Agriculture and Food

AIMS Agriculture and Food, 10(3): 719–743.
DOI: 10.3934/agrfood.2025037
Received: 28 June 2025
Revised: 05 September 2025
Accepted: 23 September 2025
Published: 28 September 2025

https://www.aimspress.com/journal/agriculture

*Research article*

# "Home is where the cheese is": Consumption, preferences and future perspectives of cheese marketing strategies in Portugal

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**Abstract:** The cheese industry in Portugal offers diverse traditional products with deep cultural and territorial significance. Despite these traditions, evolving consumer preferences and global sustainability concerns necessitate innovative marketing strategies. Understanding the interplay between consumer profiles and marketing stimuli can enhance cheese visibility and acceptance. This study investigated consumer preferences, clustering Portuguese cheese consumers based on their attitudes toward tradition, sustainability, and marketing strategies. It also explored how socio-demographic factors and neophilia influence purchasing behaviors. An online survey was conducted across nine regions in Portugal. Data from 218 respondents was analyzed using principal component analysis (PCA), K-means clustering, and correspondence analysis (CA) to identify key consumer segments and preferences for marketing stimuli. Three distinct consumer clusters emerged. The "terraphilia" group perceived local dairy supply chains as deeply intertwined with the local area, offering unique emotional and social value as well as superior quality. The "sensitive to local origin" group prioritized attributes associated with regional identity and authenticity, while "undecided consumers" expressed random and undefined preferences, showing less interest in both local origin and sustainability. Marketing stimuli such as eye-catching packaging, price variations, and sustainability claims showed differential impacts across clusters. Effective cheese marketing strategies in a local dairy market, as the Portuguese one, must align with consumer values related to tradition, sustainability, and quality. Tailored approaches can foster greater acceptance of innovative cheese products.

**Keywords:** consumer preferences; cluster analysis; consumer habits; dairy sector; marketing stimuli; Portugal

## 1. Introduction

Cheese consumption in Portugal reflects a deep cultural heritage, where traditional products serve as symbols of quality, authenticity, and regional identity. This heritage is rooted in centuries-old production methods and a strong connection between cheese and its territory of origin. However, the modern consumer landscape is characterized by shifting priorities, including a growing emphasis on health, environmental sustainability, and innovation [1]. Balancing these demands with the preservation of tradition poses a significant challenge for the cheese industry.

Consumer neophilia, defined as the willingness to explore novel food products, presents an opportunity for introducing innovative variations while retaining cultural authenticity [2,3]. Neophilic consumers are open to new technologies, ingredients, and production methods, making them a key target for innovative marketing approaches. Conversely, food neophobia, or reluctance to try unfamiliar foods, can be a significant barrier, particularly among individuals with strong attachments to traditional products. For these consumers, the emotional significance of traditional cheeses—linked to community identity and a sense of belonging—can lead to resistance toward changes in production or presentation [4].

Marketing stimuli play a crucial role in shaping consumer purchasing behaviors, especially for traditional foods [5]. Attributes such as origin certification, sustainability claims, and packaging design are strategically employed to influence consumer perceptions and intentions [6]. However, the effectiveness of these stimuli is mediated by socio-demographic, psychological, and cultural factors, which vary significantly across consumer segments and geographic contexts [7]. For example, while some consumers may prioritize sustainability certifications, others may place greater value on local origin or sensory attributes, underscoring the need for targeted marketing strategies [8,9].

Despite the extensive body of research on the importance of origin certifications such as Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI) in promoting traditional products, there is a lack of comprehensive studies exploring how consumer preferences evolve in response to marketing innovations [10]. Specifically, the interplay between tradition, sustainability, and neophilia in the context of Portuguese cheeses remains underexplored. While existing literature highlights the role of sustainability and neophilia in food choices [3,11,12], it often overlooks the nuanced ways in which these factors interact with consumer attitudes toward traditional products.

To provide a clearer foundation for this study, it is important to articulate the key constructs that underpin consumers' decision-making in relation to traditional cheeses (Figure 1). First, *tradition* refers to the cultural and historical embeddedness of cheese production methods and recipes, which convey authenticity, quality, and continuity with the past [13,14]. Second, *sustainability* encompasses environmental, social, and economic dimensions of food production, increasingly perceived by consumers as inseparable from authenticity and ethical value [15,16]. Third, *local origin* relates to the geographical identity of products, where proximity and territorial embeddedness act as guarantees of safety, quality, and community value, often reinforced by PDO and PGI certifications [17]. Finally, *neophilia* denotes the openness to trying novel products and innovations, which can stimulate market

acceptance of new versions of traditional foods when balanced with authenticity and sustainability concerns [18,19]. The interrelationship among these constructs has been documented in Mediterranean food markets, where tradition and sustainability are increasingly seen as complementary rather than conflicting, and where local origin serves both as a cultural marker and a signal of quality [20,21]. At the same time, neophilia allows consumers to engage with innovations in packaging, functional ingredients, or communication strategies, if they do not undermine authenticity. Building on this framework, the present study investigates how these constructs interact in shaping Portuguese consumers' preferences, segmentation patterns, and responses to marketing stimuli.

