level part-worths and then aggregating them

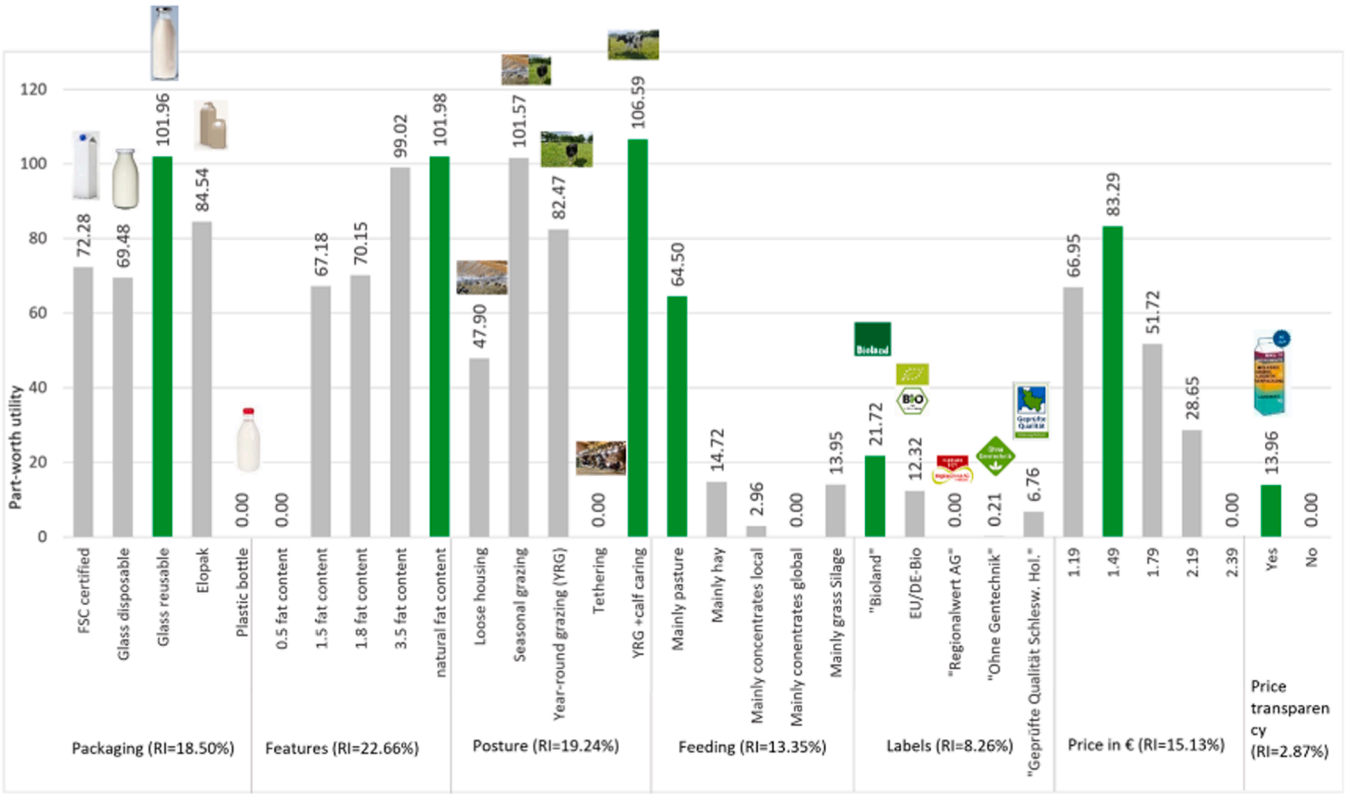

Fig. 2. Resulting part-worth utilities.
Note: "RI" Relative Importance; "Bioland" organic agriculture; "EU/DE-Bio" European/German organic; "Regionalwert AG" regional value stock corporation; "Ohne Gentechnik" without genetic technology; "Geprüfte Qualität Schleswig-Holstein" proved quality Schleswig-Holstein

Table 4
Model selection for latent class segments/groups.

Groups	Log-likelihood	AIC	CAIC	BIC	Average max. membership probability
2	−3302.43	6710.86	7082.20	7029.20	0.96497
3	−3107.23	6374.45	6934.96	6854.96	0.97754
4	−2959.67	6133.34	6883.02	6776.02	0.96341
5	−2881.52	6031.03	6969.89	6835.89	0.96268

to derive group-level insights.

Lighthouse Studio was used to create a simulation scenario with appropriate range to estimate Willingness to Pay (WTP) for the attribute levels using a generalized Sampling Of Scenarios (SOS) simulation Approach. Estimating WTP against a set of multiple competitors can lead to better results. The number of competitors was set to five as this might fall in the range of competitors available on one specific point of sale. The share of preferences was used as the simulation method and the None Option was included. The WTP are estimated relative to the following reference levels: packaging=plastic bottle; features=0.5 % fat past., homogen; husbandry=tethering; feeding=mainly concentrates global; label="Ohne Gentechnik"(no GMO); and price transparency=no. Sampling was done with 1000 competitive sets boostraping sampling was not used. That the higher part-worth utility is not always reflected by higher WTP is due to the fact, that part-worth utility is calculated as a sum of the part-worth utilities of every individual participant which mostly belongs to a particular latent class whereas the WTP of a latent class (consumer segement or group) is calcuating using the share of each individual WTP. In this case each individual contrubutes to a fraction of the latent classes WTP. One indvidual for example can be part of the segment Quality-conscious consumers to 30 % and environmentally conscious consumers to 70 % (Table 5).

All four groups show very low relative importance regarding "Price transparency" and "Labels". Regarding the labels, there is a clear preference for "Bioland" (organic agriculture) and the "EU/DE Bio" (European/German organic) label within the characteristic values. The other labels have disappearing low-part-worth utilities.

