



## Labeling of ready-to-eat minimally processed vegetables sold in Brazil

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**Introduction:** Ready-to-eat minimally processed vegetables (RTE-MPV) are vegetables subjected to several steps that modify their natural structure, while maintaining the same freshness and nutritional quality as the fresh produce. Since these products are sold in packages, they must be labeled, even though nutritional labeling is optional. **Objective:** The goal of this study was to assess the labeling aspects of several brands of RTE-MPV sold in Brazil, determining whether manufacturers adhered to the different types of food labeling legislation. **Method:** Photographic records of RTE-MPV packages were obtained in different regions of Brazil between October 2020 and August 2021, and labels were analyzed using a checklist that was prepared according to the different types of Brazilian food labeling legislation in force at the time of the study: RDC nº 259/2002, RDC nº 359/2003, RDC nº 360/2003 and Law nº 10,674/2003. **Results:** The labels of 288 RTE-MPV packages, belonging to 39 brands, were analyzed. Among these, 31 brands showed at least one aspect that was not in accordance with the legislation, such as the lack of information about place of origin, and the presence or absence of gluten. Although optional, most brands (38) adopted nutritional labeling, but the information was incomplete in ten of them. **Conclusion:** These data indicate that there are flaws in the labeling of RTE-MPV in Brazil, emphasizing the need for manufacturers to comply with the legislation. Moreover, the optional adoption of nutritional labeling by most brands is significantly important for consumers to have additional information about what they consume.

**Keywords:** Food labeling, Fresh-cut vegetables, Food legislation, Nutritional labeling, Packaged foods.

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## Rotulagem de vegetais minimamente processados prontos para consumo comercializados no Brasil

**Introdução:** Os vegetais minimamente processados (VMP) são submetidos a etapas que modificam sua estrutura natural, mantendo o frescor e qualidade nutricional dos produtos frescos. Por serem comercializados embalados, esses produtos devem ser rotulados, embora a rotulagem nutricional seja opcional. **Objetivo:** Este estudo analisou a rotulagem de diferentes marcas de VMP comercializados no Brasil, a fim de determinar a aderência dos produtores às legislações relativas à rotulagem de alimentos. **Método:** Foram obtidos registros fotográficos de embalagens VMP comercializados em diferentes regiões do Brasil entre outubro de 2020 e agosto de 2021, e os rótulos foram analisados por meio de um *checklist* elaborado com base nas legislações brasileiras de rotulagem de alimentos vigentes no período em que o estudo foi realizado: RDC nº 259/2002, RDC nº 359/2003, RDC nº 360/2003 e Lei nº 10.674/2003. **Resultados:** Foram analisados os rótulos de 288 embalagens de VMP, pertencentes a 39 marcas. Dentre essas, 31 marcas apresentaram pelo menos um item que não estava de acordo com as legislações de rotulagem vigentes, como falta de informação sobre o local de origem e a presença ou ausência de glúten. Apesar de opcional, a maioria das marcas (38) adotou a rotulagem nutricional, mas em dez delas as informações estavam incompletas. **Conclusão:** Esses dados indicam falhas na rotulagem de VMP no Brasil, enfatizando a necessidade das empresas de cumprirem essas regulamentações. Além disso, a adoção opcional da rotulagem nutricional pela maioria das marcas tem grande importância, pois fornece informações adicionais aos consumidores sobre os produtos que consomem.

**Palavras-chave:** Rotulagem de alimentos, Vegetais frescos cortados, Legislação de alimentos, Rotulagem nutricional, Comida embalada.

Submetido em: 29/03/2023

Aceito em: 29/09/2023

### INTRODUCTION

The market of ready-to-eat minimally processed vegetables (RTE-MPV) started in Brazil in the 1970s, with the expansion of fast-food chains in the southeastern region of the country<sup>1,2</sup>. Despite the lack of official data on the Brazilian RTE-MPV market, the increase in demand for these products has been reported in some studies over the past years, as well as their increasing presence in food establishments across the country<sup>2,3,4</sup>.

RTE-MPV are obtained from fresh vegetables that have been subjected to several processing steps, including selection, washing, cutting, sanitizing, rinsing, centrifuging, packaging, and storage<sup>5</sup>. These products meet consumers' demand for healthy, practical, and convenient foods, since they maintain the same nutritional and sensory attributes of fresh produce, reduce waste, and enable an easy and quick preparation of meals<sup>6,7,8</sup>.