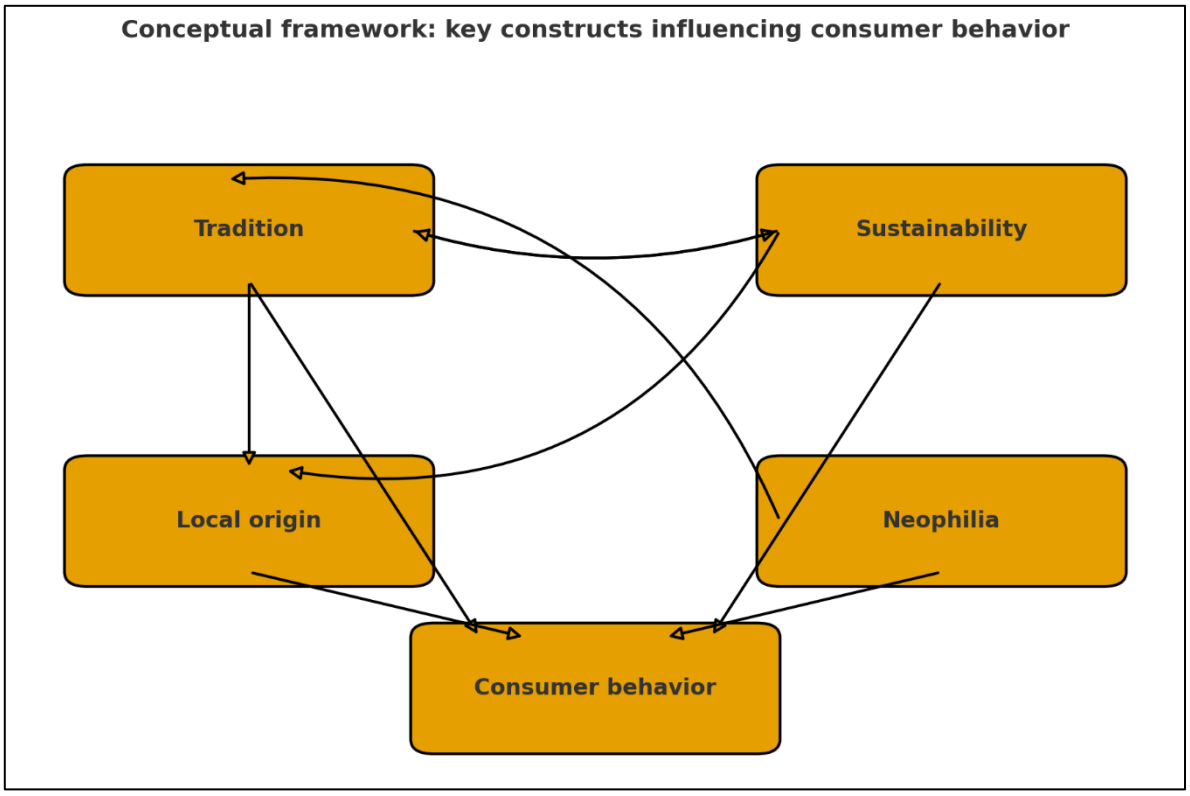


**Figure 1.** Key constructs and their interactions in consumers' decision-making in relation to traditional cheeses.

Moreover, the effectiveness of marketing stimuli, such as traceability and sustainability claims, in engaging diverse consumer segments has not been adequately investigated. Understanding how these attributes are perceived by consumers is essential for designing strategies that cater to both traditionalists and innovators without compromising the cultural integrity of the products. This shortcoming hampers the ability of local cheese producers, such as those in Portugal and so many others in Europe, to remain competitive in a globalized market while preserving the unique identity of their offerings. This study addresses these gaps through the following research questions:

1) How do Portuguese consumers perceive traditional cheese attributes, including local origin, quality, and sustainability?
2) What are the key consumer segments for Portuguese cheese, and how do their preferences and attitudes vary?
3) Which marketing stimuli are most effective in increasing acceptance and purchase intention for

innovative versions of traditional cheeses?

In order to answer the research questions, this study provides actionable insights for cheese producers and marketers in Portugal. By examining consumer preferences and segmenting consumers based on their attitudes, this study aims to identify effective marketing strategies that enhance product visibility while supporting cultural and economic sustainability. Through the integration of cluster analysis and correspondence analysis, the research seeks to bridge the gap between consumer behavior theory and practical applications in the food industry. Ultimately, this study contributes to a broader understanding of how traditional food products can adapt to modern consumer trends without losing their intrinsic value. The findings aim to support the development of the local cheese industry, ensuring its resilience and relevance in an era of rapid market transformation.

## 2. Materials and methods

### *2.1. Data collection*

A survey was conducted in Portugal between April and July 2021. The investigation was conducted following the ethical standards set out in the Declaration of Helsinki and was approved by the Bioethics Committee of the University of Turin (protocol number 0676005).

An anonymous structured questionnaire was distributed using a non-probabilistic, convenience sampling strategy. Participants were recruited from general consumer networks (mailing lists, WhatsApp, and social media), ensuring geographic representation across nine Portuguese regions: Alentejo, Algarve, Beira Interior, Beira Litoral, Entre Douro e Minho, Ribatejo e Oeste, Trás-os-Montes, Açores, and Madeira. The survey was anonymous, did not include sensitive data, and was drawn up in the Portuguese language. The average completion time was 10–15 minutes. To ensure the scientific completeness of the data, responses were mandatory for all questions, but respondents were informed that they could withdraw from the survey at any time. Informed consent was obtained from the participants before they started filling in the questionnaire. Inclusion criteria required participants to be at least 18 years old (legal age established in the country) and to purchase cheese regularly.

The questionnaire was structured into three main sections. The first section included questions about the socio-demographic characteristics (age, gender, and educational level) of the respondent. The second section explored cheese purchasing habits and preferences, assessing the importance of sixteen cheese attributes using a five-point Likert scale, as well as purchase and consumption frequencies. The attributes were selected in accordance with previous studies that explored consumer preferences toward dairy products [22–27]. The third section examined attitudes toward new cheese products and marketing stimuli, including product availability, awareness, neophilia, and reactions to marketing strategies such as packaging, price variations, product origin, production process information, and sustainability claims. The selected marketing stimuli were proposed to assess the individuals' acceptability of new product versions and presentations to hypothesize effective valorization and communication strategies for Portuguese cheeses [28,29]. In particular, they included product attributes (eye-catching packaging, longer self-life, information about the supply-chain sustainability), price (lower price, higher price), availability (information about product origin, information about the production process, like breeding system and animal feed), promotion and marketing communications (functional additives communication, brand, logos, certification about the product/production process, higher quality, traceability methods communication) [28–30].

To ensure the validity and reliability of the questionnaire, several steps were taken. Content validity was established through consultation with experts in dairy consumer research and by grounding the questionnaire items in existing literature. Construct validity was evaluated through principal component analysis (PCA) with Varimax rotation, confirming that items loaded appropriately on the intended constructs, with loadings greater than 0.35 considered significant. Internal consistency of the scales was assessed using Cronbach's alpha, with values above 0.70 indicating acceptable reliability; Pearson correlation coefficients were used to confirm coherence among items, with particular attention to correlations above 0.6. Additionally, the questionnaire was pilot tested on a small group of participants to ensure clarity, comprehensibility, and appropriateness of response options.

A detailed description of the variables contained in the questionnaire is reported in Table 1.

### *2.2. Data analysis*

To assess the potential effectiveness of the selected marketing stimuli applicable to cheese, which can be translated into an increased intention to purchase an innovative cheese, we developed a survey model, described in Figure 2. In consumer theory, individuals' perceptions of the marketing stimuli that define a product depend on the individual's internal factors (i.e., socio-demographic, psychological), individual preferences, and habits. This assumption, described graphically in Figure 2, defines the pattern of interpretation of marketing stimuli that changes according to the uniqueness of individuals and determines the perceived value of a product and, consequently, the intention to purchase it. In this regard, in our research, we assessed the association between preferences toward new marketing stimuli and different consumer profiles [29].

