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RESEARCH

Use of conjoint analysis to estimate consumer preferences for goat milk powder in the Coquimbo Region, Chile

Uso del análisis conjunto para estimar preferencias de consumo de leche de cabra en polvo en la Región de Coquimbo Chile

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Abstract

Traditional foods can use consumer science approaches to define market segments and consumer attributes, the present research analyzes the relative importance of consumer determinants for goat milk powder (origin, fat content, format, price), using the multivalent conjoint analysis methodology on a sample of 188 subjects from the Coquimbo Region (Chile). The results show that the most valued attribute in relative importance by the surveyed consumers is the origin of the product 26.7 %, preferring a national product to an international one, followed by fat content 26.4 %, distinguishing skim milk over whole milk, then product format 24.2 %, a small format, and finally price 22,8 %, as the least significant attribute, opting for the lowest cost ($15,000 CLP). Consumers preferred the skim variant, which is suitable for children and adults, as well as the small package size (450 g) because it is easier to measure and consume.

Keywords: Goat milk powder, consumer preferences, conjoint analysis, Traditional food products.

Resumen

Los alimentos tradicionales pueden utilizar enfoques de la ciencia del consumidor para definir segmentos de mercado y atributos de consumo, la presente investigación analiza la importancia relativa de los determinantes del consumidor para leche de cabra en polvo (origen, contenido de grasa, formato, precio), mediante la metodología multivalente de análisis conjunto (conjoint analysis) sobre una muestra 188 sujetos de la Región de Coquimbo Chile. Los resultados evidencian que el atributo más valorado en importancia relativa por los consumidores encuestados es el origen del producto 26.7 %, prefiriendo un producto nacional al internacional, seguido del contenido de grasa 26.4 %, distinguiendo la leche descremada sobre la leche entera, luego el formato del producto 24.2 %, un formato pequeño, y finalmente el precio 22.8 %, como atributo menos significativo optando al de menor costo ($15.000 CLP). Los consumidores prefirieron la variante nacional, descremada que se adapta a niños y adultos, también el tamaño de envases pequeño (450 gr) ya que es más fácil de medir y consumir.

Palabras Claves: Leche de cabra en polvo, preferencia del consumidor, análisis conjunto, productos agroalimentarios tradicionales

1. Introduction

Chile shares, along with many other Latin American countries, a rich heritage of traditional and typical foods with unique sensory and nutritional properties—products that reflect the history, culture, and way of life of each country and region. Traditional foods resemble functional foods in that they have proven physiological benefits, helping to improve public health and reduce the risk of diseases (Al-Sheraji et al., 2013). Consequently, consumer demand for these products has increased in recent years, with the dairy industry having the potential to become one of the main sources of traditional products.

Dairy products have been recognized as an important part of the human diet in both developed and developing countries. Goat milk (Capra hircus) contains water, proteins, fats, sugars, minerals, and vitamins, all of which are essential for maintaining good health (Pineda et al., 2017).

Goat milk is produced by female goats after giving birth. Within 0–3 days, their colostrum contains many nutrients and is considered one of the best sources of protein, almost equivalent to human breast milk (Ranadheera et al., 2019).

Fluid goat milk and its processed products are useful as functional foods for maintaining nutrition and health in both young and elderly people, especially for those with cow milk allergies (Bytyqi et al., 2020; Sánchez et al., 2020). Goat milk can be used to produce a wide variety of dairy products such as cheese, yogurt, ice cream, condensed milk, butter, and powdered milk.

Powdered milk is prepared by removing water from the liquid milk (Pineda et al., 2017). It offers better qualities for maintaining its quality, requires less storage space, and incurs lower transportation costs (Pineda et al., 2017).

El proceso de obtención de leche de cabra en polvo ha sido estudiado por diferentes autores. En este sentido, Reddy et al. (2017) optimizaron las condiciones de procesamiento para la fabricación de leche de cabra en polvo, tomando en cuenta como variables independientes la concentración de la leche (25, 40, 45%) y la temperatura del aire de entrada (160, 170, 180 ºC), obteniéndose una composición aproximada de humedad (4,08%), grasas (26.85%), proteínas (25.48%), carbohidratos (36,99%) y cenizas (6.60%) (Getaneh et al, 2016).

In the Coquimbo Region (Chile), goat farming is highly important due to its historical and territorial ties. This region holds over 54% of the country's goat population (Yañez, 2022), with 80% being local breeds from crosses between goats originating from Spain and other European countries, resulting in high genetic variability. Production is mainly aimed at obtaining milk for cheese production, for both self-consumption and informal sales in nearby urban centers. To a lesser extent, goat meat is produced for sale. The production system is extensive and characterized by low herd productivity, where goats must forage over large areas for low-quality shrubs and grasses. Goats are milked once per day with low yields, and natural weaning is practiced (Venegas, 2017).

