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LWT

journal homepage: www.elsevier.com/locate/lwt

Plant-based products: Analysis of international regulations and strategies used for designation and labeling in Brazil

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ARTICLE INFO

Keywords:

Animal product analogs
Designations
Food labeling
Vegan
Vegetarian

ABSTRACT

The consumption of vegetarian/vegan products that mimic the taste and appearance of animal products has grown worldwide. The objective of this study was to investigate the designations of these products in the Brazilian market, focusing on terms that may mislead consumers. The designations were evaluated concerning four aspects: i) use of the terms “vegan,” “vegetarian,” or similar ones; ii) misuse of standardized animal product designations; iii) misspelling of standardized animal product designations; iv) use of the terms “type” or “flavor” associated with the name of the animal products. There were 335 samples analyzed, 93 from supermarkets and 242 from websites, corresponding to three categories of analogs: meat (n = 154), dairy (n = 148), and others (n = 33). The terms “vegan” and “vegetarian” were used in 44.5% of the samples. It was concluded that most products had the wrong designations, reinforcing the need for regulation of such products in Brazil.

1. Introduction

The consumption of vegetarian and vegan products in Brazil has grown in recent years. A survey commissioned by the *Sociedade Vegetariana Brasileira* (Brazilian Vegetarian Society) (SVB - *Sociedade Vegetariana Brasileira*, 2018) and carried out entirely by the *Instituto Brasileiro de Opinião Pública e Estatística* (Brazilian Institute of Public Opinion and Statistics) in 2018 showed that 14% of Brazilians considered themselves vegetarians. More than half reported that the consumption of vegetarian products would increase if information about such foods were more transparent on their labels (55%) or if they cost the same as the products they are used to consuming (60%) (SVB - *Sociedade Vegetariana Brasileira*, 2018). Worldwide, in 2017, the World Atlas described the ten countries with the highest percentage of vegetarians: India (38%), Israel (13%), Taiwan (12%), Italy (10%), Austria (9%), Germany (9%), Great Britain (9%), Brazil (8%), Ireland (6%) and Australia (5%) (World Atlas, 2017), which shows that, after India, Brazil ranks among the most prominent global markets for vegetarian and vegan products.

Several reasons lead individuals to become vegetarians, such as

ethics, health, and the environment (Hargreaves et al., 2020; Oussalah et al., 2020). The different types of vegetarianism are classified according to the consumption or not of animal products, such as eggs, milk, and derived products (Hargreaves et al., 2020), including vegetarian diets (lacto-ovo vegetarian, ovo-vegetarian, lactovegetarian, pescetarian, semi-vegetarian) and vegan (exclusion of all animal-derived products, covering items other than food) (Dagnelie & Mariotti, 2017; Hargreaves et al., 2020). Some flexitarians follow a mainly, but not strictly, vegetarian diet, occasionally eating meat, fish, or chicken (Oussalah et al., 2020).

In this scenario, there is an emerging category of products aimed not necessarily at vegans or vegetarians but at those looking for supposedly healthier and more sustainable alternative protein sources of plant origin while maintaining the sensory profile of animal products. Such products have been designated as “analogs,” “substitutes,” “plant-based alternative milk,” “vegetable-based alternative meat,” “alternative meat,” “vegetarian meat,” “meat substitute,” and “analog meat” (Curtain & Grafenauer, 2019; Hargreaves et al., 2020; Loo et al., 2020; Silva et al., 2020).

Since 2015, launches of plant-based meat substitutes that mimic the

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<https://doi.org/10.1016/j.lwt.2024.115980>

Received 2 May 2023; Received in revised form 9 February 2024; Accepted 18 March 2024

Available online 2 April 2024

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taste, texture, and appearance of animal products have exceeded 4400 products worldwide (Curtain & Grafenauer, 2019).

Euromonitor International reports that the vegetable drinks market (drinks made mainly from rice, oats, coconut, and almonds) grew by 51.5% in Brazil in 2018 due to vegans, lactose intolerants, and fitness enthusiasts (Milk Point, 2018). Moreover, in a survey carried out by The Good Food Institute (GFI), 65% of Brazilian consumers reported consuming vegetable alternatives to replace protein products of animal origin at least once a week (59% in 2020) (GFI - Good Food Institute, 2020).

