

Is there a market for goat dairy products in the state of Paraná, Brazil?

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ABSTRACT

The objective of this work was to evaluate people's knowledge and consumption habits regarding goat milk and dairy products, as well the availability of these products in three municipalities (Londrina, Maringá, and Arapongas) in the northern region of the state of Paraná, Brazil, selected for convenience and because they are located close to the state of São Paulo, a major market that includes dairy consumption. To do this, a semi-open form, with 31 questions and hosted on Google Forms, was used. Among the 247 respondents, 47% said they did not know the difference between goat and cow milk. Images of goat UHT milk and cheese were associated (69%) with positive words or interest. The prevalence of goat dairy product consumption was associated with age group (higher milk consumption from 31 years of age and of dairy products from 41 to 60 years) and family income (46% up to three minimum wages and 27% from four to six). Cheese consumption was also associated with the number of inhabitants of the municipality and with their level of schooling. Most of the people who consume or have consumed goat milk (raw, pasteurized, long life, and powdered) and/or dairy products were motivated by taste or recommendations from friends and doctors, in this order. The main reasons pointed out for non-consumption were the lack of knowledge about this dairy product and lack of habit. Goat UHT milk and milk powder were available in all evaluated municipalities, but cheeses were found only in the two largest ones. The studied region is a potential market for the sale of goat milk products. Therefore, publicizing the health benefits of these products, through online and offline marketing strategies, as well as increasing their availability in the markets, should be taken into account.

Index terms: consumption, goat milk, marketing.

Há mercado para produtos lácteos caprinos no estado do Paraná, Brasil?

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Ideias centrais

- Images of goat UHT milk and cheese were associated with positive words or interest.
- The prevalence of goat dairy product consumption was associated with age group and family income.
- The consumption of cheeses was associated with the number of inhabitants of the city and the level of schooling.
- The consumption of goat milk and/or goat dairy products was motivated by taste, friends, or health reasons.
- Although this study was limited to a specific population in the northern region of the state of Paraná, the results obtained can be extended to regions with similar socio-economic and demographic profiles.

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RESUMO

O objetivo deste trabalho foi avaliar o conhecimento e os hábitos de consumo das pessoas referentes ao leite caprino e aos seus derivados, bem como a disponibilidade desses produtos em três municípios (Londrina, Maringá e Araçongas) da região norte do estado do Paraná, Brasil, selecionados por conveniência e por estarem localizados próximos ao estado de São Paulo, um grande mercado que inclui o consumo de laticínios. Para isto, foi aplicado um formulário semiaberto, com 31 questões, hospedado no Google Forms. Entre os 247 entrevistados, 47% afirmaram não saber a diferença entre os leites de cabra e de vaca. Imagens de leite UHT e de queijos caprinos foram associadas (69%) a palavras positivas ou interesse. A prevalência do consumo de produtos lácteos caprinos foi associada à faixa etária (maior consumo de leite a partir de 31 anos e de derivados de 41 a 60 anos) e ao rendimento familiar (46% até três salários mínimos e 27% de quatro a seis). O consumo de queijos também foi associado ao número de habitantes do município e ao seu nível de escolaridade. A maioria das pessoas que consomem ou já consumiram leite (cru, pasteurizado, longa vida ou em pó) e/ou derivados caprinos foram motivados pelo sabor ou por indicações de amigos ou médicos, nesta ordem. As principais razões apontadas para o não consumo foram a falta de conhecimento deste tipo de lácteo e a falta de hábito. Leites caprino UHT e em pó estavam disponíveis em todos os municípios avaliados, mas os queijos foram encontrados somente nos dois mais populosos. A região estudada é um mercado potencial para a venda de produtos lácteos de cabra. Portanto, deve-se considerar a divulgação dos benefícios destes produtos para a saúde, por meio de estratégias de marketing online e offline, além da sua maior disponibilização nos mercados.

Termos para indexação: consumo, leite caprino, comercialização.