However, there were also differences between the groups. Participants in group 1 are referred to as "Price-conscious consumers" because their highest value of relative importance was "Price" (21.3 %). They comprise the largest consumer group in this survey (37.6 %). It is interesting to note that this group also has the highest part-worth value at €1.49 (130.7) and not at €1.19 (118.6). Important part-worth utilities to be considered appear in this consumer group for the attribute "Features" of milk (similarly high values of all fat contents except rejection of the variant "0.5 % fat content" and "Packaging" (higher part-worth utilities for "Glass reusable" and "Elopak"). For "Price-conscious consumers", "Seasonal grazing" and "Mainly pasture" achieved the highest part-worth utilities in the attributes of "husbandry" and "feeding". The relative importance of these two attributes is 15.2 % and 10.9 %, respectively. Almost as high relative importance (20.9 %) as the "Price" is in this group the attribute "Features" of the milk. Here, the highest part-worth utilities were obtained for the lower fat variants of milk with "1.5 % fat content" (85.6) and "1.8 % fat content" (83.4). Lower values were achieved by milk varieties with a higher fat content. Thus, in this group, the partial benefit value of the milk with "3.5 % fat content" was 66.1 and that with "Natural fat content" was 59.3. Thus, it appears that the fat content of milk does not play a decisive role in this group. Only the skimmed milk variant (0.5 % fat content) was rejected. Despite very low relative importance of "Price transparency" for all groups, the "Price-consciousness consumers" had the highest part-worth within the attribute level when price transparency was given (19.2). An even greater influencing factor for this consumer group is "Packaging" with a relative importance of 18.6 %. For this attribute, this group prefers

Table 5
Part-worth utilities and willingness to pay (WTP in €) of the four user-groups ($N = 250$).

Attribute	Levels	Price-conscious 38 %	Quality-conscious 18 %	Environ-mentally- con. 18 %	Animal welfare- con. 26 %
Packaging	FSC certified	67.4 (0.53)	82.7 (1.89)	102.5 (1.77)	51.5 (1.72)
	Glass disposable	52.1 (0.42)	72.1 (0.90)	67.8 (0.54)	93.6 (2.18)
	Glass reusable	90.1 (0.70)	109.8 (2.14)	136.0 (2.02)	90.3 (2.13)
	Elopak	86.6 (0.69)	87.2 (1.87)	118.4 (1.69)	56.7 (1.84)
	Plastic bottle	0.0 (N.A)	0.0 (N.A)	0.0 (N.A)	0.0 (N.A)
Features	0.5 % fat past., homogen.	0.0 (N.A)	0.0 (N.A)	0.0 (N.A)	0.0 (N.A)
	1.5 % fat past., homogen.	85.6 (0.66)	9.8 (0.55)	98.2 (2.20)	59.0 (0.88)
	1.8 % fat past., homogen.	83.4 (0.68)	52.6 (1.92)	70.4 (1.67)	63.1 (1.79)
	3.5 % fat past., homogen.	66.1 (0.50)	223.4 (3.03)	70.8 (1.57)	80.3 (1.94)
	Natural fat content	59.3 (0.38)	245.2 (3.22)	80.9 (1.49)	79.5 (1.81)
Husbandry	Loose housing	39.4 (0.32)	29.9 (1.21)	31.1 (0.73)	83.7 (2.17)
	Seasonal grazing	68.7 (0.54)	76.9 (0.88)	82.8 (1.63)	178.0 (2.98)
	Year-round grazing (YRG)	38.8 (N.A.)*	48.2 (N.A.)*	98.2 (N.A.)*	157.3 (N.A.)*
	Tethering	0.0 (N.A)	0.0 (N.A)	0.0 (N.A)	0.0 (N.A)
	YRG with calf rearing	66.7 (N.A.)*	31.2 (N.A.)*	131.4 (N.A.)*	197.8 (N.A.)*
Feeding	Mainly pasture	42.3 (1.57)	77.7 (4.57)	19.1 (3.39)	134.7 (1.94)
	Mainly hay	17.2 (0.40)	36.7 (0.48)	1.8 (−2.15)	21.6 (1.73)
	Mainly concentrates local	0.0 (0.37)	31.5 (0.48)	0.0 (−2.22)	6.4 (1.60)
	Mainly concentrates global	10.5 (N.A.)	0.0 (N.A.)	2.5 (N.A.)	0.0 (N.A.)
	Mainly grass silage	14.3 (0.39)	27.2 (1.17)	12.9 (−0.62)	21.8 (1.62)
Label	"Bioland"[1]	9.1 (0.08)	31.3 (1.11)	28.2 (0.49)	31.9 (1.64)
	EU /DE-Bio[2]	14.5 (0.39)	7.9 (1.11)	23.5 (0.13)	7.8 (1.15)
	"Regionalwert AG"[3]	1.1 (0.43)	0.0 (1.31)	2.4 (−0.54)	0.0 (1.20)
	"Ohne Gentechnik"[4]	0.0 (N.A.)	3.8 (N.A.)	0.0 (N.A.)	1.5 (N.A.)
	"Geprüfte Qualität Schleswig-Holstein"[5]	5.7 (0.59)	8.5 (1.37)	10.0 (0.12)	8.2 (1.49)
Price	€ 1.19	118.6 (N.A.)	27.4 (N.A.)	69.4 (N.A.)	18.7 (N.A.)
	€ 1.49	130.7 (N.A.)	65.2 (N.A.)	73.0 (N.A.)	35.2 (N.A.)
	€ 1.79	87.6 (N.A.)	39.9 (N.A.)	40.8 (N.A.)	16.1 (N.A.)
	€ 2.19	41.3 (N.A.)	28.0 (N.A.)	13.3(N.A.)	21.5 (N.A.)
	€ 2.39	0.0 (N.A.)	0.0 (N.A.)	0.0 (N.A.)	0.0 (N.A.)
Price trans-parency	Yes	19.2 (0.18)	9.0 (1.06)	17.9 (0.47)	7.1 (1.16)
	No	0.0 (N.A.)	0.0 (N.A.)	0.0 (N.A.)	0.0 (N.A.)
Relative importances (%)	Packaging	18.6	17.3	22.4	16.4
	Features	20.9	36.6	23.1	15.4
	Husbandry	15.2	12.9	19.7	29.0
	Feeding	10.9	12.3	9.3	20.3
	Label	9.5	6.9	8.4	7.3
	Price	21.3	11.7	14.0	9.4
	Price transparency	3.6	2.2	3.1	2.1

NOTE: 1: organic agriculture; 2: European/German organic; 3: regional value stock corporation; 4: without genetic technology; 5: proved quality Schleswig-Holstein.
*Results include instances where willingness to pay did not converge. This may be due to utility reversals in the price attribute.