Although there is a considerable increase in the alternative protein market in Brazil, there are no regulations for the definition and use of the terms “vegan” and “vegetarian.” A possible specific regulation for the case of animal product analogs is currently being discussed by the regulatory authorities. The *Ministério da Agricultura, Pecuária e Abastecimento* (Ministry of Agriculture, Livestock and Food Supply - MAPA) published Ordinance N°. 831, of June 28, 2023 to establish the minimum identity and quality requirements for plant-based analogs, and the visual identity and labeling rules for these products. However, there has been no publication to regulate these products to date.

According to Brazilian legislation, food designation must be a specific and non-generic name that indicates the true nature and characteristics of the food (Brasil, 2022). Food designations are determined by technical regulations that establish the identity and quality standards inherent to the products (Brasil, 2022). Furthermore, food labels should not display particular quality indications, not even mentions, figures or drawings that allow a false interpretation or that mislead the consumer as to the origin, nature, or composition of the product (Brasil, 2022).

Considering this scenario, this work aimed to investigate the designations of animal product analogs sold as vegan and vegetarian in the Brazilian market, focusing on surveying the misuse of terms that may lead the consumer to error or confusion. Besides that, a search was conducted on the Brazilian labeling regulations and other types of legislation regarding products designated as vegan and vegetarian, and on the Codex Alimentarius standards.

2. Materials and methods

This observational, cross-sectional study evaluated products claimed to be vegan and vegetarian in their designation. Samples were collected from six supermarket chains in Belo Horizonte-MG and Brazilian websites from July to September 2020, constituting a convenience sampling. In cases of duplication, samples obtained from supermarkets were prioritized over those from websites. In the first case, the images of the labels were obtained through photographs, and in the second, through screen prints.

The sample inclusion criterion was the declaration of the terms “vegan,” “vegetarian,” “no meat,” and “plant-based.” Originally vegetable-based foods (snacks, chocolates, chips, dehydrated fruits, and others) and vegan supplements were excluded.

Data obtained from labels were compiled in the Microsoft Excel 2013 software, considering the following information: product category (meat, dairy, or other analogs), type of product (e.g., hamburger analog, cheese analog), brand, designation, and list of ingredients.

Product names were evaluated concerning four aspects: i) use of the terms “vegan,” “vegetarian,” or similar ones (veg, vegan, 100% vegetable, plant-based); ii) misuse of designations (name of an animal product for which there is a standard of identity and quality established in the Brazilian legislation); iii) misspelling: (words with similar spelling to the regulated names for animal products) and iv) use of the terms “type” or “flavor” associated with the name of the animal product. The use of animal images on the labels was also considered. In cases where these issues were identified, inappropriate terms or images were described. The observed frequencies for all these outcomes were compared considering the different categories of analogs products through the global non-parametric chi-square test (X^2) ($\alpha = 0.05$). The

post hoc evaluation was conducted by approximating the data distribution to a normal distribution (Cochran, 1954; Macdonald & Gardner, 2000; Sharpe, 2015).

Only analogs products whose reference food is regulated by Brazilian legislation (Brasil, 1996, 1998, 2000a; 2000b, 2000c, 2000d; 2000e, 2000f, 2003, 2005, 2017, 2018) were considered for analysis of misuse of designations and misspelling as described in Supplementary Table 1.

3. Results and discussion

Images were obtained from labels of 335 samples, 324 being considered vegan and 11 lacto-ovo vegetarian (due to the presence of egg white and dairy products). Ninety-three of the samples came from supermarkets and 242 from websites, which were divided into three categories of analogs: “meat,” “dairy” and “others.” The most frequent products in the dairy analogs category were beverages and “cheese.” For meat analogs, “hamburgers” and “processed meat” were the most prominent products, as described in Fig. 1. It is essential to highlight that the products “sausages” ($n = 13$), “wieners” ($n = 10$), “turkey breast” ($n = 1$), “salami” ($n = 2$), and “bologna” ($n = 3$) were grouped as processed meat.

