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https://doi.org/10.22239/2317-269x.02109

Online trade of products of animal origin in southeastern Brazil: a user profile analysis, sanitary aspects and consumer rights

Comércio *online* de produtos de origem animal no sudeste do Brasil: uma análise do perfil do usuário, aspectos sanitários e de direito do consumidor*

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* The manifestations recorded in this work are their own opinion, of a personal nature and do not reflect, necessarily, the positioning official from the Ministry of Agriculture and Livestock, Várzea Paulista, São Paulo Brazil.

Received: Aug 20, 2022
Approved: Jun 20, 2023

How to cite: Esper LCN, Belo VS, Vasconcelos TCB, Moutinho FFB - Online trade of products of animal origin in southeastern Brazil: a user profile analysis, sanitary aspects and consumer rights. Vigil Sanit Debate, Rio de Janeiro, 2023, v.11: e02109. https://doi.org/10.22239/2317-269X.02109

ABSTRACT

Introduction: The internet's expansion has opened possibilities for the food trade. However, its actors do not always comply with current regulations, creating a potential risk to consumers or public health. **Objective:** To analyze the user profile of online trade of animal products and discuss sanitary and consumer rights risks. **Method:** In a sample of 192 users from the Brazilian southeastern region, an electronic questionnaire was applied with options to choose between labeled and unlabeled products, and with a survey of social information. **Results:** A preference for labeled products was identified, mainly for reasons of presentation/packaging or data on the label. When the option chosen was the unlabeled product, it was evident that motivations were related to believing that such products would be natural/crafted. However, the knowledge about the registration needs of these products did not follow this trend. Among those interviewed, 41.2% had never heard about the inspection stamps. There was no significant association between this knowledge and schooling or family income; in most of the associations, there was no association between the choice of a labeled or unlabeled product and these same variables. **Conclusions:** The user of this type of online trade has a profile characterized by an insufficient knowledge about product inspection and registration, in all income and schooling ranges. Therefore, sanitary and consumer rights education is necessary at all levels of society.

KEYWORDS: Online Trade; Food Inspection; Food Safety

RESUMO

Introdução: A expansão da internet tem aberto possibilidades para o comércio de alimentos. No entanto, seus atores nem sempre cumprem as normas vigentes, gerando risco ao consumidor ou à saúde pública. **Objetivo:** Analisar o perfil do usuário do comércio *online* de alimentos de origem animal e os riscos sanitários e de direito do consumidor. **Método:** Em uma amostra de 192 usuários da Região Sudeste do Brasil, foi aplicado um questionário eletrônico com opções de escolha entre produtos rotulados e não rotulados e com um levantamento conjunto de informações sociais. **Resultados:** Identificou-se a preferência pelos produtos rotulados, principalmente por questões de apresentação/embalagem ou informações no rótulo. Porém, quando da opção pelo produto não rotulado, foi notória a motivação por se acreditar que tais produtos seriam naturais/artesanais, sem que o conhecimento quanto à necessidade de registro dos produtos acompanhasse tal movimento. Dos entrevistados, 41,2% nunca tinham ouvido falar em carimbos de inspeção. Não houve associação significativa entre o conhecimento sobre tais carimbos e a escolaridade ou a renda; nem a análise da maioria das associações entre escolha por um produto rotulado ou não rotulado e essas mesmas variáveis. **Conclusões:** O usuário desse tipo de comércio *online* tem perfil caracterizado

como deficiente em relação ao conhecimento sobre fiscalização, inspeção e registro de produtos, sendo representado por todas as faixas de renda e escolaridade, fazendo-se necessária uma educação sanitária e quanto aos direitos do consumidor, em todos os níveis da sociedade.

PALAVRAS-CHAVE: Comércio *Online*; Inspeção de Alimentos; Segurança dos Alimentos

INTRODUCTION

Over the years, trade has undergone several changes, with the main concept being the exchange of goods and services. While in the early days it was based on the model of exchanges between families with the aim of sustaining and avoiding the waste of products[1], today a new reality is being imposed on economies through technological platforms[2]. E-commerce is based on financial and commercial transactions conducted via internet access or on the internet, bringing the supply of goods and services closer together, bringing agility and speed to transactions, as well as reducing costs due to the absence of geographical borders[3].

Such activities through electronic means have proved even more relevant during the COVID-19 health crisis. During the pandemic, all market niches had to review their concepts of sales channels and consumer reach. In relation to agricultural products, this movement has been highlighted in Brazil, in the state of Rio Grande do Sul, where studies and the creation of digital platforms have been observed, seeking sales for the disposal of family farmers' production as alternatives to overcome impacts during the pandemic[4,5,6]. However, it's worth remembering that there are also important pre-pandemic initiatives, such as the Integrated Marketing System for Family Farming Products (SIPAF) along with the *Terra Crioula* fair website[7] and the *Comida da Gente* platform[8], all in the state of Rio de Janeiro. SIPAF is a *web* server that manages a virtual store, generating data for the fair organizers and streamlining and simplifying the process of marketing agroecological products[7]. *Comida da Gente*, meanwhile, is a digital platform that has been touted as a facilitator of conscious organic consumption[8]. It should be noted that, even after COVID-19, which theoretically boosted these services, the geographical distribution of family farming digital markets has not become homogeneous across the country, with initiatives leading the way in the Northeast and South, followed by the Midwest and Southeast, while there is still a lack of initiatives in the North[9].