To achieve this purpose, the answers given by the respondents were analyzed at different steps. First, the socio-demographic (internal factors) composition of the whole sample was described. A correlation matrix among consumer preferences toward cheese attributes was computed to examine the internal coherence of the variables and to identify associations that could justify the subsequent use of PCA. Inspecting correlations allows the detection of redundancy among items and highlights groups of attributes that tend to co-vary, thus providing an empirical rationale for data reduction. Only correlations above 0.6 were reported in the results, as they represent stronger associations of practical interest. Therefore, the correlation matrix was not an end but a diagnostic step to ensure the robustness and interpretability of the PCA solution [31]. Then, the preference levels expressed by consumers toward the selected cheese attributes were employed in a PCA, based on the Varimax rotation, to obtain different individual cheese consumption orientations. The normality of data was tested using the Shapiro–Wilk test. The scale reliability was tested using Cronbach's alpha and Pearson correlation tests to assess factors' reliability and internal consistency [16]. For the component's definition, we considered loading values greater than 0.35 [32]. The Kaiser–Meyer–Olkin index (KMO) and the Bartlett's sphericity test were used to test the sample's suitability by examining the relationship between the correlation coefficients and the relationship between attributes in the sample, respectively.

**Table 1.** Questionnaire information.

| Section | Variables | Questions and answers codification |
|---|---|---|
| | Age | 1 = 18–25; 2 = 26–35; 3 = 36–45; 4 = 46–55; 5 = >55 |
| 1 | Gender | 0 = male; 1 = female |
| | Educational level | 1 = primary school; 2 = lower secondary school; 3 = upper secondary school; 4 = bachelor's or master's degree; 5 = PhD |
| 2 | Preferences toward cheese attributes | *Level of preferences toward the following cheese attributes (5-point Likert Scale: 1= not important; 5= very important):*<br>1. Country of origin<br>2. Local origin<br>3. Overall quality<br>4. Safety<br>5. Price<br>6. Flavor<br>7. Packaging appearance<br>8. Production system<br>9. Organic certification<br>10. Fat content<br>11. Type of milk<br>12. Brand of cheese<br>13. Traditional recipe<br>14. Certification of origin<br>15. Sustainability certification<br>16. Animal welfare certification |
| | Point of cheese purchase | *Where do you habitually buy cheese?*<br>*Options (multiple answers; 0 = no; 1 = yes):*<br>1. Directly from the producers<br>2. Supermarket<br>3. Open-air markets<br>4. Organic shop |

*Continued on the next page*

| Section | Variables | Questions and answers codification |
|---|---|---|
| | Frequency of cheese consumption | *How often do you consume these different kinds of cheese?*<br>*(1 = never; 2 = rarely; 3 = once a week; 4 = more than once a week; 5 = everyday)*<br>1. Hard cheese (i.e., São Jorge, Cheddar, Parmesan)<br>2. Semi-hard cheese (i.e., Flamengo, Gouda, Edam)<br>3. Soft cheese (i.e., Serra da Estrela, Azeitão)<br>4. Fresh cheese<br>5. Mold-ripened soft cheese (i.e., Brie, Camembert, Roquefort, Gorgonzola)<br>6. Cow's milk–based cheese<br>7. Goat's milk–based cheese<br>8. Sheep's milk–based cheese<br>9. Mix milk–based cheese (cow, sheep, and goat milk) |
| 3 | Availability and awareness | 1. Are you familiar with the concept of "shortening the food production chain"? *(0 = no; 1 = yes)*<br>2. Are local dairy products readily available? *(0 = no; 1 = yes)*<br>3. If local products were more available on the market, would you buy them more often? *(0 = no; 1 = yes)*<br>4. If local products were promoted more widely on the market, would you buy them more often? *(0 = no; 1 = yes)* |
| | *Neophilia* and marketing stimuli | *How often do you buy dairy products that you have never tried?*<br>*(1 = never; 2 = rarely; 3 = once a month; 4 = once a week; 5 = more than once a week)*<br>*What could stimulate you to try a new cheese?*<br>*Options (multiple answers; 0 = no; 1 = yes):*<br>1. Lower price<br>2. Higher price<br>3. Eye-catching packaging<br>4. Functional additives communication<br>5. Information about product origin<br>6. Information about the production process (i.e., breeding system and animal feed)<br>7. Longer shelf-life<br>8. Information about the supply-chain sustainability<br>9. Brand, logos, certification about the product/production process, higher quality<br>10. Traceability methods communication |