"Glass reusable" (90.1) and "Elopak" (86.6).

The participants in group 2 had the highest relative importance for "Features" of milk (36.6 %). This is clearly ahead of all the other attributes. Therefore, they are named here as "Quality-conscious consumers'. They are as large as group 3 ("Environmentally conscious consumers") with 18 % of the respondents, making them the two smallest groups in this survey. Clearly the "Quality-conscious consumers" see the highest utilities in the attribute levels of "Natural fat content" (245.2) and "3.5 % fat content" (223.4). Variants with a lower fat content were clearly rejected. In the no other group, milk varieties with a higher fat content were clearly preferred. Just as in the group "Price-consciousness", "" "Seasonal grazing" (76.9) and "Mainly pasture" (77.7) showed the highest part-worth utilities for the attribute "Feeding". In the relative importance for the "Quality-conscious consumers," however, "Feeding" (12.3 %) and "Husbandry" (12.9 %) were only in the middle as influencing factors. Somewhat higher was "Packaging" with 1 relative importance of 17.3 %. This consumer group shows the highest part-worth utilities with "Glass reusable" of 109.8. This is followed on an albeit lower level, with similar part-worth values for "Elopak" (87.2) and "FSC-certified" (82.7) packaging as well as "Glass disposable" (72.1). In terms of "Labels", there is a difference to "Price-conscious consumers", with "Quality-conscious consumers" preferring the "Bioland' (organic agriculture) label. A similarly high part-worth utility is otherwise only found among the "Animal welfare-conscious consumers." With the "Price" attribute in the group the highest part-worth value was likewise for €1,49 (65,2). However, the price of €1.79 also received a part-worth value of 39.9.

Participants from group 3 showed almost similar high scores for "Features" (23.1 %), "Packaging" (22.4 %), and "Husbandry" (19.7 %). These are called "Environmentally-conscious consumers." Here, the attribute levels show that all milk types except skim milk have comparable part-worth utilities (70.4–98.2). In terms of the attribute "Packaging," the variants "Glass reusable," "Elopak, " and "FSC-certified" packaging are clearly ahead of "Glass disposable."

Together with the preferred "Year-round grazing with mother-bound calf rearing" (131.4) and "Year-round grazing" (98.2) followed by "Seasonal grazing" (82.8), an environmentally conscious attitude of this consumer group is evident. In addition, in this group, the price of €1.49 achieved the highest part-worth utility with a relative importance of 14 %. Within the "Labels" attribute the organic labels (organic agriculture 28.2 and European/German organic 23.5) are preferred, however this attribute influences the decision with only 8.4 % relative importance. "Feeding" is somewhat more important to this group with 9.3 %. Here, "Mainly pasture" 19.1 and "Grass silage" 12.9 are the variants with the highest agreement.

Group 4 showed the highest relative importance for "husbandry" (29 %), "feeding" (20.3), "packaging" (16.4 %), and "features" (15.4 %). This Group is called "Animal welfare-conscious consumers" animal welfare-conscious consumers. In "Husbandry," the largest part-worth utility is "Year-round grazing with mother-bonded calf rearing" with 197.8. Similarly, "Seasonal grazing" follows at 178.0 and "Year-round grazing" Year-round grazing' at 157.3 are well ahead of the scores of the

other three groups. In terms of "Feeding," far ahead of all the others, the highest part-worth utility is "Mainly pasture" (134.7). Again, this value was well above those of the other groups. It is interesting to note here that both "Glass disposable" and "Glass reusable" show the highest part-worth utilities within the attribute "Packaging" attribute.

3.4. Results of the sociodemographic variables for the different segments

Profiling the consumer groups according to their sociodemographic data revealed some significant differences between the groups. In the groups of "Price-conscious consumers" (53 %) and "Quality-conscious consumers" (60 %), there is a disproportionate number of males compared with the total sample (49.2 %). Across all groups, there was a clear overrepresentation of single participants. Widowed persons are also represented disproportionately high in the group of "Quality-conscious consumers." Analogous to all participants, the other three groups were underrepresented. According to the overall sample, we see the divorced over-represented in the group of "price-conscious consumers." The other three groups are also underrepresented (Table 6).

In terms of "Nutrition behavior," there is a clear dichotomy between the four groups. Among the "Price-conscious" and "Quality-conscious" consumers, there are about the same number of omnivores (75 % and 73 %), and vegetarians (3 % and 2 %). Among the Environmentally conscious" and "Animal welfare-conscious", there were only 51 % and 52 % omnivores, 13 % and 11 % vegetarians, and 33 % and 36 % flexitarians, respectively.

On the other hand, among the "Price-conscious" 16 % are flexitarians and among the "Quality-conscious" 20 %. Here, one can clearly see the dichotomy between groups. Regarding the highest level of education, 14 % in the group of "Price-conscious consumers" have a secondary school diploma. A similar number of people in all groups had a professional degree or a higher education entrance qualification. For this characteristic, the "Price-conscious" group is the lowest, the "Quality-conscious" and "Environmentally-conscious" groups are about the same, and the "Animal welfare-conscious" group is in between. The clear preponderance of females among the "Animal welfare-conscious" (61 %) and the "Environmentally-conscious" Environmentally conscious (56 %) is striking.

Still interesting in profiling the groups was the second dichotomy among the four groups in average household income food spending. For the "Price-conscious" and "Quality-conscious" groups, average spending was 9.6 % and 9.2 %, respectively. This shows lower spending than the average in Germany, which is 12 % (Agrarmarkt Informations-Gesellschaft mbH, 2021). In comparison, we observe slightly higher values for spending in the other two groups than the average for Germany. For the "Environmentally conscious, these are 12.9 % and for the "Animal welfare-conscious", 12.2 %. In absolute terms, food expenditure increases from the "Price-conscious" (€134.38) to the "Quality-conscious" (€150.11), the "Animal welfare-conscious" (€188.73) to the "Environmentally-conscious" Environmentally-conscious'(€196.97). The highest average net household income is among the "Quality-conscious consumers" (€1625.95), and the lowest among the "Price-conscious" (€1397.89). The results are shown in Fig. 3.