This whole context has brought challenges for the health care and consumer rights of individuals who spontaneously acquire consumer goods. In this area, products of animal origin (PAO) have gained prominence, requiring prior inspection in order to be offered safely to the consumer. All industrial PAo establishments must be registered with the inspection body and their products must be shipped with labels containing the mandatory information provided for in the legislation in force and stamped by the industrial and sanitary inspection service10, be it the Municipal Inspection Service (SIM - for municipal sales); State Inspection Service (SIE - for state sales); Brazilian System of Inspection of Products of Animal Origin (SISBI - for national sales); Federal Inspection Service (SIF - for national and international sales); or Art Seal (for national sales of artisanal products)[11,12].

Despite an extensive regulatory framework for PAO, aimed at ensuring the regulation of these foods from production to consumption, Brazilian PAO e-commerce seems to lack specific regulations on the subject. At the same time, the supply and commercialization of POA through *online* commerce occurs deliberately in Brazil, with greater evidence for meat products and with a greater concentration of offers in the Southeast Region, with evidence of crimes being observed, both from a health perspective and in terms of consumer rights[13].

Since online food commerce and its growth is a relatively recent activity, there is no analysis in the literature of the profile of the consumer involved in these transactions. In view of this situation, the aim of this study was to build and analyze the profile of the user of *online* commerce in POA, based on the Southeast Region of Brazil, in order to compare the results with health legislation, promoting a broad discussion about the possible risks to which the population may be exposed depending on their choices as consumers.

METHOD

This research was carried out by applying a semi-structured electronic questionnaire, from December 2021 to January 2022, on the profile and preferences of *online* PAO commerce users. The questionnaire was applied to a non-probabilistic sample of 200 users from the Southeast of Brazil using the "snowball" collection methodology. In this methodology, the survey questionnaire was made available to a group of people who met the desired characteristics for the sample, in this case, residing in the Southeast Region and being over 18 years old. From these initial participants, the questionnaire was passed on by these people to other possible participants who had the same characteristics or desired inclusion criteria, and so on and so forth[14].

When the expected number had been reached, the collection of responses ended. The questionnaires were made available by the researchers to the participants via a *link to the* Google Forms program, through the social networks *Facebook* and *WhatsApp*.

Through the questionnaire, the interviewees were shown images of POA in order to ascertain their choice profile in a potential *online* purchase of these products. They were presented with the options listed in the Chart, always comparing an unlabeled

Chart. Products and prices presented by photographic means to consumers of products of animal origin when shopping *online*, in the Southeast Region of Brazil, to observe their free choice options, between labeled and unlabeled products of the same type (2021).

Unlabeled products	Labeled products
Honey 200 g - R$ 19,00	Honey 200 g - R$ 16,50
Milk 1 L - R$ 3,50	Milk 1 L - R$ 4,90
Sausage 300 g - R$ 9,00	Sausage 300 g - R$ 7,90
Chicken 1 kg - R$ 6,90	Chicken 1 kg - R$ 9,80
Chicken eggs by the dozen - R$ 8,90	Chicken eggs by the dozen - R$ 7,50
Minas frescal cheese 1 kg - R$ 29,90	Minas frescal cheese 1 kg - R$ 26,50

Source: Prepared by the authors, 2022.

product, which is therefore not registered with a inspector body, with a labeled food of the same type.

Immediately after choosing between one or the other product (labeled or unlabeled), the interviewees were asked why they had chosen it, with the following options: "price", "presentation/packaging", "information on the label", or "other", the latter with an open response option. More than one option could be selected.

The results obtained from the questionnaires were evaluated using Excel® *software* with descriptive statistical analysis techniques (absolute and relative frequencies).

Pearson's chi-square test was used to analyze possible associations between the choice of labeled or unlabeled products, as well as knowledge about inspection stamps, education, and income, using the *Statistical Package for the Social Sciences* (SPSS).

This project was approved by the Research Ethics Committee of the Universidade Federal Fluminense, Nova Friburgo, RJ, under CAAE number 52100921.1.0000.5243.

RESULTS

Of the 200 questionnaires answered, 192 were included in the study, given that seven participants did not meet the inclusion criteria of belonging to the Southeast Region of Brazil and one chose not to accept the Free and Informed Consent Form and withdrew from taking part in the research.

From the choice between labeled and unlabeled products, the following results were obtained:

For honey, the respondents who chose the product honey 200 g - R$ 16.50 (labeled) or the product honey 200 g - R$ 19.00 (unlabeled) totaled 192 valid responses. Of these, 164 (85.4%) respondents chose the labeled product, compared to 28 (14.6%) who chose the unlabeled product.

For milk, three interviewees didn't indicate a choice, so the valid answers were 189 instead of 192. In this universe, 146 (77.3%) consumers chose the product milk 1 L - R$ 4.90 (labeled) and 43 (22.7%) chose milk 1 L - R$ 3.50 (unlabeled).

It was observed that, for honey, 50.0% (14/28) of the interviewees who preferred the more expensive, unlabeled honey did so because they believed it to be "homemade" or "natural" or "pure" or "less industrialized" or "not industrialized" or "artisanal" or "direct from the farmer", which were the terms used by consumers when they chose the open response option.