The profits obtained by small-scale goat producers (locally known as crianceros) through cheese production are low and highly dependent on climatic conditions—particularly given the region's and the country's ongoing water scarcity. Production is largely informal, with little to no implementation of food safety systems, traceability, or tax/health formalization by the producers. To reverse this situation, the Instituto de Desarrollo Agropecuario (INDAP), an agency under Chile's Ministry of Agriculture, has implemented a series of technical and commercial support programs for goat producers. These include the Programa de Desarrollo Local (PRODESAL), the Programa Agropecuario para el Desarrollo Integral de los Pequeños Campesinos del Secano de la Región de Coquimbo (PADIS), and the Programa de Alianzas Productivas (PAP).

Regarding goat milk product consumption, research exists on consumer behavior and preferences for dairy products, as well as the factors influencing such preferences toward goat milk (Bytyqi et al., 2020; Shunekeyeva, 2020; Güney & Sangün, 2019; Šugrová, 2018).

The price of goat milk is higher than that of cow milk, making it a promising commercial prospect in the long term (Tarigan et al., 2020). Moreover, studies show that consumers assume that all types

of goat dairy products—both fluid milk and its derivatives—share the same nutritional quality. Thus, it is important to study consumer preferences for a traditional product like powdered goat milk, given its high biological value, long shelf life, and ease of commercialization. It represents a significant innovation alternative for goat milk produced by crianceros in the Coquimbo Region.

Based on these considerations, it can be stated that there is limited information in the literature regarding consumer preferences for powdered goat milk in developing countries and regions with permanent water shortages. Therefore, the main objective of this study is to examine the relative importance of consumer preferences for powdered goat milk using a multivariate approach such as Conjoint Analysis. This approach assumes that a product's value (utility) is the sum of its constituent attributes (origin, fat content, format, price), which in turn determine consumer preferences for powdered goat milk in the Coquimbo Region of Chile.

2. Theoretical framework

2.1. Market Studies and Food Products

At times, market research may not be realistic or practical. Even asking respondents about preferred prices and attributes can be risky, potentially yielding impractical results. To complicate matters, it may be difficult for respondents to react to food products with which they are unfamiliar (Giacalone et al., 2015).

There is extensive literature on methodologies for evaluating consumer preferences: attribute ranking, the Zaltman technique, Kelly's repertory grid, semantic differential, preference maps, empathic design, laddering, group analysis, category appraisal, free elicitation, information acceleration, and comparisons that elicit character traits (Prada, 2013). However, the most commonly used method for assessing consumer preferences for a set of attributes is conjoint analysis (Eversheim, 2009).

Conjoint analysis is widely used in the food industry to develop experiments that examine the interaction between the various components and characteristics of food products (Calegari et al., 2018; Decloedt, Van Landchot & Vanhaecke, 2016; Qian et al., 2022). It is used to identify and understand consumer behavior toward attributes and stimuli, as well as to study how consumers perceive different combinations of attributes that make up food product offerings (Jensen et al., 2019; Lee & Hwang, 2016; Krystallis & Ness, 2005).

In food products, intrinsic properties such as flavor, texture, and aroma affect customers' perceived value (Reis et al., 2017; Calegari et al., 2018). However, several studies also highlight the importance of extrinsic attributes—such as brand, price, and packaging—in the purchasing decisions of food products (Ahmad & Anders, 2012; Annunziata & Scarpato, 2014; Bronnmann & Asche, 2016). It is important to note that product attributes are elements that consumers consider important and that serve as the basis for decision-making (Hidayat et al., 2012; Tekea, 2021).

In the global food market, the demand for animal-origin products is expected to grow in the coming years due to increasing urbanization, population growth, and rising incomes. The average growth rate of milk production was 2.1% over the last decade, and it is projected to increase by 22% by 2027 compared to the base period of 2015–2017 (OECD/FAO, 2018). Milk and dairy products fall under the category of frequently purchased food items, which makes the factors influencing their consumption even more important (Kurajdováa et al., 2015).

In recent years, there has been a growing trend in the consumption and awareness of goat milk and its products, based on their nutritional value and high digestibility compared to other types of milk (Popescu, 2019).

2.2. Traditional Agri-food Products

Traditional agri-food products (TAPs) are usually linked to the history and culture of a specific region (Cavicchi & Santini, 2018). TAPs can command a premium price because they are perceived as authentic, which in Europe often includes certification (Balogh et al., 2016). Although traditional foods may be considered more time-consuming, consumers are often willing to make this trade-off for health reasons (Almli et al., 2011; Balogh et al., 2016). Essentially, consumers prefer to

purchase typical and traditional foods that provide them with a sense of trust, familiarity, and tradition (Espejel, Camarena & Sandoval, 2014).