The groups differed only slightly in age. The average age of the groups is 50.3 for "Price-conscious," 53.1 for "Quality-conscious consumers," 46.3 for "Environmentally-conscious" and 47.1 for "Animal welfare-conscious."

3.5. Results of the factor analysis

To develop a better understanding of the four consumer segments, the measured items from the survey were reduced to factors in SPSS using principal component analysis with varimax rotation. The survey is described in Section 2.3. Since factor analysis of all constructs did not reliably upload them to one factor, four-factor analyses were conducted. The results of the four-factor analysis were as follows: In the first analysis, constructs 1–3 were analyzed. Table 7 presents the results. The Kaiser-Meyer-Olkin criterion (KMO), which serves as a measure of whether the data set can be represented as factors, can assume values from 0 to 1. Depending on which authors are followed, acceptable values are above 0.5 (Kaiser, 1974) or 0.6 (Möhring and Schlütz, 2013, S. 50), and our data set is well above this at 0.622. Bartlett's test for sphericity was used to validate the approach. If significant values are shown, the null hypothesis is rejected, and the approach can be pursued. In the factor analysis, this value was significant.

In the second factor analysis (Table 8), the items of constructs four and nine were examined. Here, KMO is 0.743, and BTS is significant. Thus, these constructs could also be included.

In the third factor analysis (Table 9), the items of constructs five and

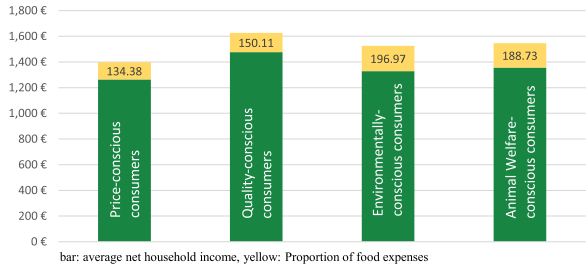

Fig. 3. Food grocery expenses are a proportion of average net household income.

Table 6
Frequency of sociodemographic attributes for latent class segments.

		Price- conscious consumers 38 %	Quality- conscious consumers 18 %	Environmentally conscious consumers 18 %	Animal welfare- conscious consumers 26 %
Gender	Female	44	18	25	40
	Male	50	27	20	26
Relationship status	Single	45	21	20	30
	Married	36	17	21	32
	Divorced	7	1	2	2
	Widowed	5	6	2	2
Education level	Secondary school	13	3	4	3
	University entrance qualification	19	8	8	14
	Professional degree	30	12	10	21
	College/university	31	22	23	28
Nutrition behavior	Omnivore	70	33	23	34
	Vegetarian	3	1	6	7
	Flexitarian	15	9	15	24
	Other	5	2	1	1

Table 7
Results of the factor analysis 1–3.

	Mean	SD	Factor loading
1) Prepared to kill pests[a] (Cronbachs Alpha: 0.508)			
Pests should be controlled in Germany by systematic gassing, shooting, or trapping	2.57	1.089	0.715
I have no qualms about personally killing rabbits	3.33	1.119	0.806
I would put down suffering, incurable animals myself	3.62	1.150	0.606
2) Knowledgeable/interactive[a] (Cronbachs Alpha: 0.611)			
The government should pay for improvements in farm animal welfare	3.91	1.006	0.811
I like to be informed about new knowledge relating to animal welfare	3.29	1.090	0.775
3) Atheoretical/superficial[a] (Cronbachs Alpha: 0.758)			
An animal that is physically fit must have good welfare	3.79	1.085	0.787
If an animal is growing well, it must be experiencing good welfare	3.23	1.239	0.871
If an animal is reproducing efficiently its welfare standards must have been good	2.69	1.116	0.777

Note: a: Austin et al. (2005); Per construct the three items, in one case two items, with the highest factor loading in the source were used in the present study to reduce the number of items.

Table 8
Results of factor analysis 4 + 9.

	Mean	SD	Factor loading
4) Empathy/liking[a] (Cronbachs Alpha: 0.802)			
Companion animals (pets) enhance our quality of life	3.88	1.051	0.901
I would not want to be without household pets	3.32	1.284	0.889
It is important for children to have the experience of keeping pets	3.84	1.010	0.754
9) Quality aspects[b] (Cronbachs Alpha: 0.772)			
I like to buy foods that have hand-crafted production	3.80	0.841	0.775
I prefer to buy food from my region	4.14	0.809	0.799
I prefer to buy food that were traditionally handmade	3.63	0.924	0.711
I prefer food with a trustworthy character (for example organic, Fairtrade, animal welfare) to foods without a label	3.83	0.981	0.654
I am willing to pay a higher price for products of good quality	4.13	0.765	0.656

Note: a Austin et al. (2005); b Gunarathne et al. (2017) Per construct the three resp. five items with the highest factor loading in the source were used in the present study to reduce the number of items.

seven were examined. Here, KMO is 0.738, and BTS is significant. Thus, these constructs could also be included. Importantly, with factor 8, one item had to be removed so that the items were not loaded into two constructs.

In the final factor analysis (Table 10), the items of constructs 6 and 8 were examined. Here, KMO is 0.762, and BTS is significant. Thus, these constructs could also be included.

Tables 7–10 list the factors, arithmetic means, standard deviations, and factor loadings. Cronbach's alpha was used to measure internal consistency. The values range from 0.508 to 0.867, and as recommended by Streiner (2010), the values should not be less than 0.6. Thus, the factors omitted in the presentation of the results blow Table 11 are "Health consciousness" and "Prepared to Kill Pests".

To better understand the differences in consumer choice behavior, the values determined for the four consumer groups were profiled using the factors listed in the tables above. The results are shown as mean values and standard deviations in Table 11.

Table 9
Results of factor analysis 5 + 7.