INTRODUCTION

Brazil stands out in goat herding in South America, with 12.1 million head in 2020, concentrated mainly in the Northeastern region, and an average production of 9,800,000 kg goat milk per year (Embrapa Caprinos e Ovinos, 2022). In the Southern region, the state of Paraná has the largest goat herd, with 85,845 head, representing 45.62% of the region's total goat population (Magalhães et al., 2021), and produces 3,625,000 kg goat milk annually, that is, 37% of the total produced in the country (Embrapa Caprinos e Ovinos, 2022). The sector is supported by active research carried out mainly by the National Goat and Sheep Research Center of the Brazilian Agricultural Research Corporation (EMBRAPA) (Miller & Lu, 2019). To increase the production and marketing of goat milk in Brazil, regional evaluations are important to determine the true potential of each scenario, together with a study of the consumer profile (Guimarães & Cordeiro, 2015).

In Brazil, 70% of the goat herds belong to small producers, who own 80% of the rural properties (Lucena et al., 2020). However, the goat milk production chain is more organized in the Southern and Southeastern regions of the country, based on a more professional and technical production structure (Delgado Junior et al., 2020a). In either context, dairy goat farming is an excellent option for the generation of employment and income due to the nutritional quality of the milk and the rusticity of the goats (Delgado Junior et al., 2020b).

Therefore, because of their health and nutritional benefits, the demand for dairy goat products is rising in both traditional and new markets (Miller & Lu, 2019), including, in addition to fluid milk, cheeses, yogurt, dulce de leche, ice cream, functional products, and cosmetics (Martins et al., 2007; Embrapa Caprinos e Ovinos, 2018; Rios et al., 2018). This increased demand can also be attributed to the COVID-19 pandemic, considering the immunity-boosting benefits of goat milk (Imarc, 2022). Goat milk is more digestible than that of dairy cows and has a mild odor and a sweet and pleasant taste (Furtado, 1988; Park & Haenlein, 2006), consisting, on average, of 3.85% (3.08 to 4.25%) fat, 3.7% (2.8 to 5.8%) protein, and 4.3% lactose (Park, 2007; Prosser, 2021). The size of the fat globules and casein micelles, in addition to the low frequency of α 1-casein, makes goat dairy products a great alternative for individuals with protein malabsorption syndrome, gastritis, osteoporosis, and allergy to dairy cow milk (Park, 2007). For these reasons, goat dairy products have been an alternative to cow milk for people with certain food diseases.

The objective of this work was to evaluate people's knowledge and consumption habits regarding goat milk and dairy products, as well the availability of these products in three municipalities (Londrina, Maringá, and Araçongas) in the northern region of the state of Paraná, Brazil, selected for convenience and because they are located close to the state of São Paulo, a major market that includes dairy consumption.

MATERIALS AND METHODS

First stage

The research was carried out in two stages, from 2019 to 2021. A descriptive research was used to determine the profile of the group of participating consumers (questionnaire respondents), including their knowledge about goat milk and dairy products, and the reasons for consuming or not these foods. A semi-open structured questionnaire, with 31 questions in Portuguese and hosted by Google Forms™, was sent to the participants through social networks and WhatsApp groups. Therefore, the criteria for the inclusion of the participants, from both sexes and over the age of 18, was to be connected to social media (social networks and WhatsApp) and to have consumed milk and/or dairy products. The research was approved by the ethics committee of Universidade Pitágoras UNOPAR under protocol number 3,651,677.

The questionnaire was divided into two sections. The first covered socio-demographic questions, such as gender, age, family income, place of residence, and schooling. The second was related to the consumption of milk and dairy products of any animal species, knowledge about goat milk and/or dairy products, and consumption habits. The questionnaire was piloted with a sample of ten consumers, who did not participate in the final study, in order to evaluate the time and ease of completion, as well as the existence of ambiguity.