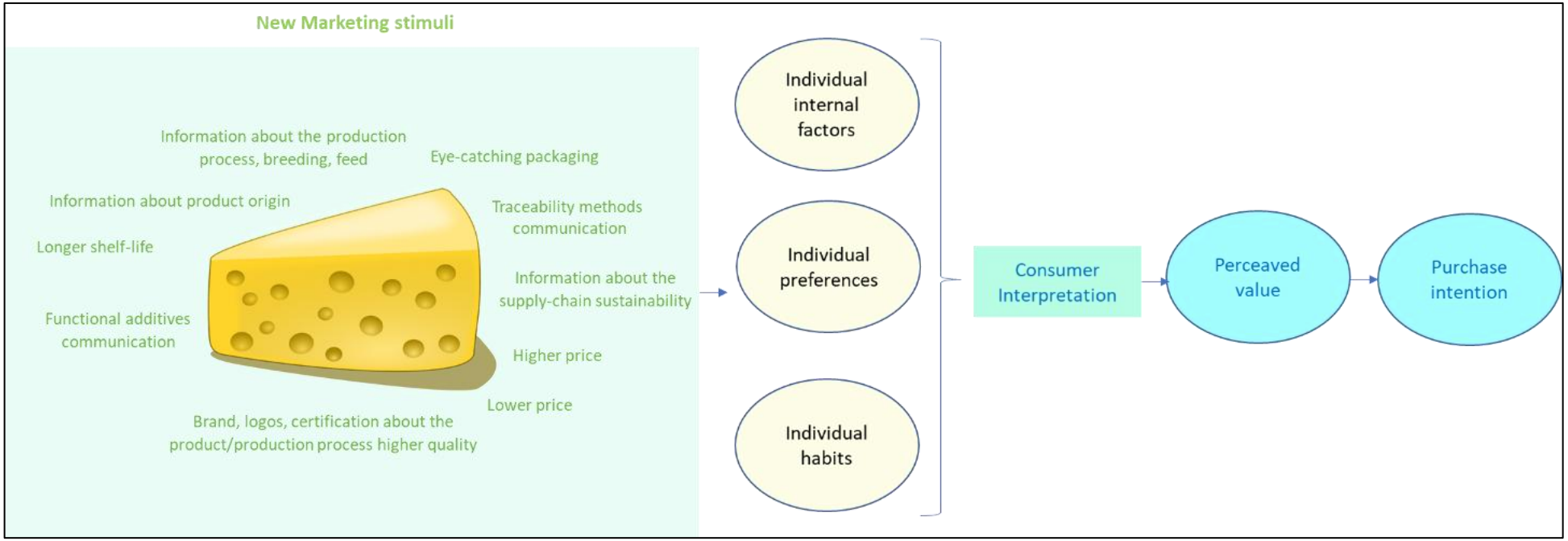


**Figure 2.** Data analysis assumption.

To cluster consumers according to their preferences and perception patterns toward cheese, the new principal components (PC) were employed as variables in a cluster analysis using the K-means technique. The K-means approach is extensively used in various fields, including customer segmentation [33,34]. The K-means algorithm using the Euclidean distances was performed, setting as number of clusters the better segmentation suggested by the preliminary analysis conducted with hierarchical cluster analysis and the two-steps clustering methods. The 3-cluster segmentation was judged to be good in terms of cohesion and silhouette separation by employing both Bayesian information criterion (BIC) and Akaike information criterion (AIC) indexes. Clusters composition was examined using the consumers' socio-demographic characteristics (gender, age, and educational level) as independent variables. In particular, the socio-demographic features, the purchasing and consumption preferences, and the information about the individual's availability and awareness toward cheese products were used to evaluate clusters heterogeneity. To this purpose, the Chi-square test ($\chi 2$) was applied to evaluate the dissimilarities among groups ($P < 0.05$).

Clusters diversity was also tested using an ANOVA, by comparing the groups in relation to the results about individual neophilia. Finally, a correspondence analysis (CA) was performed to identify patterns and associations between the obtained clusters and the marketing stimuli suggested to improve new cheese product visibility and acceptability. This statistical method allows for the simultaneous organization of the variables graphically in the same dimensional space [35]. Starting from a contingency table, the CA arranges the points of frequency of rows and columns in a geometric space following the proportion of frequency in the cells: a higher proportion is highlighted in the map by a greater proximity between the points. Mathematically, the CA breaks down the square measure of the table association into components in a similar way to the main component analysis for continuous data. The dimensions identified in the CA can be interpreted by identifying the major contributor relative to the variance explained by the axis. Therefore, this methodology allows a complete view of the data in a space structured by a Chi-square distance by representing the variables based on the main identified components (axes) [36,37]. In addition, the CA provides statistical measures that can be used to describe the number of dimensions and the proportion of the variance explained by each dimension (singular values). In this work, each dimension was accepted only when a singular value above 0.20 was obtained [38,39]. The choice of CA was guided by the exploratory nature of the study. In fact, CA is particularly suited for contingency data and for visualizing the relationships between categorical variables, such as consumer clusters and the considered marketing stimuli. Rather than aiming to quantify the predictive strength of each factor, our objective was to provide a descriptive mapping of the associations, offering an intuitive representation of how marketing stimuli align with distinct consumer profiles. This makes CA an appropriate tool for highlighting patterns and guiding hypotheses for future confirmatory research.

All statistical analyses were performed using SPSS v. 28.0 for Windows (SPSS Inc., Chicago, IL, USA).

## 3. Results and discussion

### *3.1. Sample characteristics*

A total of 218 cheese consumers filled in the questionnaire. The final sample consisted of 71.2% women and 28.8% men. The most common age groups were 26–35 years old (28%), 36–45 years old (31%), and 46–55 years old (25%), with a mean age of 41.1 years ± 3.3 (SD). The age

distribution closely mirrors the Portuguese population's demographic characteristics, where the mean age is approximately 45 years old [40]. The interviewees originated from various regions of Portugal, with the highest representations from Extremadura (25.5%), followed by Entre Douro e Minho (22.6%) and Beira Litoral (19.8%), also reflecting the national population distribution concentrated in the region of Lisbon (28%), north (35%, including also Trás-os-Montes and Beira Interior), and center (22%) [40]. Regarding their place of residence, 26% of consumers lived in population centers with at least 50,000 inhabitants, while 17% resided in metropolises with populations exceeding 500,000 inhabitants. On the other hand, 11% and 16% of respondents were from rural areas and villages, respectively. This reflects a diverse geographical spread as compared to the national population that is predominantly concentrated in large urban areas (72%), and less present in medium and small cities (16%) and rural areas (12%) [40].

In terms of educational attainment, most participants reported holding advanced degrees, with 65.6% having either a bachelor's or master's degree. This aligns with the national trend of increasing higher education levels among the Portuguese population, although the general level of higher education of the population reached only 20% [40,41]. Regarding their financial situation, 45.8% of the respondents described their economic situation as good, while 46.7% stated it was sufficient.

Overall, the sample composition is representative of the Portuguese population in terms of some of the studied demographic factors, whereas the major differences were found for gender and educational level distribution [40].

### *3.2. Correlation analysis*

The results of the correlation analysis among consumer preferences for cheese attributes are presented in Table S1 (Supplementary). All the variables were found to be significantly and positively correlated.

#### 3.2.1. Origin and local attributes

The product’s country of origin showed a strong positive correlation with its local origin, overall quality, safety, and flavor. This result contrasts with the prevailing perception that animal-based products are inherently unsafe or unhealthy. While some consumers are reducing or eliminating cheese consumption due to perceived adverse health effects, specific consumer segments are rediscovering cheese as a product with potential health benefits. This renewed appreciation is often tied to the association between safety and local production systems, which emphasize fresh feed and traditional aging processes, conferring unique organoleptic properties [42].

The positive correlation between local origin, traditional recipe, and certification of origin underscores consumers' trust in products that reflect authenticity. The perception of "local" encompasses spatial, technological, and cultural dimensions. Studies have shown that the production region significantly influences perceived product quality [43–45].

For cheese, attributes like PDO and PGI certifications, regulated under EU legislation (Reg. EC No. 1151/2012), play a pivotal role in consumer decision-making, as consumers are willing to pay premium prices for certified traditional products [46,47].

#### 3.2.2. Sensory attributes and tradition

A notable correlation was observed between positive sensory perceptions of cheese and

traditional recipes, place of origin, and production processes, consistent with findings by Cayot [48] and Merlino et al. [49]. This relationship highlights the importance of tradition and place of origin in shaping consumer preferences. The sensory and quality attributes associated with traditional recipes contribute to the perceived authenticity and uniqueness of cheese products.

#### 3.2.3. Price as an indicator of quality

Product quality was significantly correlated with price, as consumers often associate higher prices with superior quality. This is especially evident in premium-priced traditional cheeses with PDO or PGI labels. Research has shown that consumers view price as a proxy for quality, linking it to attributes like local origin and safety [50,51].