Traditional channels clearly have an opportunity to attract highly involved consumers who display price inelasticity. Applying consumer science can help bring innovation to traditional agricultural products (Torquati et al., 2018). Studies such as Nazzaro et al. (2019) have shown consumer acceptance of purchasing a traditional yet innovative product. However, consumers also tend to look for foods that are easy to transport, prepare, and store—that is, they seek convenience when it comes to preparing and cooking food (Botonaki, Natos & Mattas, 2009).

All of the above leads us to the following general research questions: (1) What are the most highly valuable attributes by consumers of powdered goat milk from the Coquimbo Region of Chile?, (2) What is the best combination of attribute utilities for powdered goat milk preferred by consumers in the Coquimbo Region of Chile? (3) What is the most relevant relative attribute for consumers of powdered goat milk in the Coquimbo Region of Chile?

3. Methodology

The research employed a quantitative, explanatory, and cross-sectional approach, measuring consumer preferences by calculating marginal utility indices for the different attributes valued by consumers in powdered goat milk. A field study was conducted in the main municipalities of the Coquimbo Region of Chile: La Serena, Coquimbo, Ovalle, Illapel, and Salamanca, using a convenience sample of 188 subjects, both men and women, who were adults and consumers of traditional goat milk products (target segment).

Data collection for the study was carried out in three stages: 1º a literature review to identify the main attributes considered important when choosing traditional goat milk products and their derivatives; 2º interviews with experts (8 professionals specializing in agri-food product development) and one focus group (10 participants from the target segment) define the purchase decision characteristics, resulting in four attributes and eight proposed levels; 3º a questionnaire was applied, composed of three sections: (i) respondent characterization questions, including gender, age, family income, place of residence, education level, among others; (ii) questions regarding the purchasing behavior of traditional goat milk products, especially powdered goat milk; (iii) an experiment with 8 product alternatives that respondents had to rank based on their consumption preferences (ordinal scale from 1 to 8), using the full-profile method (Naous & Legner, 2017). Respondents assigned a value of 1 to the most desired profile and 8 to the least desired, which was necessary for conducting the conjoint analysis. The product card is shown in Figure 1.

Table 1. Proposed attributes and levels for the purchase decision experiment of powdered goat milk in the Coqimbo Region, Chile.

Experiment	Product origin	Price	Fat content	Format
Product 1	National	$19.900	Skimmed	900 gr
Product 2	International	$15.900	Skimmed	450 gr
Product 3	National	$19.900	Skimmed	450 gr
Product 4	International	$19.900	Whole	450 gr
Product 5	International	$15.900	Skimmed	900 gr
Product 6	National	$15.900	Whole	450 gr
Product 7	International	$19.900	Whole	900 gr
Product 8	National	$15.900	Whole	900 gr

Source: Own elaboration.

Figure 1. Proposed card with the 8-product alternative (experiments)

Source: Own elaboration.

For the analysis of preferences, the product valuation

formula was used, which provides an estimate of the relative importance weights of the attributes. It is based on the premise that the different levels of attributes make a partial contribution to the total utility (Naous & Legner, 2017)).

$$Valuation = \beta_0 + \sum_{i=1}^{n} \beta_{1i} D_{1i} + \sum_{j=1}^{m} \beta_{2j} D_{2j} + \sum_{k=1}^{p} \beta_{3k} D_{3k} + \sum_{l=1}^{q} \beta_{4l} D_{4l}$$

Where $\beta_{1i}, \beta_{2j}, \beta_{3k}, \beta_{4l}$ are the values associated with levels i (i=1, 2, ..., n); j (j=1,2,.....,m), k (k=1,2,....., p) and l (l=1,2,...., q), corresponding respectively to the attributes: (1) product origin, fat content (2), format (3), and, price (4). The dummy variables $D_{1i}, D_{2j}, D_{3k}, D_{4l}$ take a value of 1 if the corresponding attribute level is present, and 0 otherwise (Malhotra, 2019).