As the milk and dairy consumers connected on the internet were the target group of the present study, the appropriate sample size was based on the number of internet users in Brazil (nearly 149 million people in 2020), following the formula: $Ss = (Z^2 \times p(1-p))/\mathcal{E}^2$, where Ss is the sample size, Z is the Z-value (e.g., 1.96 for a 95% confidence level), p is the estimated prevalence (e.g., estimated prevalence of the consumption of goat milk on population = 0.5), and \mathcal{E} is the confidence interval. In this way and using a confidence level of 95% and a 5% margin of error, it was estimated that 385 cases would be required to obtain results that reflect the target population (IBGE-SIDRA, 2021).

Second stage

The availability of goat milk and dairy products was verified in formal (products validated by the inspection service) and informal (products not validated by the inspection service) markets of three municipalities (Londrina, Maringá, and Araçongas) located in the northern region of the state of Paraná. These municipalities were selected because they show important characteristics for the study of the consumer market: Londrina and Maringá are among the three largest municipalities and among the four with the highest current gross domestic product in the state; and Araçongas, although representing a smaller consumer market, is between the 20 most populous municipalities in the state (IBGE, 2022) (Table 1). In addition, the municipalities are also close to the state of São Paulo, which is a major consumer market, also of dairy products.

Table 1. Characteristics of the three Brazilian municipalities used for the study of the consumer market of goat dairy products.

Municipality	Location	Population
Londrina	Latitude: 23°17'34"S, Longitude: 51°10'24"W	580,870
Maringá	Latitude: 23°25'38"S, Longitude: 51°56'15"W	436,472
Araçongas	Latitude: 23°24'56.78"S, Longitude: 51°25'35.06"W	126,545

A total of 12 different stores of the main supermarket chains and grocery stores, 3 main street markets, and 3 rural properties were visited. The types of goat milk products marketed were recorded, and the information displayed on their labels was cross-examined.

Statistical analyses

The chi-square correlation test was used to verify whether the prevalence of consumption of goat milk and dairy products differed among participants regarding the evaluated socio-economic variables (gender, age, place of residence, and income). The analysis of adjusted residues was used as a post hoc test. Data were analyzed using the Statistica, version 10.0, software (TIBCO Software Inc., Palo Alto, CA, USA), at 5% probability.

RESULTS AND DISCUSSION

Unfortunately, the sample size was below the expected to reflect the target population with the intended margin of error of 5%. A total of 267 questionnaires were answered, of which 247 were valid for the statistical analysis and data discussion, resulting in a 6.2% margin of error.

Respondents' profile and knowledge about goat dairy products

The majority of the 247 respondents were female (79%), had completed higher education (52%), were between 18 and 30 years old (56%), had an income of up to six minimum wages (68%), came from municipalities with 101,000 to 600,000 inhabitants (55%), and belonged to families of three or four people (57%).

Fluid milk (67%) and dairy products (76%) of either animal species were consumed by most respondents, and 86% of them had the habit of ingesting from one to two glasses (200 mL) of milk per day. A total of 38% of the participants consumed milk and dairy products five or more times a week, and 35%, once to twice a week.

Yogurts (32%), butter (27%), and cheeses (25%) were the most consumed dairy products, and 52% of the respondents consumed these foods five or more times a week. Of the participants of the survey, 86% had the habit of buying dairy products mainly in grocery stores and supermarkets.

When asked about the difference between goat and cow milk, 47% of the respondents answered that they did not know, whereas 50.4% had some or little knowledge. These results emphasize the need of this production sector disseminating more information to potential consumers about the high nutritional value of goat dairy products, especially for elderly and children, and about other health benefits such as a greater digestibility, lower allergenic potential, and improvement of the body's immune response (Santos et al., 2019).