	Mean	SD	Factor loading
5) Necessary killing[a] (Cronbachs Alpha: 0.812)			
I prefer not to kill rats but do so if strictly necessary	3.55	1.163	0.895
I prefer not to kill mice but do so if strictly necessary	3.51	1.150	0.915
I do not like to kill rabbits but do so if strictly necessary	3.08	1.228	0.754
7) Benefits of action[b] (Cronbachs Alpha: 0.867)			
Environmental protection will provide a better world for me and my children	4.38	0.708	0.821
Environmental protection is beneficial for my Health	4.19	0.843	0.853
Environmental protection is benefits everyone	4.31	0.835	0.806
Environmental protection will help people have a better quality of life	4.27	0.770	0.912

NOTE: a Austin et al. (2005); b Ryan and Spash (2008), Per construct the three resp. four items with the highest factor loading in the source were used in the present study to reduce the number of items.

Table 10
Results of factor analysis 6 + 8.

	Mean	SD	Factor loading
6) Health consciousness[a] (Cronbachs Alpha: 0.585)			
To me the naturalness of the food that I buy is an important quality	4.18	0.852	0.685
I try to avoid food products with additives	3.81	0.967	0.769
I try to plan the amounts and types of food that the family consumes	4.05	0.881	0.737
8) Price consciousness[b] (Cronbachs Alpha: 0.796)			
I am willing to go extra effort to find lower prices	3.10	1.096	0.603
I would never shop at more than one store to find low prices	2.95	1.069	0.856
The time it takes to find low prices is usually worth the effort	2.97	1.060	0.836
The money saved by finding low prices is usually worth the time and effort	2.89	1.034	0.832

NOTE: a Grunert et al. (1993); b Lichtenstein et al. (2014) Per construct the three resp. four items with the highest factor loading in the source were used in the present study to reduce the number of items.

The "Animal welfare-conscious" and the "Price-conscious" groups show significantly different values from the other two groups in the construct "Benefits of action." With the "Price-conscious" ranging in the lower, the "Animal welfare-conscious" Animal welfare-conscious' in the higher values. The "Quality-conscious" and the "Environmentally-conscious" groups are in between. For the construct "Empathy/liking" the dichotomy is not as strong, but the groups "Price-conscious" and "Animal welfare-conscious" show positive, the other two groups negative values. Overall, the "Price-conscious" group hardly shows any specific deviations. Only in the construct "Necessary killing" it is positioned between the "Quality-conscious" on the one hand and the "Environmentally-" and "Animal welfare-conscious" Animal welfare-conscious' on the other. The "Quality-conscious" group showed significantly higher values for "Necessary killing" than all other groups. The "Quality-conscious" group also shows deviating values in the construct Quality aspects" compared to the other groups. In the case of "quality aspects", the groups are divided into three parties. The "Animal welfare-conscious" and the "Quality-conscious" group show positive agreement values here. With the "Animal welfare-conscious" group having the visibly higher value of the two, so that the "Quality-conscious" group falls between the "Animal welfare-conscious" and the other two. The values for the "Price-conscious" and "Environmentally conscious"

Table 11
Customer segment profiling.

Factors	Price-conscious	Quality-conscious	Environmentally-conscious	Animal welfare-conscious
Prepared to kill pests*	0.077 (0.901)[a]	0.245 (1.115)[a]	−0.151 (1.111)[a]	−0.170 (0.947)[a]
Knowledgeable/ interactive	−0.069 (0.939)[a]	−0.262 (1.094)[a]	−0.220 (1.014)[a]	0.427 (0.889)[b]
Atheoretical/ superficial	0.245 (0.893)[a]	−0.172 (0.960)[a]	−0.152 (0.948)[a]	−0.126 (1.148)[a]
Empathy/ liking	0.118 (0.908)[a]	−0.149 (1.065)[a]	−0.293 (1.084)[a]	0.134 (0.988)[a]
Necessary killing	−0.006 (0.884)[a,b]	0.365 (0.943)[b]	−0.132 (1.149)[a]	−0.147 (1.045)[a]
Health consciousness*	−0.175 (1.165)[a]	0.050 (0.837)[a]	−0.025 (0.932)[a]	0.240 (0.838)[a]
Benefits of action	−0.253 (1.026)[a]	−0.054 (1.077)[a,b]	0.134 (0.949)[a,b]	0.303 (0.856)[b]
Price consciousness	0.140 (1.019)[a]	−0.156 (0.962)[a]	0.200 (1.046)[a]	−0.232 (0.922)[a]
Quality aspects	−0.299 (1.041)[a]	0.072 (1.032)[a,b]	−0.124 (0.977)[a]	0.465 (0.741)[b]

Note: Superscripted letters represent statistically significant ($p < 0.05$) differences on post hoc Tukey's tests. * Cronbach's alpha < 0.6 and therefore poor internal consistency/reliability.

groups are significantly lower.

It is interesting and surprising that all groups have quite low approval rates for the topic of "Price." Interestingly, in all groups, the "Price-conscious" ones do not show the highest rates either, but the "Environmentally-conscious" Environmentally conscious ones do. For the remaining factors, the approval rates of the four consumer groups were similar.

4. Discussion

Looking at the whole sample, the attributes with the highest relative importance were the features of the milk, packaging, and husbandry practices. This indicates that consumers place significant weight on the physical and nutritional qualities of the milk, the type of packaging used, and the conditions under which the cows are raised.

Examining the part-worth utilities of the attribute levels of the whole sample offers further insight into consumer preferences. For the attribute "Features," the highest part-worth utility was observed for milk with natural fat content (not homogenized), suggesting a strong preference for minimally processed milk. In contrast, the lowest part-worth utility was found for milk with 0.5 % fat, pasteurized and homogenized. This preference aligns with the findings of Jensen et al. (2021), who noted that consumers often favor less processed dairy products due to perceived health benefits.