Among the meat analogs, the hamburger was the item found in the most significant quantity, and this is due to the fact that the global vegetable-based hamburger market started as a niche market for the vegetarian/vegan community and is now growing, reaching approximately US\$2.7 billion in 2020 and whose compound annual growth rate is projected to increase by 22% between 2020 and 2030 (Boukid & Castellar, 2021).

In the Brazilian market, the availability of hamburger analogs has also increased significantly in recent years (Nagagata et al., 2020). Between May 2019 and May 2020, data released by a large retail chain showed that one third of sales of frozen hamburgers came from vegetable-based ones, with the sale of plant-based products increasing at a constant average above 150% (GPA - Grupo Pão de Açúcar, 2020). This increase is believed to be due to the introduction of various vegetable burgers, which attracted a large group of flexitarians (Reportlinker, 2020).

When it comes to “dairy” products, beverages were the most frequent types. The consumption of pulse, cereal and nut-based beverages increased considerably in 2018 (18%), and it has been estimated that the global market for such products will grow to be 20% of the market value in the next few years. This increase is due to concerns about health, the environment, animal protection, and flexible choice of food consumption (Leialohilani & de Boer, 2020).

In Brazil, according to RDC 91/2000, the expression “soy milk” is prohibited (Brasil, 2000f). For the European Court of Justice (ECJ), “soy milk” is not an established designation either (Domke, 2018). On the other hand, in Brazil, RDC 08/2013 (Brasil, 2013) allows the use of the expression “coconut milk,” which is also guaranteed by RDC 727/2022, affirming that the term can be used since it is an established, fanciful, factory or registered trademark (Brasil, 2022).

For the Codex CXS 206-1999, milk is a normal mammary secretion from animals obtained from one or more milkings without any addition; therefore, it can be understood that the expression “vegetable milk” would not be allowed (Codex Alimentarius, 1999). In this study, among the dairy analogs found ($n = 148$), 33 (22.3%) beverages contained the term “milk” in their sales name, such as “soy milk” ($n = 1-0.7\%$), “vegetable milk” ($n = 3-2.0\%$) and “coconut milk” ($n = 29-19.6\%$).

As for the terms “type” or “flavor,” some of the products contained one of them in their denominations. Higher frequencies were evidenced for the other dairy categories, which differed from the estimated frequency for meat ($p < 0.05$).

Expressions such as “pepperoni-type vegetable salami,” “butter-type vegetable food,” “provolone-type vegetable cheese,” and “mayonnaise-type vegan sauce” were found. It is essential to highlight that Brazilian legislation states that the expression “type” must be used in foods that are

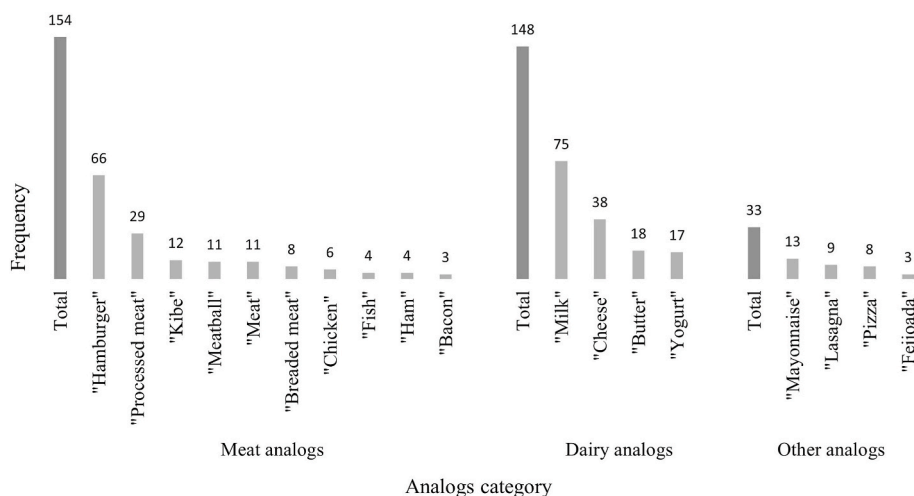


Fig. 1. Frequency of food products analyzed according to the categories of analogs.

manufactured according to technologies that are characteristic of different geographic locations (Brasil, 2022), which is also described in European legislation (Domke, 2018).