It can be seen that for milk, 48.8% (21/43) of the consumers who opted for the unlabeled product chose this option because they thought it was "unprocessed" or "less processed" or "natural" or "homemade" or "without chemicals" or "without preservatives" or "direct from the producer" or "purer" or "from the farm" or "raw".

As for the sausage, 13 interviewees did not give a choice, so the total number of responses was 179. Of these, 131 (73.2%) chose the sausage product 300 g - R$7.90 (labeled), while 48 (26.8%) chose sausage 300 g - R$9.00 (unlabeled).

For the chicken product, seven interviewees didn't answer, so 185 responses were obtained. Of these consumers, 159 (85.9%) chose the whole chicken 1 kg - R$ 9.80 (labeled) and 26 (14.1%) chose the whole chicken 1 kg - R$ 6.90 (unlabeled).

It should be highlighted that, for sausage, 39.6% (19/48) of the interviewees who opted for the more expensive unlabeled product chose it because they thought it would be "homemade" or "artisanal", "less or not industrialized", "without condiments", "healthier" or "tastier because it's homemade".

As for the chicken product, 46.2% (12/26) of the consumers who preferred the unlabeled product did so because they believed that, due to its appearance, it was "natural" or "more natural", "not industrialized" or "less industrialized", homemade", "without preservatives", "more artisanal" or "from small producers" or "organic".

For the eggs, five interviewees didn't answer, which resulted in 187 responses. Of these, 116 people (62.0%) chose hen's eggs by the dozen - R$7.50 (labeled) and 71 (38.0%) chose the product hen's eggs by the dozen - R$8.90 (unlabeled).

For cheese, five respondents did not answer, bringing the total to 187. Of these, 132 (70.6%) chose the product minas frescal cheese 1 kg - R$ 26.50 (labeled), while 55 (29.4%) chose minas frescal cheese - 1 kg R$ 29.90 (unlabeled).

It was found that 33.8% (24/71) of consumers who opted for unlabeled bulk eggs chose them because they believed them to be "natural", "free-range", "tastier and healthier because they are free-range", "direct from the producer or farm", "less or not industrialized", "because they thought it was organic", "fresh", "healthy", "from a small farm", "homemade", "home-grown", "because of animal welfare (if the chickens are free-range)", or because "they had fewer hormones".

For cheese, 47.3% (26/55) of the people who opted for the more expensive product without packaging or a label chose it because they thought it was "natural", "homemade", "not

industrialized", "because of the possible better taste", because it would be "chemical-free" or "without so many chemical processes" or "fresh", "artisanal" or "raw artisanal" or "direct from the producer", these being the main terms used in the open-ended responses.

For each product, the open question option in the questionnaire generated a wide variety of responses which, for better analysis and due to the characteristics of the motivations obtained, were grouped into two large groups which could be defined as: 1) Consumers who believe that unlabeled products, i.e. informal, would be artisanal, natural or less industrialized, which we will call the "Natural/artisanal" group and 2) Consumers who believe that labeled products have known provenance, greater reliability and safety, which we will call "Provenance/registration". Responses that did not fit into any of the defined universes or when the interviewee did not indicate any answer for their motivation are presented as "No answer as to motivation for choice or other answers".

The reasons for choosing the POA involved in this research are shown in Table 1.

At the end of the questionnaire assessing the user profile of POA *online* shopping, consumers were asked if they had ever heard of SIM, SIE, SISB, or SIF stamps (official inspection stamps). One hundred and eleven people (57.8%) had heard of the stamps, while 79 (41.2%) had never heard of them. Two consumers did not respond (1.0%).

Also in this study, a profile of the interviewees was collected in relation to education and income. In terms of education, there were two people with completed primary education (1.0%), 45 with completed secondary education (23.4%), 61 with completed higher education (31.8%), 47 with *lato sensu* postgraduate degrees (24.5%), and 37 with *stricto sensu* postgraduate degrees - masters or doctorate (19.3%). As for income, 26 (13.5%) interviewees earned up to two minimum wages (up to R$2,200), 39 (20.3%) earned between two and four minimum wages (R$2,200 to R$4,400), 82 (42.7%) earned between four and 10 minimum wages (R$4,400 to R$11,000), 38 (19.8%) earned between 10 and 20 minimum wages (R$11,000 to R$22,000), five (2.6%) earned over 20 minimum wages, and two (1.0%) didn't answer.

From the relationships between the variables studied, it can be seen that the greatest acceptance of an unlabeled product with the "Natural/artisanal" criterion was for minas frescal cheese (13.5% of consumers). For those who felt that the information on the label made a difference to their decision, 42.2% did so for labeled honey, which was the product with the highest number of choices due to this motivation.

It can be seen that we identified choices motivated solely by the price factor, regardless of other variables. Most of the time, for all the products, this choice was motivated by the lowest price. This choice was most notable for the minas frescal cheese product, for which 5.2% of consumers determined their choice solely by the price factor, when this was lower than the other product option in the same category (regardless of whether it was labeled or not). Despite this, there was no significant difference between the choice of labeled and unlabeled cheese and the consumer's family income, although the descriptive analysis showed that those consumers who opted exclusively for the lower price of the cheese were distributed in all family income brackets, except the highest (over 20 minimum wages).

Regarding knowledge of inspection stamps, there was no significant association ($p > 0.05$) between knowledge or lack of knowledge of these stamps and the variables of schooling and family income.