In terms of "Packaging," the highest part-worth utility was assigned to glass reusable bottles. This preference underscores a growing consumer inclination towards sustainable packaging options, consistent with the research by Steenis et al. (2017), which highlighted the positive response to environmentally friendly packaging materials. On the other end of the spectrum, plastic bottles received the lowest part-worth utility, reflecting widespread consumer concerns about plastic waste and environmental impact (Bock and Meyerding, 2023). Most participants in the survey showed roughly equal rejection of milk in plastic bottles. It can be assumed that due to media reporting on poor recycling rates and the increasing problem of microplastics, there is general rejection among the general population. In Germany, milk is rarely sold to end-consumers in plastic bottles or bags. Habitual factors may be responsible for this.

For the "Husbandry" attribute, the practice of year-round grazing with mother-bonded calf rearing received the highest part-worth utility, indicating a strong preference for animal welfare-oriented practices. This result is in line with the study by Cardoso et al. (2016), which emphasized the importance of animal welfare in shaping consumer choices. Conversely, tethering practices had the lowest part-worth utility, further emphasizing the consumer demand for humane and ethical treatment of animals. Pasture-based husbandry was shown to be particularly preferred by consumers in this survey. High part-worth utilities were achieved by husbandry forms "Year-round grazing," "Seasonal grazing," and "Year-round grazing with mother-bound calf rearing." Zühlsdorf et al. (2014) showed in their study that consumers' desire for milk from pasture-raised animals was high. Consumer preference over other housing systems is interesting, as year-round pasture-raised mother-reared calves represent only a very small proportion of dairy farming, including organic dairy farming. The total share of organic milk in the German market in 2021 was 4.06 % (Milchindustrie-Verband e.V, 2022). Only a small proportion of the organic farms practice year-round grazing. Mother bonded calf rearing is also found in only a few suppliers. Busch et al. (2022) showed that the proportion of farms with grazing declined between 2009 and 2019; farms have also become larger (consolidation in farms, with 39.5 % fewer farms). They consider the concern expressed by Kühl et al. (2016) about the leakage effect, which describes the fact that a pasture milk label has led to a separation of the flow of goods, but so far, not to a conversion of the farms. The reason for this is the lack of connection to cheese dairy products. Because cheese dairies do not join the label, pasture milk on the market is sufficient and is diverted to the pasture milk label. Therefore, there is no incentive for farmers to convert their farms to grazing (Busch et al., 2022). Future research could determine whether there is a relevant market for cheese products from pasture milk to show if a respective label or branding for cheese dairies could be beneficial for converting more farms to a more animal and environmentally friendly production scheme.

When considering "Feeding" methods, milk produced from cows mainly fed on pasture achieved the highest part-worth utility. This preference is consistent with the findings of Boogaard et al. (2008), who reported that consumers associate pasture feeding with better animal welfare and higher product quality. In contrast, milk from cows fed mainly on globally sourced concentrates had the lowest part-worth utility, likely due to concerns about sustainability and the carbon footprint associated with long-distance feed transport.

The "Label" attribute showed that the Bioland (organic agriculture) label had the highest part-worth utility, reflecting consumer trust and preference for organic certification (Meyerding and Merz, 2018). This preference is also supported by Janssen et al. (2016), who found that organic labels significantly influence consumer purchasing decisions. The lowest part-worth utility was associated with the Geprüfte Qualität Schleswig-Holstein (proved quality Schleswig-Holstein) label, which may be due to lower consumer recognition or perceived benefits.

Price, a critical factor in consumer decision-making, exhibited a quadratic pattern in the part-worth utilities. The price level of €1.49 had the highest part-worth utility, suggesting that consumers prefer a mid-range price point over both the lowest (€1.19) and higher prices (€2.39). This non-linear relationship between price and consumer preference aligns with the observations of Koistinen et al. (2013), indicating that consumers do not necessarily favor the cheapest options but rather those that offer perceived value for money.

Lastly, "Price Transparency" had minimal impact on consumer choices across the sample, with relatively low part-worth utilities for both levels of this attribute. This suggests that while transparency may be valued, it is not a decisive factor for most consumers when selecting milk.

The results of the latent class analysis reveal the presence of four distinct consumer segments, each characterized by unique preferences for milk attributes.

The first segment, "Price-conscious consumers," which comprises 38 % of the sample, places the highest relative importance on price (21.3 %). For this group, the highest part-worth utility is observed for the price

level of €1.49 (130.7). This finding aligns with Grebitus et al. (2007), who noted that price-sensitive consumers are heavily influenced by cost considerations. In terms of packaging, this segment prefers glass reusable (part-worth utility (PWU) 90.1, WTP €0.70), followed by Elopak (PWU 86.6, WTP €0.69). The lowest preference is for plastic bottles (PWU of 0.0, (reference value)). The features attribute is also significant, with higher part-worth utilities for lower-fat milk variants, particularly 1.5 % fat (PWU 85.6, WTP €0.66). This preference for lower-fat options reflects broader health trends identified by Vargas-Bello-Pérez et al. (2020). The husbandry practices preferred by this group include seasonal grazing (PWU 68.7, WTP €0.54) and mainly pasture feeding (PWU 42.3, WTP €1.57), while tethering receives the lowest preference (PWU 0.0, (reference value)). Demographically, this segment has a higher proportion of omnivores (75 %) and single individuals, which may explain their price sensitivity and simpler dietary preferences. Psychographically, the "Price-conscious consumers" exhibit moderate levels of quality consciousness and necessary killing, indicating a balanced approach to cost and ethical considerations.

The second segment, "Quality-conscious consumers," representing 18 % of the sample, assigns the highest relative importance to the features of milk (36.6 %). The most preferred feature is natural fat content (PWU 245.2, WTP €3.22), consistent with the trend towards high-quality, minimally processed foods noted by Jensen et al. (2021). Packaging is also crucial for this group, with a strong preference for glass reusable (PWU 109.8, WTP €2.14) and Elopak (PWU 87.2, WTP €1.87). The lowest preference is again for plastic bottles. For husbandry, the highest part-worth utility is for seasonal grazing (PWU 76.9, WTP €0.88), reflecting a preference for perceived higher-quality milk production practices. The price attribute is less important for this group. Demographically, this group has a higher proportion of individuals with professional degrees, suggesting a demographic willing to invest in quality products. They have relatively high food expenditure, reflecting their commitment to purchasing premium products. Psychographically, the "Quality-conscious consumers" score high on quality aspects, indicating a strong preference for traditionally handmade and regionally produced foods.