Partial utilities may reach zero contribution, indicating the lowest preference for certain levels and, therefore, the minimum contribution to the total expected utility. They may also obtain the highest score, indicating the highest level of preference (Choi et al., 2013). The estimation of the partial utility values was carried out under an additive conjoint model, whose mathematical structure is expressed through the following equation of U(*Total*):

$$U_{(Total)} = U_{(Origin)i} + U_{(fat\ content)j} + U_{(Format)k} + U_{(Price)l} + constant$$

4. Results and discussion

There is evidence that factors such as gender, age, and educational level are linked to the preference for health-beneficial foods. Table 2 shows the demographic characteristics of consumers (survey respondents) of powdered goat milk in the Coquimbo Region of Chile. 64% are female, while male consumers make up 36%. This is consistent with the findings of Nugroho et al. (2020) and Agustina et al. (2021), which suggest that women tend to have a higher consumption-oriented nature. In particular, housewives play a fundamental role in determining and deciding the food consumed by their family members. Most respondents are between 31–40 years old (46%), and the highest level of education reported is technical-professional training (44%).

Table 2. Characteristics of goat milk consumers

N.º	Characteristics	Number of respondents	Percentage (%)
1	**Gender**		
	Female	125	66
	Male	63	34
	Total	**188**	**100**
2	**Age range**		
	18-30	44	23
	31-40	87	46
	41-50	46	24
	>50	11	6
	Total	**188**	**100**
3	**Educational level**		
	High school	38	20
	Technical-professional	46	25
	University degree	84	44
	Graduate studies	20	11
	Total	188	100

Source: Own elaboration based on primary data.

4.1. Research Data Correlation Test

This correlation test aimed to determine the relationship between the research data, i.e., the combination of attributes and consumer preferences for goat milk products in the Coquimbo Region. Table 3 shows the statistical correlation of the proposed model, identifying a strong relationship between attribute combinations and consumer preferences. The Pearson correlation coefficient was 0.897, indicating that consumer preference influences up to 91.8%. This reflects a very strong correlation, supported by a significance level of 0.001. Similarly, Kendall's Tau confirmed the correlation of the proposed variables with a coefficient of 0.786.

Table 3. Statistical correlation of the proposed model

	Value	Sig.
Pearson's R	0.897	0.001
Kendall's Tau	0.786	0.003

Source: Own elaboration.

4.2. Utility Value for Each Attribute Level Based on Consumer Preferences

The utility value expresses each respondent's opinion in numerical form as a basis for determining satisfaction levels (Shingh et al., 2020; Velcovská & Larsen, 2021). The utility value reflects consumer evaluation of each attribute level using positive and negative numbers. Larger positive values indicate higher acceptance of the attribute level, while negative values indicate lower acceptance. Table 4 shows the utility values for each attribute level based on consumer preferences. The most important attribute in goat milk from the Coquimbo Region is product origin, with an importance value of 26.7%. This aligns with findings from Hoffmann et al. (2020) and Achabou et al. (2022), which emphasize the relevance of extrinsic product attributes such as the country or region of origin. This is followed by fat content (26.4%), product format (24.2%), and finally, price (22.8%).

These results suggest that consumers perceive the origin of a product as a differentiating and health-promoting image, which could be leveraged as a commercial differentiation strategy. This would enable producers to maintain and enhance competitiveness and profitability in the market (Bentivoglio et al., 2019; Toledo-Macas et al., 2021).

Table 4. Utility value by preference for each attribute level

Attribute	Level	Utility estimate	Importance value (%)
Product origin	National	0.197	26.7
	International	-0.197	
Fat content	Whole	-0.265	26.4
	Skimmed	0.265	
Product format	450 gr	0.382	24.2
	900 gr	-0.382	
Price	$15.900 CLP	0.034	22.8
	$19.900 CLP	-0.034	

Source: Own elaboration.

5. Conclusions

This study aimed to examine the relative importance of consumer preferences for powdered goat milk in the Coquimbo Region, Chile, through the application of Conjoint Analysis methodology. The results reveal that the most accepted preferences for establishing a product were: product origin, fat content, packaging format, and price.

The most highly valued attribute by surveyed consumers was product origin (26.7%), with a preference for domestic over international products. This was followed by fat content (26.4%), where skimmed milk was favored over whole milk; product format (24.2%), with a preference for smaller packages; and finally, price (22.8%), where the lower price ($15,900 CLP) was the least significant attribute. Consumers preferred the skimmed variant, which is suitable for both children and adults. They also favored the smaller package size (450 g) due to its ease of use and consumption.

The results also highlight potential alternatives for adding value and innovating in traditional agri-food products—specifically, powdered goat milk—by identifying factors for differentiation and repositioning. These findings can guide local producers in developing strategies based on product origin.

Future research could apply Conjoint Analysis to gain deeper insight into the value attributes influencing product choice and estimate willingness to pay for features like a specific origin label. This study presents limitations related to its geographic scope; therefore, it is recommended to replicate it in other regions of the country (central and southern) to validate the findings.

Ultimately, the study's results offer valuable insights for professionals and decision-makers responsible for designing and implementing targeted strategies and policies to promote the differentiation and consumer acceptance of traditional agri-food products.

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