Images of animals (cattle, chicken, and fish) were only present in the "meat" analog category, with all products coming from the same company, which may indicate a specific problem.

Regarding the packaging images, a study carried out to assess hamburger preference found that the choice was much more significant when transparent film packing was used because the product could be seen rather than when it could not be seen, indicating that the differences in the expected taste were probably due to the confidence inspired by seeing the "real thing" and a familiar image (Tarrega et al., 2020).

This strategy can mislead the consumer since the product does not have any ingredient of animal origin. Brazilian legislation is clear when it states that the images on the product label cannot lead the consumer to error, misunderstanding, confusion, or deception regarding the true nature of the product, its composition, origin, type, or quality (Brasil, 2022).

In many of the samples, the misuse of animal product names in the designation was identified. Among the categories, the frequency of misuse was higher for "other products," with examples such as "creamy mayonnaise-like sauce", and for meat analogs with "soy burger with sundried tomato," for instance.

Of the products researched, some had similar spelling, for example: "Vegan Burger," "IogVeg," and "RequeVeg." Misspelling was more frequent among dairy analogs than in other categories. The aspects analyzed for the sales denominations are described in Table 1.

The lack of specific legislation for vegetarian/vegan products is not restricted to Brazil. A working group led by Safe Food Advocacy Europe (SAFE) in the European Union has been working to clarify the concept of

vegan, and they specify that products must meet minimum criteria to be eligible to carry such term on labels (SAFE - Safe Food Advocacy Europe, 2021). There is also no legislation on labeling vegan or vegetarian foods in the UK. Creating legislation for these products is necessary to ensure everything is clear, indicating that they are suitable for vegetarians/vegans (Barrow, 2020).

In 2021, a report was published by the International Organization for Standardization (ISO), ISO 23662:2021, determining technical criteria and labeling definitions for products and ingredients for vegetarian/vegan products (ISO, 2021). This standard does not apply to human safety, environmental safety, socio-economic considerations (e.g., fair trade, animal welfare), religious beliefs, or the characteristics of packaging materials. However, the debate on the regulation of animal product analogs is growing, especially concerning issues such as labeling (Table 2).

Some countries, such as France, the United States, and Australia have restrictions on terms that are not allowed on products. In 2018, the US Cattleman's Association (USCA) filed a petition asking the United States Department of Agriculture (USDA) to ban the use of meat terms for non-animal products (Loo et al., 2020). In addition, the food standards of the European Union place restrictions and rules on the composition and quality of foods and establish general labeling requirements. These are related to protecting specific terms such as beef, pork, chicken, hops, milk, and cheese (COM - Commission of the European Communities, 2008). In relation to how the labeling is judged by vegetarians and non-vegetarians, a survey involving general consumers representative of the national populations of the European Union countries (~11.000) found that only one in five consumers believe that the use of "meaty" names should never be allowed for vegetarian/vegan products, and one in four have no problem using these names. Austrians and Germans were

Table 1

Questions considered in the sales denominations of similar products and respective percentages of occurrence for the different categories and for the total sample.

Aspects	Meat (n = 154)		Dairy (n = 148)		Others (n = 33)		Total (n = 335)	
	%Y	%N	%Y	%N	%Y	%N	%Y	%N
Vegan, vegetarian or similar term	50.0b	50.0	32.4c	67.6	72.7a	27.3	44.5	55.5
Use of terms/words such as type, flavor	9.7b	90.3	19.6a	80.4	33.3a	66.7	16.4	83.6
Use of animal images	1.9a	98.1	0.0a	100.0	0.0a	100.0	0.9	99.1
Aspects	Meat (n = 153)		Dairy (n = 148)		Others (n = 21)		Total (n = 322)	
Misuse of designation	86.3a	13.7	56.1b	43.9	100a	0.00	73.3	26.7
Misspelling (Use of spelling similar to those of animal origin)	5.9b	94.1	12.8a	87.2	0.00b	100.0	8.7	91.3

Y:Yes. N: No.

Frequencies indicated by the same lowercase letter horizontally indicate that they did not differ from each other by the X² test and in the approximation to the post hoc normal distribution (p > 0.05).

Table 2

Legislation for the labeling of vegetarian/vegan products and the use of terms for animal products in analogs.