#### 3.2.4. Safety and supply chain

The correlation matrix revealed a strong association between safety and local origin, indicating that consumers trust products tied to short supply chains and local production systems. Moreover, attention to the milk production system was positively correlated with organic certification, milk type, traditional recipe, sustainability, and animal welfare certification. These results reflect consumers' awareness of the socio-environmental aspects of cheese production, emphasizing their preference for products that prioritize sustainability and ethical practices [26,52].

#### 3.2.5. Milk type and sustainability

The type of milk (cow, sheep, goat) used in cheese production was positively correlated with the fat content, which significantly influences cheesemaking technology and the nutritional and organoleptic properties of the final product [53]. Additionally, a noteworthy correlation was observed between milk type and sustainability, highlighting consumer awareness of the ecological value of certain supply chains, such as those involving small ruminants. These systems play a crucial role in preserving ecosystems and revitalizing marginal territories, aligning sustainability goals [54,55].

#### 3.2.6. Brand and tradition

A significant positive correlation between brand and traditional recipes suggests that consumers recognize the connection between specific local products and reputable regional brands [56,57]. Traditional cheeses, deeply rooted in their territory of origin, serve as cultural and historical symbols of their communities. Consumers also associate these products with social values such as animal welfare and environmental sustainability, alongside territorial identity reflected in local branding [58].

The inspection of the correlation matrix confirmed the presence of consistent associations among attributes, particularly between quality, safety, and sustainability-related characteristics. This coherence justified the use of PCA, which successfully grouped these correlated attributes into meaningful components.

### *3.3. Principal component analysis*

In the PCA, 71% of the total variance was explained by two PC (Table 2). This suggests that the selected set of attributes captures consumers' preferences in a clear and consistent way, with limited dispersion across unrelated dimensions. Most of the heterogeneity in consumer evaluations can often be traced back to two main interpretative axes [16].

**Table 2.** Principal component analysis.

| Variables | Principal component | |
|---|---|---|
| | Tradition is sustainable | Local is better |
| Country of origin | | 0.784 |
| Local origin | | 0.751 |
| Overall quality | | 0.888 |
| Safety | | 0.846 |
| Price | | 0.764 |
| Flavor | | 0.857 |
| Packaging appearance | 0.550 | |
| Production system | 0.847 | |
| Organic certification | 0.889 | |
| Fat content | 0.638 | |
| Type of milk | 0.729 | |
| Brand of cheese | 0.596 | |
| Traditional recipe | 0.705 | |
| Certification of origin | 0.696 | |
| Sustainability certification | 0.885 | |
| Animal welfare certification | 0.846 | |

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization. KMO and Bartlett's test. Kaiser–Meyer–Olkin measure of sampling adequacy = 0.922; Bartlett's test of sphericity: Chi-Square = 3507.132; $P = 0.000$.

The first one, renamed as "Tradition is sustainable" (59.9% of the total explained variance), delineates a cheese choice orientation characterized by attention toward aspects of environmental, social, and economic sustainability of the cheese production chain, considered a traditional production, from which higher quality products derive. The second PC, renamed as "Local is better" (10.2% of the total explained variance), defines a choice profile characterized by attention to the local origin of the product that defines a product of higher organoleptic quality and safety, for which a premium price is recognized. These results suggest that consumer choices in the dairy sector are influenced by two main orientations: one oriented toward sustainability and authenticity of traditional production [59], and the other focused on enhancing local products and their distinctive characteristics [60]. Understanding these preferences is crucial for marketing strategies and for developing products that meet consumer expectations.

The two identified PC reflect the strong interplay between tradition, sustainability, and local origin as theoretical constructs, confirming their relevance in shaping consumer perceptions. At the same time, the clusters highlight how neophilia moderates these orientations, opening space for innovation within the boundaries of authenticity.

### *3.4. Cluster analysis*

The cluster analysis segmented the sample into three distinct consumer groups based on their preferences. The segmentation highlights notable differences in preferences and behaviors among consumer groups, offering valuable insights for targeted marketing strategies. This section describes each group considering the cluster composition in function of PCs weight and influence, and the socio-demographic composition of each group (Table 3), the purchasing habits of cheese for each cluster (Table 4), and the importance given by each cluster to the selected marketing stimuli emerged with the CA (Figure 3). The eigenvalues of the CA are reported in Table 5.

**Table 3.** Cluster analysis: clusters definition in function of the PCs influence and weight and socio-demographic characteristics.

| Principal components | Clusters | | | |
|---|---|---|---|---|
| | Terraphilia | Sensitive toward local origin | Undecided consumer | *F* |
| Tradition is sustainable | 1.63264 | −2.88473 | −1.99446 | 187.997*** |
| Local is better | 0.26689 | 1.36645 | −4.04763 | 338.524*** |
| Socio-demographic characteristics | | | | *Chi-square* |
| *Gender* | | | | |
| Male | 24% | 35% | 67% | 131.956*** |
| Female | 76% | 65% | 33% | |
| *Age* | | | | |
| 18–25 | 6% | 11% | 60% | 30.10*** |
| 26–35 | 28% | 28% | 20% | |
| 36–45 | 34% | 28% | 10% | |
| 45–55 | 25% | 25% | 0% | |
| >55 | 7% | 8% | 10% | |
| *Educational level* | | | | |
| Primary school | 2% | 0% | 60% | 131.02*** |
| Lower secondary school | 5% | 2% | 0% | |
| Upper secondary school | 64% | 69% | 20% | |
| Master's degree | 29% | 29% | 20% | |
| PhD | 0% | 0% | 0% | |

Significance level: ***$P < 0.001$.