The third segment, "Environmentally-conscious consumers," also comprising 18 % of the sample, places almost equal relative importance on features (23.1 %), packaging (22.4 %), and husbandry (19.7 %). This segment demonstrates a strong preference for environmentally friendly practices, with the highest part-worth utility for glass reusable packaging (PWU 136.0, WTP €2.02) and Elopak (PWU 118.4, WTP €1.69). The least preferred packaging is again plastic bottles. For husbandry, the most preferred practice is year-round grazing with mother-bonded calf rearing (PWU 131.4, WTP €2.02), consistent with findings by Sinclair et al. (2022) on the importance of animal welfare. In terms of feeding, mainly pasture feeding is preferred (PWU 19.1, WTP €3.39). Price is relatively less important. Demographically, this group has the highest proportion of flexitarians (33 %) and vegetarians (13 %), indicating a strong alignment with environmental and ethical consumption values. They show the highest average food expenditure, reflecting their commitment to sustainable consumption. Psychographically, this group scores high on benefits of action, indicating a strong belief in the positive impacts of environmental protection.

The fourth segment, "Animal welfare-conscious consumers," making up 26 % of the sample, assigns the highest relative importance to husbandry (29.0 %) and feeding (20.3 %). This group shows a strong preference for year-round grazing with mother-bonded calf rearing (PWU 197.8, WTP €2.02) and mainly pasture feeding (PWU 134.7, WTP €1.94). Packaging preferences are also significant, with glass reusable (PWU 90.3, WTP €2.13) and glass disposable (PWU 93.6, WTP €2.18) being the most favored. The features attribute, though less important, still shows a preference for natural fat content (PWU 79.5, WTP €1.81). The price attribute is least important, indicating a lesser concern for cost in favor of ethical production practices. Demographically, this segment has a higher proportion of females (61 %) and a substantial number of flexitarians (36 %), aligning with the high importance placed on ethical considerations. They also show substantial food expenditure, reflecting their commitment to ethical consumption. Psychographically, the "Animal welfare-conscious consumers" exhibit high empathy and quality aspects, indicating a strong preference for products that ensure animal welfare and quality.

In the present study, the quadratic nature of pricing is evidenced by the varying part-worth utilities at different price points. Specifically, the highest part-worth utility is not at the lowest price (€1.19) but at €1.49, suggesting a non-linear relationship between price and consumer preference. This indicates that consumers do not necessarily prefer the cheapest option, but rather show a stronger preference for a mid-range price point. The quadratic effect is further highlighted by the steep decline in utility at higher prices (€1.79 and €2.19), demonstrating a significant drop in consumer preference as prices increase beyond a certain threshold. This pattern is crucial for understanding consumer behavior, as it suggests that moderate pricing may optimize both consumer satisfaction and sales, avoiding the pitfalls of both overly low and excessively high pricing. Incorporating this insight into pricing strategies can help producers and retailers set optimal prices that balance consumer demand and profitability.

Comparing these segments, it is evident that while price is a dominant factor for the "Price-conscious consumers," quality, environmental sustainability, and animal welfare significantly influence the other segments. The "Quality-conscious consumers" focus on high-quality product attributes, the "Environmentally-conscious consumers" prioritize sustainability, and the "Animal welfare-conscious consumers" emphasize ethical husbandry and feeding practices. These distinctions align with broader trends in consumer behavior noted in the literature, reflecting diverse motivations driving milk purchase decisions.

The low influence of the “Labels’ is interesting. The labels with higher influence on the choice decisions were the "big" labels “EU/DE Bio” (European/German organic) and “Bioland” (organic agriculture). The influence of the labels „Ohne Gentechnik“ (without genetic technology), „Regionalwert AG“ (regional value stock corporation) and „Geprüfte Qualität Schleswig-Holstein“ (proved quality Schleswig-Holstein) was negligible. The reasons for this can be assumed to be a lack of awareness or unclear benefits for consumers. The unclear benefit of labels that are too complex was also shown in the discussion by Weinreich et al. (2014, 2015) and Weinreich and Spiller (2016), who found that they tend to confuse consumers. This may be present in the case of the “Regionalwert AG” label. The goal is regional networking and building mutual support between producers and consumers. The financial resources of the AG are invested in member farms with the aim of operating more regionally and ecologically. This is summarized very clearly in the claim "agriculture suitable for grandchildren.” However, this complexity is difficult for consumers to grasp when they see the label on a package. Familiar labels may have a supporting effect on choice decisions. Given that these labels promote sustainable food production, they do not seem to help consumers make environmentally positive decisions.

The study presented contributes to the existing literature on consumer preferences for milk by addressing gaps identified in previous research. While prior studies have primarily focused on isolated attributes such as price or packaging (Grebitus et al., 2007; Bock and Meyerding, 2023), the present research provides a comprehensive analysis that incorporates multiple attributes simultaneously, including packaging, husbandry practices, feeding methods, price, and price transparency. By employing a discrete choice experiment with a sample of 250 participants, our study offers detailed insights into how these diverse attributes collectively influence consumer decisions in the German market.

One of the critical contributions of this study is its segmentation of consumers into four distinct groups: "Price-conscious," "Quality-conscious," "Environmentally-conscious," and "Animal welfare-conscious." This segmentation, supported by latent class analysis,

reveals the nuanced preferences and psychographic profiles of each consumer group, which previous studies have not thoroughly explored. For instance, while Sinclair et al. (2022) highlighted the importance of animal welfare, our study goes further by linking these preferences to specific consumer segments and their psychographic characteristics, such as empathy and quality aspects.

Furthermore, the study addresses the research gap related to the perceived versus actual environmental impact of packaging materials. Despite the growing preference for glass packaging, the findings suggest a possible misconception among consumers regarding its environmental benefits, which aligns with recent discussions by Bock and Meyerding (2023). By highlighting these perceptions, our study emphasizes the need for clearer communication about the environmental impacts of different packaging options.