Most of the other results did not generate sufficient statistical evidence ($p > 0.05$) to demonstrate a significant difference between the choice of a labeled/registered product or an unlabeled/unregistered one, and the different levels of education or family income, with the exception of the relationship between the choice of minas frescal cheese and education ($p < 0.05$); and the choice of honey and milk products, associated with income levels ($p < 0.05$). For all three products, the majority of consumers opted for the labeled option. For cheese, the lowest proportion of consumers with complete secondary education chose the labeled option. For honey and milk, the lowest proportion choosing the labeled product was for consumers with an income of up to two minimum wages.

All the results relating to the associations between the variables studied, their proportions and the *p-values* found using Pearson's chi-squared test are available in Tables 2, 3, and 4.

DISCUSSION

When consumers were shown photos of labeled and unlabeled products (honey, milk, sausages, chicken, eggs, and cheese), it was observed that there is still a certain preference for labeled products for all the products analyzed. The percentages for choosing a product with packaging and a label were always higher, and the main motivations for this choice were presentation/packaging issues or the information on the label, which had higher percentages than the motivations indicated within the subgroup of consumers who opted for labeled products (from 36.6% to 54.1%). In smaller percentages in this sub-group (0.9% to 5.5%), there were consumers who opted for labeled products because they believed them to be of known origin, more reliable and safer. The factor of choosing exclusively on the basis of price was noticed, especially when the price was lower, although in smaller percentages.

The observation that consumers choose lower prices exclusively, regardless of other factors such as presentation/packaging, information on the label, artisanal characteristics or origin, may be a reflection of the social inequality that is still notorious in Brazil. In this sense, this survey generally reached consumers from all income levels in the 2021 classification of the Brazilian Institute of Geography and Statistics (IBGE), ranging from families earning up to two minimum wages (up

Table 1. Distribution of choices made by consumers of products of animal origin when shopping online for the following products: honey 200 g, milk 1 L, sausage 300 g, whole chicken 1 kg, chicken eggs by the dozen, and minas frescal cheese 1 kg, with the respective price options, in the Southeast Region of Brazil. Data obtained from December 2021 to January 2022.

Reason for choice	Chosen product	
	Honey 200 g - R$ 16.50 (labeled): 164 respondents (85.4%)	Honey 200 g - R$ 19.00 (unlabeled): 28 respondents (14.6%)
Price	5,5%	10,7%
Presentation/packaging	36,6%	32,1%
Information on the label	49,4%	-
Price + Presentation/packaging	1,2%	-
"Natural/artisanal"	-	50,0%
"Origin/registration"	3,7%	-
"No answer or other answers"	3,7%	7,1%
Reason for choice	**Chosen product**	
	1 L milk - R$ 4.90 (labeled): 146 respondents (77.3%)	1 L milk - R$3.50 (unlabeled): 43 respondents (22.7%)
Price	2,1%	18,6%
Presentation/packaging	45,2%	20,9%
Information on the label	43,8%	-
"Natural/artisanal"	-	48,8%
"Origin/registration"	5,5%	-
"No answer or other answers"	34,3%	11,6%
Reason for choice	**Chosen product**	
	Sausage 300 g - R$ 7.90 (labeled): 131 respondents (73.2%)	Sausage 300 g - R$ 9.00 (unlabeled): 48 respondents (26.8%)
Price	6,1%	6,3%
Presentation/packaging	42,0%	37,5%
Information on the label	47,3%	-
Price + Presentation/packaging	0,8%	-
"Natural/artisanal"	-	39,6%
"Origin/registration"	2,3%	-
"No answer or other answers"	1,5%	16,7%
Reason for choice	**Chosen product**	
	Whole chicken 1 kg - R$9.80 (labeled): 159 respondents (85.9%)	Whole chicken 1 kg - R$ 6.90 (unlabeled): 26 respondents (14.1%)
Price	-	15,4%
Presentation/packaging	54,1%	11,5%
Information on the label	40,9%	-
"Natural/artisanal"	-	46,2%
"Origin/registration"	2,5%	-
"No answer or other answers"	2,5%	26,9%
Reason for choice	**Chosen product**	
	Dozen chicken eggs - R$7.50 (labeled): 116 respondents (62.0%)	Dozen chicken eggs - R$8.90 (unlabeled): 71 respondents (38.0%)
Price	20,7%	8,5%
Presentation/packaging	43,1%	32,4%
Information on the label	31,9%	-
"Natural/artisanal"	-	33,8%
"Origin/registration"	0,9%	-
"No answer or other answers"	3,4%	25,4%

Continue

Continuation

Reason for choice	Chosen product	
	Minas frescal cheese 1 kg - R$ 26.50 (labeled): 132 respondents (70.6%)	Minas frescal cheese 1 kg - R$ 29.90 (unlabeled): 55 respondents (29.4%)
Price	7,6%	7,3%
Presentation/packaging	34,9%	27,3%
Information on the label	53,0%	-
"Natural/artisanal"	-	47,3%
"Origin/registration"	3,8%	-
"No answer or other answers"	0,8%	18,2%

Source: Prepared by the authors, 2022.

to R$2,200) to those with a family income of over 20 minimum wages (over R$22,000), corroborating the wide variation in income distribution among the Brazilian population. In fact, the country has a Gini index of 48.9, making it one of the 20 most unequal countries in the world. This index measures the extent to which the distribution of income between individuals or families within an economy deviates from a perfectly equal distribution, ranging from zero (perfect equality) to 100 (perfect inequality)[15]. In this case, for the product with the highest number of choices based exclusively on price, minas frescal cheese, all the family income brackets except the highest (over 20 minimum wages) could be observed among the ten consumers listed. These results corroborate the representation of Brazilian inequality.