**Table 4.** Cluster analysis: clusters' purchasing habits about cheese.

| Purchasing habits for cheese | | Clusters | | | |
|---|---|---|---|---|---|
| | | Terraphilia | Sensitive toward local origin | Undecided consumer | Chi-square |
| Point of cheese purchase | Directly from the producer | 27% | 27% | 10% | 2.46 |
| | Supermarket | 26% | 26% | 30% | 46.87*** |
| | Open-air market | 24% | 25% | 30% | 4.33 |
| | Organic shop | 23% | 21% | 30% | 6.93* |
| Frequency of cheese consumption | | | | | |
| Hard cheese (i.e., São Jorge, Cheddar, Parmesan) | Never | 8% | 0% | 10% | 135.93*** |
| | Rarely | 30% | 27% | 20% | |
| | Once a week | 42% | 31% | 25% | |
| | More than once a week | 14% | 27% | 35% | |
| | Everyday | 6% | 7% | 10% | |
| Semi-hard cheese (i.e., Flamengo, Gouda, Edam) | Never | 4% | 5% | 25% | 140.339*** |
| | Rarely | 26% | 27% | 0% | |
| | Once a week | 25% | 11% | 50% | |
| | More than once a week | 34% | 35% | 25% | |
| | Everyday | 12% | 23% | 0% | |
| Soft cheese (i.e., Serra da Estrela, Azeitão) | Never | 14% | 7% | 50% | 138.645*** |
| | Rarely | 18% | 14% | 25% | |
| | Once a week | 58% | 57% | 25% | |
| | More than once a week | 8% | 18% | 0% | |
| | Everyday | 2% | 4% | 0% | |
| Fresh cheese (i.e., queijo fresco) | Never | 4% | 2% | 25% | 134.564*** |
| | Rarely | 38% | 35% | 25% | |
| | Once a week | 37% | 31% | 50% | |
| | More than once a week | 19% | 25% | 0% | |
| | Everyday | 2% | 6% | 0% | |
| Soft cheeses with certification | Never | 28% | 29% | 50% | 132.814*** |
| | Rarely | 11% | 10% | 25% | |
| | Once a week | 54% | 54% | 25% | |
| | More than once a week | 6% | 5% | 0% | |
| | Everyday | 0% | 2% | 0% | |
| Cow's milk–based cheese | Never | 10% | 6% | 75% | 126.141*** |
| | Rarely | 22% | 29% | 25% | |
| | Once a week | 38% | 22% | 0% | |
| | More than once a week | 22% | 29% | 0% | |
| | Everyday | 8% | 13% | 0% | |
| Goat's milk–based cheese | Never | 14% | 12% | 75% | 137.639*** |
| | Rarely | 18% | 24% | 25% | |
| | Once a week | 58% | 51% | 0% | |

*Continued on the next page*

| Purchasing habits for cheese | | Clusters | | | |
|---|---|---|---|---|---|
| | | Terraphilia | Sensitive toward local origin | Undecided consumer | Chi-square |
| | More than once a week | 9% | 10% | 0% | |
| | Everyday | 1% | 4% | 0% | |
| Sheep's milk–based cheese | Never | 14% | 11% | 75% | 136.351*** |
| | Rarely | 18% | 16% | 25% | |
| | Once a week | 59% | 58% | 0% | |
| | More than once a week | 9% | 14% | 0% | |
| | Everyday | 1% | 1% | 0% | |
| Mix milk–based cheese (cow, sheep, and goat milk) | Never | 14% | 11% | 75% | 135.607*** |
| | Rarely | 23% | 22% | 25% | |
| | Once a week | 50% | 49% | 0% | |
| | More than once a week | 10% | 16% | 0% | |
| | Everyday | 2% | 2% | 0% | |

Significance level: ***$P < 0.001$; *$P < 0.05$.

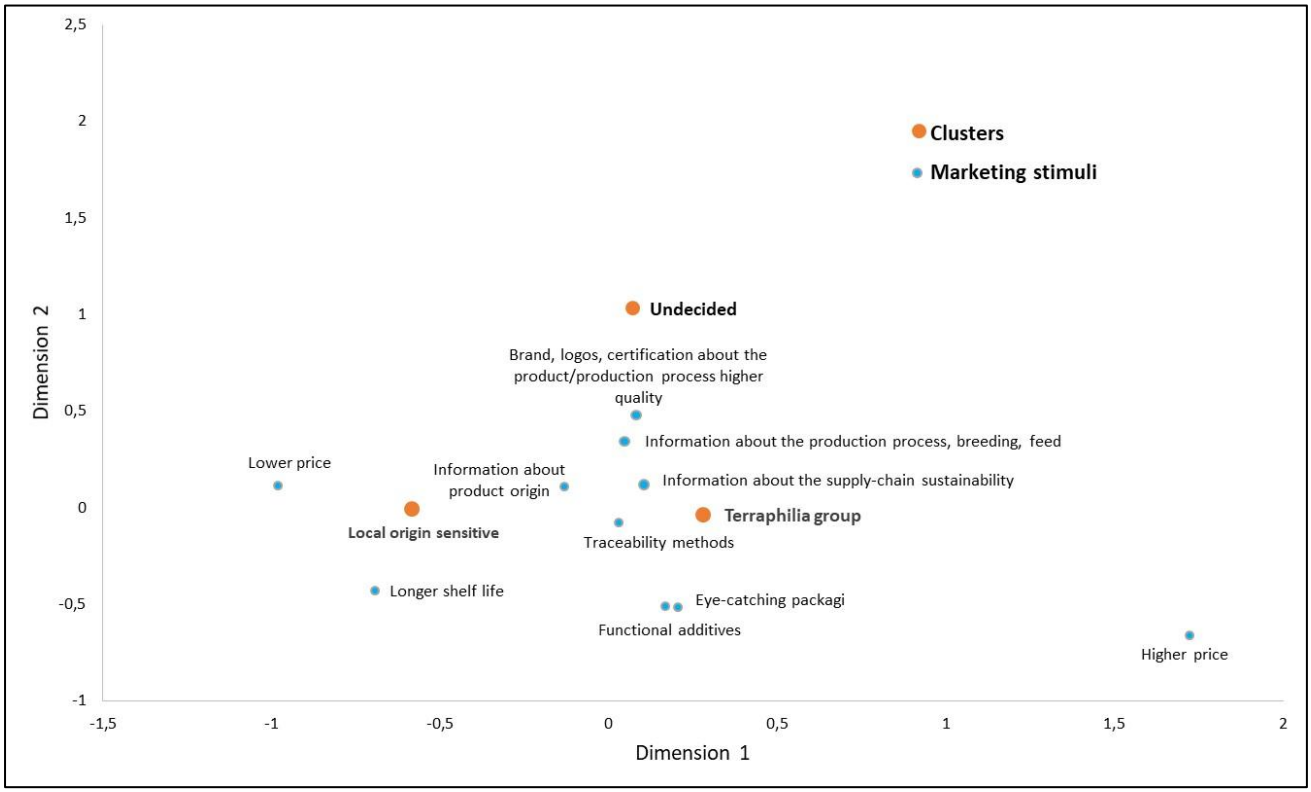


**Figure 3.** Correspondence analysis: marketing stimuli association with consumer clusters.

**Table 5.** Eigenvalues and appropriate dimensionality determination by the correspondence analysis. The Chi-square of independence between the two variables (columns and rows) and the significance are also reported. The accepted dimensions are highlighted in bold.

| Dimension | Singular value | Inertia | Chi-square | Sig. | Explained proportion | Cumulative proportion |
|---|---|---|---|---|---|---|
| 1 | 0.163 | 0.226 | | | 0.889 | 0.889 |
| 2 | 0.057 | 0.003 | | | 0.111 | 1.000 |
| Total | | 0.229 | 21.497 | * | 1.000 | 1.000 |

Significance level: *$P < 0.05$.