Countries	Requirements for using the terms "vegetarian/vegan"	Use of animal product terms in analogs and/or vegetarian/vegan products
Australia (Leialohilani & de Boer, 2020) Brazil (Brasil, 2000f, 2013)		You can use the term "milk" for soy milk It does not allow the use of the term "soy milk", but the term "coconut milk" is consolidated
Canada (CRC, 2021)		There are laws that prohibit dairy alternatives from being labeled as milk.
USA (Beaver, 2019)		In some states, it is not allowed to use terms similar to "meat"
France (CE, 2018)		Since 2018 it is not allowed to use the terms "dairy" and "meat" for analogs
India (FSSAI - Food Safety and Standards Authority of India, 2011)	There is specific legislation for vegetarian/vegan products	
United Kingdom (Alves & Varella, 2016)	There is no legislation, but the Food Standards Agency, which is a government agency, provides an official guide for companies and organizations that want to label food as vegetarian or vegan.	
Singapore (SFA - Singapore Food Agency, 2021)	Instead of just labeling their products as meat, companies selling pre-packaged alternative protein products in Singapore will be required to label the product with qualifying terms such as "simulation", "culture" or "plant-based" to indicate their true nature, so that consumers can make informed decisions when deciding whether to consume these products or not	
Switzerland (Pichler, 2016)	It has legal definition of vegetarian and vegan	
European Union (UE, 2011; Loo et al., 2020)		Plant-based foods cannot be labeled or marketed using dairy terms.
Taiwan (Joshi, 2009)	There is specific legislation for vegetarian/vegan products	

the most hostile towards names, particularly meat-related names for plant-based products. About a third of respondents in these countries said such names should never be allowed for vegetarian or vegan products (de Consommateurs, 2020). Another survey with 428 German consumers found that a label containing the term "vegan" for what is already vegan (for example, hummus and jam) would distort consumer perceptions of the product, increasing the perceived healthiness, expected taste, and perceived sustainability if buyers did not anticipate that such vegan products would automatically be vegan (Stremmel et al., 2022).

As far as we know, this is the only study dedicated to evaluating the labeling of vegan/vegetarian or plant-based foods. However, it has limitations that merit discussion. The collection of more comprehensive information on labeling, such as the nutrition information table, could

have helped to assess the nutritional composition of the products. Moreover, even though data were collected on the Internet, some labels were collected in local supermarkets, which may be different from products of this nature sold throughout Brazil.

4. Conclusions

It is concluded that most of the analogs products found use the sales denomination for products of animal origin followed by the terms "vegetarian" and "vegan," which is not in compliance with Brazilian legislation.

It is important to emphasize that products of animal origin have inspection bodies that monitor their production processes, besides identity and quality standards. In contrast, there are projects and discussions aimed at addressing what constitutes a plant-based product and how they should be labeled. designs address a suitable product to service a correct product. Furthermore, as plant-based products do not yet have legislation outlining standards for how they should be labeled or marketed, it would be interesting that similar products could have names such as: vegetable analog of hamburger or soy balls.

More studies of this nature are necessary to meet the need for more research on the labeling of vegetarian/vegan products. This work also reinforces the need for regulations that address food products more clearly, at least concerning the terms that should not be allowed, since the food market that aims at consumers who call themselves "vegetarians" or "vegans" has been growing significantly and deserves similar consideration as other areas of the food sector.

CRedit authorship contribution statement

Crisei Gonçalves Pereira: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing, Data curation. **Rosimeire Efigênia de Castro Moreira:** Data curation, Formal analysis, Investigation, Methodology, Resources, Writing – review & editing. **Poliana Aparecida Afonso:** Data curation, Formal analysis, Methodology, Resources, Writing – review & editing, Investigation. **Alessandro Rangel Carolino Sales Silva:** Formal analysis, Resources, Writing – review & editing. **Marina de Paula Penna e Palhares:** Methodology, Resources, Writing – review & editing. **Scheilla Vitorino Carvalho de Souza:** Methodology, Resources, Writing – review & editing. **Lucilene Rezende Anastácio:** Conceptualization, Formal analysis, Resources, Supervision, Writing – review & editing.

Declaration of competing interest

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

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.lwt.2024.115980>.

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