Presentation/packaging issues may be more related to the aesthetics of presentation than to the reliability of the product itself. In a similar vein, but linked to the *online* shopping environment, a study of 1,403 Chinese university students revealed that students were in fact more influenced by this *online* shopping environment (aesthetics and platform functionality) than by concerns about food safety, although the latter still proved to be an important factor in students' decision-making[16]. In fact, the choices made because of the information on the label, as well as because of the "origin/registration" noted in this study, corroborate the idea of concern for food safety.

Of those who chose the unlabeled product, a sub-group of consumers stood out because they believed these products to be natural/artisanal. These results point to a tendency to choose informal products, without, however, being aware of the need to register and source these products. In fact, any PAO, even artisanal ones, can only be offered for sale after having undergone prior industrial and sanitary inspection[17], and these procedures must also comply with the rules and competencies of the National Health Surveillance System[18].

It was also noted that for the honey, sausage, eggs and cheese products, the unlabeled option presented was more expensive than the labeled one. Even so, there was a notable group of consumers who chose this more expensive product because of the natural/artisanal criterion. Some of the terms used by consumers are noteworthy, such as "direct from the producer" or "from a small producer", "organic", and "artisanal". The use of these terms as a reason for choosing a product that is not labeled and therefore not registered with an inspection body or certified in any way indicates that the general population is unaware of the regulations governing these products, whether they come from small producers, are organic or artisanal.

In fact, there is an extensive regulatory framework involving these products. For small producers and family farmers, the specific rules for sanitary inspection of their products were regulated by Normative Instruction (NI) No. 16, of June 23, 2015[19]. For artisanal production, it is important to highlight the existence of the Art Seal. This seal made interstate trade in artisanal products more flexible, guided by Law No. 1,283, of December 18, 1950[17,] but amended by Law No. 13,680, of June 14, 2018[20], and recently regulated by Decree No. 11,099, of June 21, 2022[21]. This relaxation does not extinguish the requirement for inspection, which are mentioned in the Regulatory Decree, in addition to the fact that Law No. 13.680/2018 itself makes interstate marketing conditional on the products being subject to inspection by the Public Health bodies of the states and the Federal District[20,21].

As far as organic production is concerned, the relevant legislation is wide-ranging, with a recent highlight being Ordinance No. 52 of March 15, 2021, which sets out the Technical Regulations for Organic Production Systems, which lists substances and practices for use in these systems[22]. However, the guidelines for organic farming have much higher requirements than simply using or not using certain substances, and there must be a contribution to sustainable local, social and economic development, and the maintenance of permanent efforts by the organic production network to comply with environmental and labor legislation[23].

Therefore, there is a lack of knowledge among the public assessed about the conditions for complying with health regulations to guarantee food safety, despite the fact that the results showed that some of those interviewed had even heard of official inspection stamps. It suggests that the lack of knowledge observed may be closely linked to a lack of awareness of the potential risks associated with consuming PAO without origin and registration. In fact, trust in food safety is a dynamic process and should be based on the transfer of information about the

Table 2. Statistical associations between the schooling variable and the choice of products: honey, milk, sausage, whole chicken, chicken eggs, and minas frescal cheese, in the labeled and unlabeled options.