Similar segmentation patterns have also been observed in other Mediterranean countries, where consumer groups often differentiate between those oriented toward sustainability and authenticity and those primarily guided by price or convenience. For example, studies in Italy and Spain reported clusters emphasizing PDO/PGI origin labels and sustainability certifications, confirming that traditional food markets across the Mediterranean area share common consumer logics, even if with country-specific nuances [61,62].

This comparative perspective strengthens the interpretation of our clusters, suggesting that Portuguese consumers follow trends aligned with their neighboring contexts. In our study, the first group, renamed as "Terraphilia" (57%), is the largest cluster and underscores the importance of sustainability as a core value. It is composed primarily of millennials with medium-high educational attainment. Their decision-making process of cheese is driven by a combination of forces derived from both PCs, valuing both local origin and sustainability as important aspects of cheese. These consumers perceive local cheese supply chains as deeply intertwined with the territory, offering unique emotional and social value in addition to higher quality. They prefer hard and semi-hard cheeses from cow, sheep, and goat milk, without a clear preference for specific outlets, and are more influenced by sustainability claims, traceability information, and innovative packaging that conveys environmental responsibility. The "Terraphilia" group reflects a growing trend among women millennials toward sustainability and ethical production practices. Based on the results reported in Figure 3, this group's preference for sustainability claims and traceability information mirrors findings that sustainability-conscious consumers are willing to pay a premium for environmentally friendly products [55,63]. The importance of ecological and organic certifications, as well as the emphasis on the environmental benefits of cheese supply chains (e.g., small ruminants' role in ecosystem recovery), could resonate strongly with this segment. Marketing strategies for this group should emphasize traceability, sustainable production methods, and certifications that attest to environmental stewardship. Packaging that communicates these values could be particularly effective, as suggested by previous studies on consumer behavior toward eco-labeled foods [64]. Comparable results were found in Mediterranean markets where sustainable production and animal welfare certifications are increasingly perceived as integral to the authenticity of traditional products [65–67].

The "Sensitive toward local origin" (38%) cluster prioritizes attributes associated with the "Local is better" component, placing significant emphasis on regional identity and authenticity. Members of this cluster show a strong preference for locally sourced cheeses, driven by their perceived quality, safety, and connection to regional heritage, making them highly responsive to attributes such as PDO and PGI certifications. This group is represented predominantly by women, evenly distributed across middle-age groups, with a medium-high educational level. They prefer semi-hard and fresh cheeses made from cow's milk, often certified, and purchase from a variety of outlets. In addition, lower prices,

clear origin labeling, and extended shelf-life appear to be effective stimuli for this group. The "Sensitive to Local Origin" group aligns with studies that outline profiles of consumers who value local food systems by associating them with superior quality of the resulting product and regional pride [8,34,52]. Marketing efforts should focus on origin transparency, leveraging geographical indications and competitive pricing to attract this group. This finding is consistent with evidence from Spain, Greece, and Italy, where PDO and PGI schemes are strongly associated with consumer trust and willingness to pay, reinforcing the role of geographical indications as a strategic tool across Mediterranean dairy markets [68].

Finally, the "Undecided consumers" (5%) cluster exhibits random and undefined preferences, showing less interest in both local origin and sustainability. They are mainly younger males with a lower educational level. This group indiscriminately chooses cheese types and outlets, showing little preference for certifications or specific attributes. In addition, they respond more to visual cues like logos and recognizable brands. The "Undecided consumers", while less defined in their preferences, represent an opportunity for growth through branding. Visual elements such as logos and recognizable packaging could capture their attention, consistent with studies indicating that branding can significantly influence less engaged consumers [69,70]. Interestingly, while both the "Sensitive toward local origin" and "Undecided" groups showed similar levels of neophilia (the PC "Tradition is sustainable" weighted negatively on the cluster definition), their motivations differ. The former prioritizes price and origin, while the latter responds to the brand, logos, and certification about product sustainability. These distinctions highlight the need for differentiated marketing strategies to maximize engagement across segments.

Beyond consumer segmentation, it is important to situate these results in the context of global trends affecting agri-food marketing. The digitalization of food purchasing, particularly through e-commerce platforms for typical and certified products, has expanded the accessibility of traditional cheeses beyond local markets. At the same time, digital storytelling strategies—such as online narratives highlighting certifications, heritage, and sustainable practices—are increasingly used to communicate authenticity and strengthen consumer trust [71]. These dynamics are particularly relevant for Portuguese cheeses, which can benefit from combining strong territorial identity with modern digital communication to enhance competitiveness in both domestic and international markets.

The findings of our study reveal critical insights into consumer preferences and their implications for marketing strategies in the Portuguese cheese sector. By clustering consumers into three distinct groups, the analysis highlights the diversity in attitudes and motivations among Portuguese cheese buyers.

## 4. Limitations of the study

Although the sample was geographically balanced across the nine Portuguese regions, some socio-demographic characteristics were not fully aligned with the structure of the national population. In particular, women were overrepresented (71% of respondents), and the level of education was higher than the national average. These characteristics reflect, at least in part, the recruitment method, which relied on online distribution channels such as mailing lists, social media, and messaging applications. It is well documented that such approaches often attract younger, more educated, and predominantly female participants, especially in surveys related to nutrition and lifestyle. Although this imbalance does not compromise the internal validity of the study, it may limit its external validity

and the extent to which the results can be generalized to the entire Portuguese population.

Another limitation of this study is that cheese was analyzed as a broad and heterogeneous category, without focusing exclusively on specific PDO and PGI varieties. While this choice reduced the level of detail for individual products, it was consistent with the exploratory aim of the research, specifically to capture general consumer orientations toward Portuguese cheeses. Future research should therefore aim to validate these findings with larger, more representative samples, possibly combining online and offline recruitment methods to reduce demographic biases. Nevertheless, the present study provides valuable information on the orientation of a relevant segment of Portuguese consumers, namely educated and predominantly female shoppers, who often play a key role in food purchasing decisions and therefore represent an important target group.

## 5. Conclusions

The study confirms that the future of traditional cheese lies in its ability to integrate heritage with innovation. By understanding consumers' motivations and tailoring marketing strategies accordingly, producers can enhance product acceptance while preserving the cultural significance of their cheeses. The PCA and cluster analysis reveal diverse consumer profiles, with sustainability and local origin emerging as key drivers of cheese preference. These findings emphasize the importance of aligning production and marketing strategies with consumer values, particularly those related to tradition, environmental sustainability, attention toward animal welfare, and local identity. Targeted approaches that highlight origin certifications, eco-friendly practices, and visually appealing branding could effectively meet the needs of distinct consumer groups, fostering greater market engagement and loyalty.