The participants were shown images of UHT goat milk and cheese, containing both the product's name and a picture of a goat, which were associated by the majority (69%) with positive or interesting words. Of the respondents, 23% used the words "yummy", "delicious", "strong", and "healthy", and 36.4%, "different", "unusual", "curious", and "interesting". Other positive words, although less expressive, were "childhood", "I'd like to test", "dairy products", "sweetness", and "rural". This result indicates the interest of the participants in obtaining information about goat dairy products, making them potential consumers of this segment. Conversely, negative terms such as "bad", "strange, and "strong and bad smell" were used by 21% of the respondents, whereas "high price" was also cited by 17% of them. Despite having a lower consumer acceptance than cow milk, several goat milk products have been developed over the last decade, such as functional drinks, yogurts, cheeses, flavored milk varieties with a low-sugar and fat-free content, and goat milk-based infant formulas (Imarc, 2022; Santos et al., 2022). In Europe, Miller & Lu (2019) reported that consumers associate goat milk with natural, rural, and sustainable farming, choosing to purchase it to support a way of life they value. However, in Brazil, to increase the availability and number of consumers of goat dairy products in the market, there needs to be a policy for publicizing these products and their benefits.

Characteristics of the consumption of goat dairy products

Most respondents who consume or have already consumed goat milk and/or goat dairy products were motivated by taste, followed by the recommendations of friends and doctors (Table 2). Half of the participants were motivated due to health issues as “intolerance”, followed by “sensitivity” or “allergy”, which, together, covered 21% of the answers. Cow milk allergy is one of the most common food allergies among children, affecting 1.9 to 4.9% of them (Vieira et al., 2020), explaining why children and other individuals who require special milk consume large amounts of goat dairy products (Guimarães & Cordeiro, 2015). The α 1-casein protein associated with allergic processes is present in cow milk at a concentration of 12 to 15 g L⁻¹, while, in goat milk, its maximum amount is 7 g L⁻¹, which makes the latter and its products potential good foods for individuals allergic to the former. In addition, the fat globules and casein micelles of goat milk are significantly lower than those of cow milk, allowing of a better digestibility, which is especially important for children and elderly people (Park, 2007; Anjos et al., 2020). Santos et al. (2022) added that the quality, safety, sensory attractiveness, nutritional value observed in goat dairies are what consumers search for in a product.

Table 2. Relative frequency patterns of the consumption of goat milk and dairy products among 247 respondents from the state of Paraná, Brazil⁽¹⁾.

	Milk (%)	Dairy product (%)
Reason for consumption		
Flavor	30.00b	40.45b
Recommended by friends	23.75b	30.34b
Recommended by doctors	20.00b	11.24a
Healthy/strong	12.50a	7.87a
Habit of the region	8.75a	7.87a
Easy digestibility	5.00a	2.25a
X ² ; p	21.85; <0.01	61.14; <0.01
Reason for lack of consumption		
Never thought about it	30.65b	28.27b
Lack of habit	25.27b	32.98b
Lack of information	17.74a	16.23b
Lack of supply	11.83a	19.90b
High price	6.45a	0.00a
Unpleasant smell	4.84a	1.57a
Lack of trust	3.23a	1.05a
X ² ; p	88.43; <0.01	101.24; <0.01
Consumption frequency		
Once	64.56c	53.33b
Eventual	31.65b	43.33b
Five or more times a week	3.80a	3.33a
X ² ; p	43.85; <0.01	37.80; <0.01
Place of purchase		
Grocery stores and/or bakeries	53.85c	56.32b
Directly from the producer	37.18b	28.74b
Street market	3.85a	10.34a
Own production	3.85a	3.45a
Door to door	1.28a	1.15a
X ² ; p	90.20; <0.01	92.14; <0.01
Consumed product		
Pasteurized	42.68b	-
Raw	36.59b	-
Long life	18.29a	-
Powder	2.44a	-
X ² ; p	32.83; <0.01	-

⁽¹⁾Percentages followed by equal letters, in the same column, do not differ by the chi-square test, at 5% probability.