		Chosen product	
		Honey 200 g - R$ 16,50 (labeled)	**Honey 200 g - R$ 16,50 (unlabeled)**
Education	Complete primary education	2 (100,0%)	0 (0,0%)
	Complete high school	36 (80,0%)	9 (20,0%)
	Complete higher education	53 (86,9%)	8 (13,1%)
	Lato sensu postgraduate courses	38 (80,9%)	9 (19,1%)
	Stricto sensu postgraduate degree (master's or doctorate)	35 (94,6%)	2 (5,4%)
Pearson's Chi-square test: $p = 0.309$			
		Chosen product	
		Milk 1 L - R$ 4,90 (labeled)	**Milk 1 L - R$ 3,50 (unlabeled)**
Education	Complete primary education	2 (100,0%)	0 (0,0%)
	Complete high school	30 (66,7%)	15 (33,3%)
	Complete higher education	47 (78,3%)	13 (21,7%)
	Lato sensu postgraduate courses	10 (22,2%)	35 (77,8%)
	Stricto sensu postgraduate degree (master's or doctorate)	32 (86,5%)	5 (13,5%)
Pearson's Chi-square test: $p = 0.258$			
		Chosen product	
		Sausage 300 g - R$ 7,90 (labeled)	**Sausage 300 g - R$ 9,00 (unlabeled)**
Education	Complete primary education	0 (0,0%)	1 (100,0%)
	Complete high school	33 (75,0%)	11 (25,0%)
	Complete higher education	43 (75,4%)	14 (24,6%)
	Lato sensu postgraduate courses	29 (67,4%)	14 (32,6%%)
	Stricto sensu postgraduate degree (master's or doctorate)	26 (76,5%)	8 (23,5%)
Pearson's Chi-square test: $p = 0.425$			
		Chosen product	
		Whole chicken 1 kg - R$ 9,80 (labeled)	**Whole chicken 1 kg - R$ 6,90 (unlabeled)**
Education	Complete primary education	1 (100,0%)	0 (0,0%)
	Complete high school	36 (83,7%)	7 (16,3%)
	Complete higher education	49 (83,1%)	10 (16,9%)
	Lato sensu postgraduate courses	39 (84,8%)	7 (15,2%)
	Stricto sensu postgraduate degree (master's or doctorate)	34 (94,4%)	2 (5,6%)
Pearson's Chi-square test: $p = 0.566$			
		Chosen product	
		Dozen chicken eggs - R$ 7,50 (labeled)	**Chicken eggs by the dozen - R$ 8,90 (unlabeled)**
Education	Complete primary education	0 (0,0%)	1 (100,0%)
	Complete high school	23 (52,3%)	21 (47,7%)
	Complete higher education	40 (67,8%)	19 (32,2%)
	Lato sensu postgraduate courses	29 (61,7%)	18 (38,3%)
	Stricto sensu postgraduate degree (master's or doctorate)	24 (66,7%)	12 (33,3%)
Pearson's Chi-square test: $p = 0.334$			
		Chosen product	
		Minas frescal cheese 1kg - R$ 26,50 (labeled)	**Minas frescal cheese 1kg - R$ 29,90 (unlabeled)**
Education	Complete primary education	1 (100,0%)	0 (0,0%)
	Complete high school	23 (52,3%)	21 (47,7%)
	Complete higher education	43 (72,9%)	16 (27,1%)
	Lato sensu postgraduate courses	34 (72,3%)	13 (27,7%)
	Stricto sensu postgraduate degree (master's or doctorate)	31 (86,1%)	5 (13,9%)
Pearson's chi-square test: $p = 0.018$			

Source: Prepared by the authors, 2022.

Table 3. Statistical associations between the family income variable and the choice of honey, milk, sausage, whole chicken, chicken eggs, and minas frescal cheese, in the labeled and unlabeled options.

		Chosen product	
		Honey 200 g - R$ 16,50 (labeled)	**Honey 200 g - R$ 16,50 (unlabeled)**
Family Income	Above 20 minimum wages (above R$ 22,000)	4 (80,0%)	1 (20,0%)
	Up to 2 minimum wages (up to R$ 2,200)	14 (65,4%)	9 (34,6%)
	From 10 to 20 minimum wages (from R$ 11,000 to R$ 22,000)	35 (92,1%)	3 (7,9%)
	From 2 to 4 minimum wages (from R$ 2,200 to R$ 4,400)	36 (92,3%)	3 (7,7%)
	From 4 to 10 minimum wages (from R$ 4,400 to R$ 11,000)	70 (85,4%)	12 (14,6%)
	No answer	2 (100,0%)	0 (0,0%)
Pearson's chi-square test: $p = 0.039$			

		Chosen product	
		Milk 1 L - R$ 4,90 (labeled)	**Milk 1 L - R$ 3,50 (unlabeled)**
Family Income	Above 20 minimum wages (above R$ 22,000)	4 (80,0%)	1 (20,0%)
	Up to 2 minimum wages (up to R$ 2,200)	15 (60,0%)	10 (40,0%)
	From 10 to 20 minimum wages (from R$ 11,000 to R$ 22,000)	32 (84,2%)	6 (15,8%)
	From 2 to 4 minimum wages (from R$ 2,200 to R$ 4,400)	31 (81,6%)	7 (18,4%)
	From 4 to 10 minimum wages (from R$ 4,400 to R$ 11,000)	64 (79,0%)	17 (21,0%)
	No answer	0 (0,0%)	2 (100,0%)
Pearson's Chi-square test: $p = 0.027$			

		Chosen product	
		Sausage 300 g - R$ 7,90 (labeled)	**Sausage 300 g - R$ 9,00 (unlabeled)**
Family Income	Above 20 minimum wages (above R$ 22,000)	5 (100,0%)	0 (0,0%)
	Up to 2 minimum wages (up to R$ 2,200)	17 (70,8%)	7 (29,2%)
	From 10 to 20 minimum wages (from R$ 11,000 to R$ 22,000)	29 (85,3%)	5 (14,7%)
	From 2 to 4 minimum wages (from R$ 2,200 to R$ 4,400)	23 (63,9%)	13 (36,1%)
	From 4 to 10 minimum wages (from R$ 4,400.00 to R$ 11,000.00)	57 (72,2%)	22 (27,8%)
	No answer	0 (0,0%)	1 (100,0%)
Pearson's chi-square test: $p = 0.117$			

		Chosen product	
		Whole chicken 1 kg - R$ 9,80 (labeled)	**Whole chicken 1 kg - R$ 6,90 (unlabeled)**
Family Income	Above 20 minimum wages (above R$ 22,000)	5 (100,0%)	0 (0,0%)
	Up to 2 minimum wages (up to R$ 2,200)	19 (76,0%)	6 (24,0%)
	From 10 to 20 minimum wages (from R$ 11,000 to R$ 22,000)	34 (89,5%)	4 (10,5%)
	From 2 to 4 minimum wages (from R$ 2,200 to R$ 4,400)	30 (85,7%)	5 (14,3%)
	From 4 to 10 minimum wages (from R$ 4,400 to R$ 11,000)	71 (87,7%)	10 (12,3%)
	No answer	0 (0,0%)	1 (100,0%)
Pearson's Chi-square test: $p = 0.088$			