From an operational perspective, producers and marketers could strengthen the visibility of Portuguese cheeses by investing in storytelling strategies that emphasize PDO and PGI certifications, sustainability, and local origin, using both traditional channels and digital platforms. Packaging design should clearly communicate quality signals (e.g., traceability, animal welfare, ecological value of small ruminant systems) to appeal to sustainability-oriented segments, while more competitive pricing and recognizable branding could capture undecided or price-sensitive consumers. Collective initiatives, such as consortia of protection, could also play a crucial role in coordinating communication strategies and ensuring coherent promotion of Portuguese cheeses both nationally and internationally.

In addition, the results provide useful guidance for public policy. Consumer education campaigns could be promoted to raise awareness about the cultural and environmental value of traditional cheeses, while public support for short supply chains and certified production systems would help align institutional strategies with consumer expectations. Such measures would not only enhance consumer trust and willingness to pay but also contribute to the long-term resilience of rural economies and the preservation of gastronomic heritage.

Future research should explore the long-term impacts of these strategies on consumer behavior and market dynamics, particularly in the context of global trends, such as digital marketing and e-commerce. Additionally, investigating the role of education and awareness campaigns in shaping consumer attitudes toward sustainability could provide further insights into promoting traditional cheeses.

In summary, this study provides a roadmap for sustaining the Portuguese cheese industry in an era of rapid change, ensuring that these iconic products remain relevant and cherished for generations to come.

## Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

## Acknowledgments

This research was funded by EIT FOOD, 2021, project "RIS Professional Development - Support for Diary Production Sector in RIS Region", funded by H2020 – EITFOOD ID 21324 (project number: 21324). The authors would like to thank the Italian EIT FOOD Hub for technical support.

## Conflict of interest

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

## Author contributions

Valentina Maria Merlino: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing—original draft preparation, Writing—review and editing, Visualization, Project administration; Manuela Renna: Data curation, Writing—review and editing, Visualization, Supervision, Project administration, Funding acquisition; Martina Tarantola: Writing—review and editing, Supervision, Funding acquisition; Alessandro Ricci: Writing—review and editing; Ana Sofia Santos: Investigation, Writing—review and editing; Ana Cristina Monteiro: Investigation, Writing—review and editing; Joana Nery: Writing—review and editing, Supervision, Project administration, Funding acquisition. All the authors critically reviewed the manuscript for its intellectual content and gave their approval for the final version to be published.

**Table S1.** Correlation matrix among consumer preferences toward cheese characteristics.

| | Country of origin | Local origin | Overall quality | Safety | Price | Flavor | Packaging appearance | Production system | Organic certification | Fat content | Type of milk | Brand of cheese | Traditional recipe | Certification of origin | Sustainability certification | Animal welfare certification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country of origin | 1 | 0.864** | 0.732** | 0.724** | 0.507** | 0.695** | 0.400** | 0.515** | 0.444** | 0.392** | 0.493** | 0.507** | 0.519** | 0.566** | 0.447** | 0.487** |
| Local origin | 0.864** | 1 | 0.738** | 0.717** | 0.518** | 0.693** | 0.415** | 0.594** | 0.495** | 0.406** | 0.491** | 0.494** | 0.832** | 0.799** | 0.513** | 0.561** |
| Overall quality | 0.732** | 0.738** | 1 | 0.915** | 0.707** | 0.890** | 0.552** | 0.564** | 0.484** | 0.500** | 0.551** | 0.494** | 0.550** | 0.578** | 0.485** | 0.545** |
| Safety | 0.724** | 0.717** | 0.915** | 1 | 0.655** | 0.846** | 0.556** | 0.590** | 0.487** | 0.531** | 0.570** | 0.484** | 0.541** | 0.580** | 0.515** | 0.584** |
| Price | 0.507** | 0.518** | 0.707** | 0.655** | 1 | 0.678** | 0.475** | 0.413** | 0.363** | 0.444** | 0.353** | 0.445** | 0.345** | 0.364** | 0.357** | 0.331** |
| Flavor | 0.695** | 0.693** | 0.890** | 0.846** | 0.678** | 1 | 0.528** | 0.527** | 0.459** | 0.508** | 0.539** | 0.465** | 0.547** | 0.563** | 0.463** | 0.545** |
| Packaging appearance | 0.400** | 0.415** | 0.552** | 0.556** | 0.475** | 0.528** | 1 | 0.555** | 0.575** | 0.520** | 0.488** | 0.573** | 0.539** | 0.474** | 0.515** | 0.489** |
| Production system | 0.515** | 0.594** | 0.564** | 0.590** | 0.413** | 0.527** | 0.555** | 1 | 0.863** | 0.576** | 0.670** | 0.526** | 0.636** | 0.658** | 0.827** | 0.807** |
| Organic certification | 0.444** | 0.495** | 0.484** | 0.487** | 0.363** | 0.459** | 0.575** | 0.863** | 1 | 0.595** | 0.700** | 0.520** | 0.610** | 0.605** | 0.840** | 0.778** |
| Fat content | 0.392** | 0.406** | 0.500** | 0.531** | 0.444** | 0.508** | 0.520** | 0.576** | 0.595** | 1 | 0.683** | 0.565** | 0.495** | 0.468** | 0.536** | 0.576** |
| Type of milk | 0.493** | 0.491** | 0.551** | 0.570** | 0.353** | 0.539** | 0.488** | 0.670** | 0.700** | 0.683** | 1 | 0.548** | 0.593** | 0.591** | 0.622** | 0.632** |
| Brand of cheese | 0.507** | 0.494** | 0.494** | 0.484** | 0.445** | 0.465** | 0.573** | 0.526** | 0.520** | 0.565** | 0.548** | 1 | 0.699** | 0.550** | 0.526** | 0.497** |
| Traditional recipe | 0.519** | 0.832** | 0.550** | 0.541** | 0.345** | 0.547** | 0.539** | 0.636** | 0.610** | 0.495** | 0.593** | 0.699** | 1 | 0.720** | 0.634** | 0.659** |
| Certification of origin | 0.566** | 0.799** | 0.578** | 0.580** | 0.364** | 0.563** | 0.474** | 0.658** | 0.605** | 0.468** | 0.591** | 0.550** | 0.720** | 1 | 0.697** | 0.705** |
| Sustainability certification | 0.447** | 0.513** | 0.485** | 0.515** | 0.357** | 0.463** | 0.515** | 0.827** | 0.840** | 0.536** | 0.622** | 0.526** | 0.634** | 0.697** | 1 | 0.853** |
| Animal welfare certification | 0.487** | 0.561** | 0.545** | 0.584** | 0.331** | 0.545** | 0.489** | 0.807** | 0.778** | 0.576** | 0.632** | 0.497** | 0.659** | 0.705** | 0.853** | 1 |

Significance level: $^{**}P < 0.01$.

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