The present study also underscores the importance of sustainable and ethical production practices, with strong preferences for pasture milk and year-round grazing with mother-bonded calf rearing among the "Environmentally-conscious" and "Animal welfare-conscious" segments. These preferences align with trends noted by Boogaard et al. (2008) and Cardoso et al. (2016), but the present study uniquely ties these preferences to specific consumer segments and their willingness to pay, thereby offering actionable insights for producers and marketers.

The following limitations of this study must be acknowledged to contextualize the findings accurately. Firstly, the sample size of 250 participants may not fully represent the broader population's diverse preferences, particularly given the over-representation of specific demographic groups such as students and older individuals. This imbalance could skew the results towards certain preferences not reflective of the general consumer base (Statistisches Bundesamt, 2022). Additionally, the study's reliance on self-reported data and hypothetical scenarios may introduce biases such as social desirability or hypothetical bias, where participants' stated preferences do not accurately reflect their actual purchasing behavior in real-world settings. Previous research has shown that consumer intentions in surveys often differ from actual market behaviors (Ryan and Spash, 2008). Moreover, the complexity of the choice experiment, involving multiple attributes and levels, might have overwhelmed some participants, leading to inconsistent or less reliable responses. This complexity mirrors challenges noted by Weinreich and Spiller (2016) regarding multi-level labeling strategies that can confuse consumers. Finally, while the latent class analysis provides a robust method for identifying distinct consumer segments, the segmentation's reliance on statistical techniques might not capture all the nuances of consumer behavior, particularly those influenced by contextual or situational factors not included in the model (Nylund et al., 2007).

The sample selection process aimed to ensure a representative distribution of gender and age. However, it is acknowledged that the sample is skewed concerning income and education levels. Specifically, a disproportionately high number of respondents reported monthly household incomes of up to €1000 or €1000–2000, comprising 52 % of the sample. Additionally, there is an overrepresentation of participants with university or college degrees, accounting for 41.8 % of the sample compared to 18.5 % in the general population (Statistisches Bundesamt, 2020). These demographic skews are significant as income and education are closely linked to lifestyle choices, including dietary habits and health consciousness (Bock and Meyerding, 2023; Meyerding et al., 2019; Meyerding et al., 2019, 2018), which can directly affect dairy product consumption patterns. Higher education levels are often associated with greater health awareness and a preference for products perceived as healthier (Meyerding et al., 2018), such as organic or pasture-raised milk (Weinrich et al., 2014). Similarly, income levels influence purchasing power and access to a variety of food products (Hough and Sosa, 2015), potentially leading to differences in milk consumption preferences. The skewed data might impact the study results by overemphasizing preferences and behaviors typical of higher-educated and lower-income groups. For instance, the overrepresentation of lower-income participants might skew the results towards more price-sensitive purchasing behaviors, whereas the overrepresentation of higher-educated individuals might highlight preferences for certain ethical or health-related attributes of milk. This demographic imbalance necessitates cautious interpretation of the results, as the findings may not fully represent the broader population's milk consumption preferences and behaviors.

Future research should aim to address several areas to build on the findings of this study. One critical direction is to expand the sample size and ensure a more representative distribution of demographic characteristics, particularly regarding income and education levels, to enhance the generalizability of the results (Bock and Meyerding, 2023). Additionally, incorporating real-world purchase data alongside survey responses could help mitigate the biases inherent in self-reported data and hypothetical scenarios, providing a more accurate picture of consumer behavior (Ryan and Spash, 2008). Another important area for future research is the exploration of the perceived versus actual environmental impacts of different packaging materials. Our findings suggest that consumers may hold misconceptions about the sustainability of glass packaging, particularly single-use glass, and further studies could help clarify these perceptions and promote more informed consumer choices (Bock and Meyerding, 2023). Moreover, examining the effectiveness of different communication strategies in conveying the environmental benefits of packaging options like Elopak could be beneficial. Lastly, investigating the factors influencing consumer willingness to pay for ethical and sustainable attributes in different market segments and geographical regions could provide valuable insights for tailoring marketing strategies and policies to various consumer groups.

5. Conclusion

This study provides significant insights into consumer preferences for milk attributes in the German market by identifying four distinct consumer segments: Price-conscious, Quality-conscious, Environmentally-conscious, and Animal welfare-conscious. Theoretical implications of the findings extend the current understanding of consumer behavior by demonstrating that preferences for milk attributes are multifaceted and strongly influenced by psychographic factors such as empathy, quality consciousness, and environmental and ethical considerations. These insights align with and expand upon existing literature, highlighting the importance of integrating multiple attributes into consumer preference models (Jensen et al., 2021; Sinclair et al., 2022).

From a managerial perspective, the segmentation of consumers based on their preferences offers actionable strategies for producers and marketers. For example, targeting the Quality-conscious segment with high-quality, minimally processed products and premium packaging could enhance market penetration. Similarly, emphasizing sustainable and ethical production practices in marketing campaigns could appeal to Environmentally-conscious and Animal welfare-conscious consumers. These strategies could help dairy producers differentiate their products in a competitive market, fostering consumer loyalty and willingness to pay premium prices.

However, this study has several limitations that must be considered. The sample size and demographic skew may not fully capture the broader population's preferences, potentially limiting the generalizability of the findings. Additionally, the reliance on self-reported data and hypothetical scenarios might introduce biases, and the complexity of the choice experiment could affect response reliability (Ryan and Spash, 2008; Weinreich and Spiller, 2016). Future research should aim to use larger, more representative samples, incorporate real-world purchase data, and simplify experimental designs to enhance the robustness and applicability of the results.

Looking forward, future studies should explore the perceived versus actual environmental impacts of different packaging materials to address potential consumer misconceptions (Bock and Meyerding,

2023). Further investigation into effective communication strategies for environmental benefits and examining consumer willingness to pay for sustainable attributes across various regions could provide deeper insights. Expanding research to include longitudinal studies might also capture changes in consumer preferences over time, offering a dynamic view of market trends.

CRediT authorship contribution statement

Stephan G.H. Meyerding: Writing – review & editing, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization, Writing – original draft. **Anja Seidemann:** Writing – original draft, Visualization, Validation, Investigation, Formal analysis, Data curation, Conceptualization.

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.

Data availability

Data will be made available on request.

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