		Chosen product	
		Dozen chicken eggs - R$ 7,50 (labeled)	**Chicken eggs by the dozen - R$ 8,90 (unlabeled)**
Family Income	Above 20 minimum wages (above R$ 22,000)	2 (40,0%)	3 (60,0%)
	Up to 2 minimum wages (up to R$ 2,200)	12 (50,0%)	12 (50,0%)
	From 10 to 20 minimum wages (from R$ 11,000 to R$ 22,000)	27 (71,1%)	11 (28,9%)
	From 2 to 4 minimum wages (from R$ 2,200 to R$ 4,400)	22 (59,5%)	15 (40,5%)
	From 4 to 10 minimum wages (from R$ 4,400.00 to R$ 11,000)	53 (65,4%)	28 (34,6%)
	No answer	0 (0,0%)	2 (100,0%)
Pearson's chi-square test: $p = 0.180$			

Continue

Continuation

		Chosen product	
		Minas frescal cheese 1 kg - R$ 26,50 (labeled)	Minas frescal cheese 1 kg - R$ 29,90 (unlabeled)
Family Income	Above 20 minimum wages (above R$ 22,000)	4 (80,0%)	1 (20,0%)
	Up to 2 minimum wages (up to R$ 2,200)	11 (45,8%)	13 (54,2%)
	From 10 to 20 minimum wages (from R$ 11,000 to R$ 22,000)	27 (73,0%)	10 (27,0%)
	From 2 to 4 minimum wages (from R$ 2,200 to R$ 4,400)	29 (76,3%)	9 (23,7%)
	From 4 to 10 minimum wages (from R$ 4,400 to R$ 11,000)	61 (74,4%)	21 (25,6%)
	No answer	0 (0,0%)	1 (100,0%)
Pearson's Chi-square test: $p = 0.052$			

Source: Prepared by the authors, 2022.

Table 4. Statistical associations between the variable knowledge of inspection stamps and the choice of honey, milk, sausage, whole chicken, chicken eggs, and minas frescal cheese, in the labeled and unlabeled options.

		Chosen product	
		Honey 200 g - R$ 16,50 (labeled)	Honey 200 g - R$ 16,50 (unlabeled)
Knowledge of inspection stamps	Yes	95 (85,6%)	16 (14,4%)
	No	68 (86,1%)	11 (13,9%)
Pearson's Chi-square test: $p = 0.924$			
		Chosen product	
		Milk 1 L - R$ 4,90 (labeled)	Milk 1 L - R$ 3,50 (unlabeled)
Knowledge of inspection stamps	Yes	88 (80,0%)	22 (20,0%)
	No	58 (75,3%)	19 (24,7%)
Pearson's Chi-square test: $p = 0.447$			
		Chosen product	
		Sausage 300 g - R$ 7,90 (labeled)	Sausage 300 g - R$ 9,00 (not labeled)
Knowledge of inspection stamps	Yes	76 (76,0%)	24 (24,0%)
	No	55 (70,5%)	23 (29,5%)
Pearson's Chi-square test: $p = 0.410$			
		Chosen product	
		Whole chicken 1 kg - R$ 9,80 (labeled)	Whole chicken 1 kg - R$ 6,90 (unlabeled)
Knowledge of inspection stamps	Yes	93 (86,1%)	15 (13,9%)
	No	66 (86,8%)	10 (13,2%)
Pearson's chi-square test: $p = 0.887$			
		Chosen product	
		Dozen chicken eggs - R$ 7,50 (labeled)	Chicken eggs by the dozen - R$ 8,90 (unlabeled)
Knowledge of inspection stamps	Yes	71 (67,0%)	35 (33,0%)
	No	45 (57,0%)	34 (43,0%)
Pearson's Chi-square test: $p = 0.163$			
		Chosen product	
		Minas frescal cheese 1 kg - R$ 26,50 (labeled)	Minas frescal cheese 1 kg - R$ 29,90 (unlabeled)
Knowledge of inspection stamps	Yes	82 (75,9%)	26 (24,1%)
	No	50 (64,1%)	28 (35,9%)
Pearson's Chi-square test: $p = 0.080$			

Source: Prepared by the authors, 2022.

associated risks[16]. In this sense, a recent study in Brazil pointed to the notoriety of the supply and commercialization of POA through *online* commerce, with greater evidence for meat products and with a greater concentration of offers in the Southeast Region. The study found evidence of criminal offenses, both in terms of health and consumer rights[13].

In fact, the risks involved can be divided into two main groups: health risks and consumer rights. In the context of consumer harm, fraud and adulteration stand out, as provided for in Brazil's Regulations of Industrial and Sanitary Inspection of Products of Animal Origin (RIISPOA)[24]. In this sense, however, in a comparison with the European standard, an Italian study sought to assess consumer risks in relation to cheeses and meat products with a protected designation of origin. Compliance with product specifications, labeling, originality, and European Community requirements was checked. The results showed that 55% of the samples were labeled incorrectly, in a way that was incompatible with the product specifications. In addition, real-time polymerase chain reaction analysis revealed that 71.4% of dairy products and 46.1% of meat products, both with protected designations of origin, were fraudulent due to species substitution. In order to guarantee the authenticity of these products, as well as consumer protection, the authors stress the need to implement control systems such as Hazard Analysis and Critical Control Points (HACCP), as well as the development of legislation specifically aimed at *online* commerce[25].