Less than 4% of the respondents declared themselves to be assiduous consumers (at a frequency equal to or above five times a week) of goat milk and dairy products, although they frequently consumed dairy products of other animal species. This result highlights that the participants have the habit of consuming dairy products, just not of goat origin. The main reasons pointed out for non-consumption were the lack of knowledge and habit, which, together, represented more than 55% of the answers.

The most consumed type of goat milk was pasteurized (43%), followed by raw milk (37%), long life (18%), and powder milk (2.5%). More than half of the participants reported purchasing milk (54%) and dairy products (56%) from grocery stores and/or bakeries. Furthermore, the goat milk purchased by most respondents (71%) was not used in the production of dairy products but only of beverages (Table 2). In Brazil, the little data available on the consumption of fluid goat milk comes from the Northeastern region, where milk goat farming is more expressive. Still, Lucena et al. (2018) found that the average per capita consumption in the state of Ceará was only 3.2 L goat milk per inhabitant per year. Once again, although goat milk is an excellent matrix for the development of dairy products, its low consumption is associated with the low or lack of knowledge about its therapeutic and nutritional benefits (Guimarães & Cordeiro, 2015; Zine-Eddine et al., 2021).

Although most of the goat milk consumed is heat-treated, more than a third (37%) of the participants consume raw milk obtained in the informal trade (Table 2), which could represent a zoonotic risk. The main pathogens associated with this habit are *Brucella melitensis*, *Campylobacter* spp., *Listeria* spp., *Salmonella* spp., Shiga-toxin producing *Escherichia coli*, *Staphylococcus aureus*, tick-borne encephalitis virus, and *Toxoplasma gondii* (Brom et al., 2020). On average, 41% of the respondents said that they acquired goat milk and dairy products informally from street markets, street vendors, and directly from the producers.

Demographic characteristics and consumption of goat dairy products

Although the majority of the respondents were aged between 18 and 30 years (56%), most consumers of goat milk were 31 years old and over, while those of dairy products were from 41 to 60 years old (Table 2). These results show that different ages should be considered, depending on the type of goat dairy product to be publicized. Moreover, although 79% of the dairy product consumers were female, there was no difference in the consumption of goat milk and dairy products between both genders.

Most consumers of goat dairy products had family incomes between zero and three (46%) and between four and six (27%) minimum wages, with one minimum wage being equivalent to \$197.00 (Table 3). Although the different family incomes did not significantly affect the consumption of goat milk and dairy products, it should be noted that these products have a higher market value than those obtained from cows: the liter of UHT goat milk, for example, costs four to ten times more than a liter of cow milk (Accomig, 2022); and goat dairy products, such as cheeses, are considered gourmet products (Delgado Junior et al., 2020a).

The prevalence of consumers who have already tasted goat dairy products was higher among the respondents with a complete higher education and who lived in municipalities with a population from 301,000 to 600,000 inhabitants (Table 3). Therefore, a higher level of education may contribute to a greater knowledge about the benefits of consuming goat dairy products. In addition, it is possible to associate the greater availability of these products with municipalities with a higher number of inhabitants. However, differently from what was observed for dairy products, the size of the population and schooling were not correlated to the consumption of goat fluid milk.

Table 3. Prevalence of consumers (n = 247 respondents) who have already tasted goat milk and dairy products, categorized by age group, gender, population of place of residence, schooling, and family income⁽¹⁾.