It should be noted that the protected designation of origin mentioned in the study by Di Pinto et al.[25] is one of the types of certified guarantee for a product with an officially recognized geographical indication (GI). GI occurs when a geographical name that identifies a product or service has its origin in a delimited geographical area, and its quality, reputation or other characteristic is related to its origin. In Brazil, it can be divided into two types: indication of origin, when the geographical name of a locality or region has become known as the center of extraction, production or manufacture of the product or provision of the service; and denomination of origin, when the geographical name of a country, city, region or locality designates a product or service whose qualities or characteristics are due exclusively to the geographical environment, including natural and human factors[26,27]. The list of National and International Agricultural Geographical Indications registered in Brazil can be consulted on the *website of* the Ministry of Agriculture, Livestock and Food Supply (MAPA)[28]. Some interesting examples are French *roquefort* cheese, by designation of origin, and Brazilian *canastra* cheese, by indication of origin[28]. Thus, selling a similar product, but without recognition, and inspection, as a unique product in terms of quality and cultural context, is to cause serious harm to the consumer, and is also considered a crime under the Industrial Property Law[27].

In the context of risks to public health, those of a microbiological nature are particularly noteworthy. Pao and Ettinger[29] evaluated the microbiological quality of meat products sold locally and online in the United States. The researchers analyzed products made up of raw ground beef and frozen beef burgers, bought locally, and frozen ground beef and frozen beef burgers, bought online. The results showed that frozen burgers bought locally had significantly lower levels of mesophilic aerobes, psychrotrophs and coliforms than all the other products. In addition, frozen ground beef purchased online had higher levels of *Escherichia coli* detection than raw ground beef and locally purchased frozen hamburger. However, no sample was contaminated with *E. coli* O157:H7 but *Salmonella* spp. and *Listeria* spp. were detected in higher percentages in products purchased online. *Listeria monocytogenes* was found in all product categories.

In a similar study, Kim et al.[30] compared the microbiological quality of lamb and goat meat sold locally and online in the United States. Frozen ground lamb and frozen lamb ribs, both purchased locally, and ground lamb, ground goat, lamb ribs, goat ribs, cooked lamb, and cooked goat, all purchased *online, were* tested. In this case, significantly higher levels of aerobic mesophiles, psychrotrophs, and coliforms were found in meat purchased locally when compared to meat obtained via the Internet. In addition, an average prevalence of 27% of *E. coli* was observed, regardless of the market of origin. The ground beef product showed significantly high levels and prevalence of mesophiles, psychrotrophs, coliforms and *Listeria* spp. A sample of ground lamb purchased locally showed detection of *Campylobacter* and a sample of goat ribs purchased online showed *Salmonella*. *Listeria* spp. was present in percentages ranging from 23% to 40% in the samples purchased at the local market and from 17% to 80% in the internet samples.

It can therefore be seen that the worst microbiological results were not always detected in products purchased *online* when comparing the studies by Pao and Ettinger[29] and Kim et al.[30]. In fact, various factors can influence the quality and safety of food, based on compliance with current legislation. However, the risks highlighted in both articles are still notorious.

It should be noted that consumers are not only subject to biological risks. There are also chemical hazards, caused by substances such as: disinfectants, detergents, rodenticides, insecticides, antibiotics, pesticides; and physical hazards characterized by materials that can injure the consumer when ingested, such as: nails, pieces of plastic, glass[31].

In conclusion, the analysis of the association between the variables in this study showed that there was no statistical association between knowledge of inspection stamps and the variables of education and family income. Also, despite the statistical significance between the choice of labeled cheese, honey, and milk, in smaller proportions, among consumers with a high school education for the first product, and among those with an income of up to two minimum wages for the others, the vast majority of choices did not result in a significant association with education or income.

This suggests that the lack of awareness of the need to register PAO is not necessarily associated with low schooling or low income but is widespread and largely independent of these variables.

CONCLUSIONS

Based on the analysis of a sample universe made up of users of PAO *online* commerce in the Southeast of Brazil, a certain preference for labeled products was observed. However, when people chose unlabeled products, i.e., informal products, they were clearly motivated by the belief that these products were natural/artisanal, without being aware of the need to register the products. It was also noted that most of those interviewed had never heard of an official inspection stamp.

It was concluded that users of this type of *online* commerce have a profile characterized as deficient in terms of knowledge about the inspection and registration of products, and are represented by all income and education levels, so that health education and consumer rights education are needed at all levels of society.

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Authors' Contribution

Esper LCN - Conception, planning (study design), data acquisition, and writing the work. Belo VS - Analysis, data interpretation, and writing of the work. De Vasconcelos TCB - Conception, planning (study design), acquisition, analysis, data interpretation, and writing of the work. Moutinho FFB - Conception, planning (study design), data acquisition, and writing of the work. All the authors approved the final version of the wok.

Conflict of Interest

The authors inform that there is no potential conflict of interest with peers and institutions, political or financial, in this study.