Factor	Prevalence of milk consumption (%)	Prevalence of dairy product consumption (%)
Age group		
18–25	17.57a	10.61a
26–30	16.67a	18.18a
31–40	38.78b	40.00b
41–50	42.31b	40.00b
51–60	38.46b	36.36b
>60	40.00b	25.00a
X ² ; p	17.20; <0.01	19.55; <0.01
Gender		
Female	27.55a	26.35a
Male	31.37a	23.26a
X ² ; p	0.29; 0.59	0.17; 0.68
Population of place of residence		
<51 thousand	30.30a	25.00a
51–100 thousand	33.33a	14.29a
101–300 thousand	21.79a	12.31a
301–600 thousand	33.06a	36.54b
> 1 million	11.11a	0.00a
X ² ; p	4.73; 0.32	9.37; 0.02
Schooling		
Incomplete primary school	30.00a	12.50a
Complete primary school	10.53a	5.26a
Incomplete high school	21.05a	11.11a
Complete high school	22.86a	8.82a
Incomplete higher education	17.14a	18.52a
Complete higher education	36.43a	40.38b
X ² ; p	5.08; 0.41	17.56; <0.01
Income ⁽²⁾		
0–3 wages	20.35a	11.11a
4–6 wages	28.36a	13.58a
>7 wages	41.79a	23.64a
X ² ; p	0.46; 0.79	2.60; 0.46

⁽¹⁾Proportions followed by equal letters, in the same column, do not differ by the chi-square test, at 5% probability.⁽²⁾Minimum wage value = \$197.00

Availability of goat dairy products for sale

In Arapongas, the municipality with the lowest number of inhabitants, only two types of goat dairy products (UHT milk and milk powder) were found. In Londrina, in addition to UHT milk (40%) and milk powder (30%), cheeses (30%) of three different brands (B, C, and D) were for sale. In these municipalities, UHT milk was the only goat dairy product found in all visited stores (Table 4). In Maringá, the goat dairy products available were the same as in Londrina, but they were found in a higher number of supermarkets (Table 4), which had UHT milk (37%), milk powder (36%), and cheeses (27%) of brands B and C.

Table 4. Brands and availability of goat milk products in 12 of the main supermarket chains and grocery stores in the municipalities of Londrina, Arapongas, and Maringá, in the state of Paraná, Brazil.

Goat milk product	Londrina Brand (availability)	Maringá Brand (availability)	Arapongas Brand (availability)
UHT milk	A (100%)	A (100%)	A (75%)
Milk powder	A (75%)	A (100%)	A (75%)
Cheese	B (25%) C (25%) D (25%)	B (50%) C (50%)	Not found

The UHT and powdered milk that were available in all municipalities belonged to the same brand (A). Cheese, which is an important production in the dairy sector due to its specific sensory characteristics (Bermudez-Aguirre & Cánovas, 2015), was only found in the main supermarkets of the two largest municipalities (Londrina and Maringá) under a greater diversity of brands. Although other municipalities in the state of Paraná, such as Arapoti, Carambeí and Campos Floridos, benefit from goat milk and produce cheeses and yogurts, the supermarkets visited in the present study did not have products from these places.

The sale of goat milk and dairy products was not observed in the street markets visited. In the rural properties in Londrina and Maringá, raw milk, dulce de leche, and fresh cheese were available for purchase.

In Brazil, the availability of goat dairy products is higher than that observed in the present study. Among the main products marketed are pasteurized and/or frozen, sterilized, or UHT whole goat milk; assorted cheeses, such as frescal, Boursin, Moleson, Chevrotin, Chabichou, Crostin, Saint Maure, and Piramide; and different flavors of ice cream (Delgado Junior et al., 2020a). There is also a specific niche in gastronomy for goat milk and dairy products, used to produce sauces and several different meals (Silva & Favarin, 2020).

CONCLUSIONS

The studied region is a potential market for the sale of goat dairy products. Therefore, in the marketing of this sector, it is important to disseminate the benefits of goat milk to health, which is a current trend, as well to increase the availability of these products in the markets. This can be done through online marketing strategies, such as the use of social media, blogs, and websites. Moreover, it can be effective to approach dairy consumers in supermarkets, presenting and distributing to them visual materials and recipes with goat milk, also promoting their sensory experience through product tastings.

Although the present study was limited to a specific population in the northern region of the state of Paraná, the obtained results can be extended to regions with similar socio-economic and demographic profiles.

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