In Brazil, as in other countries, food packaged in the absence of consumers must be labeled<sup>9</sup>. Food labeling is an important instrument of communication between the producer and consumers and must contain reliable and consistent information, including food composition, nutritional content, country of origin and storage conditions, among others, allowing consumers to be aware of their choices, purchases and/or what they consume<sup>10,11,12,13,14,15,16</sup>. Nevertheless, certain food categories have exemptions. For instance, vegetables sold in fresh, refrigerated, or frozen forms are exempt from the need for nutritional labeling. However, manufacturers may choose to include it, which play an important role in providing consumers with additional information about these products. Therefore, the goal of this study was to assess the labeling aspects of several brands of RTE-MPV sold in Brazil, determining whether manufacturers adhered to the different types of food labeling legislation.

## METHODS

Photographic records of commercialized RTE-MPV packages were obtained in supermarkets and grocery stores located in different regions of Brazil between October 2020 and August 2021. The labels were analyzed using a checklist that was prepared based on four Brazilian food labeling legislation in force at the time of the study: Resolutions RDC n° 259 from September 20th, 2002 (Technical regulation on the labeling of packaged foods), RDC n° 359 from December 23rd, 2003 (Technical regulation on packaged food portions for nutritional labeling purposes), RDC n° 360 from December 23rd, 2003 (Technical regulation on nutritional labeling of packaged foods) and Law n° 10,674 from May 16th, 2003 (Regulation on the labeling of marketed foods for the presence of gluten, as a preventive and control measure for celiac disease)<sup>17,18,19,20</sup> (Table 1). Although not all types of

legislation apply to RTE-MPV (e.g., RDC n° 359/2003 and RDC n° 360/2003), the authors chose to consider them in this study to provide a more comprehensive overview of their adoption by the manufacturers.

Only the states of Sao Paulo and Rio Grande do Sul, in the southeast and south regions of Brazil, respectively, have recommendations for RTE-MPV: Resolution SAA n° 42 from June 19th, 2009 (Technical standard for fresh cut and minimally processed produce)<sup>21</sup> and Ordinance SES-RS n° 90 from February 13th, 2017 (Technical standard of good manufacturing practices and standard operating procedures for the industrialization of minimally processed fruits and vegetables)<sup>22</sup>. Only the Resolution SAA n° 42/2009 from Sao Paulo addresses aspects related to RTE-MPV labeling. Thus, the brands sold in Sao Paulo were also analyzed according to this Resolution.

**Table 1.** Food labeling legislation and parameters evaluated in the present study.

| Food labeling legislation                                   |  | Parameters  |
|---|--|---|
| RDC n° 259 from September 20th, 2002 (Federal)              | Technical regulation on the labeling of packaged foods   | Name (brand), address, country/city, registration number or manufacturer identification number, language, sales denomination, type of packaging, storage temperature, expiration date, batch identification and list of ingredients |
| RDC n° 359 from December 23rd, 2003 (Federal)               | Technical regulation on packaged food portions for nutritional labeling purposes   | Portion (amount per package and homemade measure)   |
| RDC n° 360 from December 23rd, 2003 (Federal)               | Technical regulation on nutritional labeling of packaged foods   | Nutritional content   |
| Law n° 10,674 from May 16th, 2003 (Federal)                 | Regulation on the labeling of marketed foods on the presence of gluten, as a preventive and control measure for celiac disease | Expression “contains gluten” or “does not contain gluten”   |
| Resolution SAA n° 42 from June 19th, 2009 (Sao Paulo State) | Technical standard for fresh cut and minimally processed produce   | Sanitization condition, vacuum-packed product, expiration date after opening the package and declaration of food additives  |

**Note:** RDC n° 259, RDC n° 359 and RDC n° 360 have been updated over the past few years.

**Source:** Authors.

The checklist included the following items: name (brand), address, country/city of origin, registration number or manufacturer identification number, language, sales denomination, type of packaging, storage temperature, expiration date, batch identification, list of ingredients, nutritional content, portion (amount per package and homemade measure) and the presence of the expression “contains gluten” or “does not contain gluten”. Moreover, labels of brands sold in Sao Paulo were also analyzed for the presence of the following information, according to the recommendation of Resolution SAA n° 42/2009: sanitization condition and the expressions “sanitized fresh vegetable(s)”, “ready for consumption or for cooking” and “vacuum-packed product: do not consume in the absence of vacuum” (if applicable). Information on expiration date after opening the package and declaration of food additives in the list of ingredients (if applicable) were also taken into consideration.

The criterion adopted for sampling was availability, including an intentional sampling; that is, all products found in at least three different supermarket chains visited by the research team, with the designation of MPV and sold in the following locations, were collected: Sao Paulo - Sao Paulo (Southeast), Porto Alegre - Rio Grande do Sul (South), Goiania - Goias (Midwest), Fortaleza - Ceara (Northeast) and Porto Velho - Rondonia (North). The analyzed labels were collected by partner researchers who lived in these locations and demonstrated their willingness to participate in the study. The information collected on the labels was organized with the aid of a spreadsheet designed with the Microsoft Excel 2007® program.

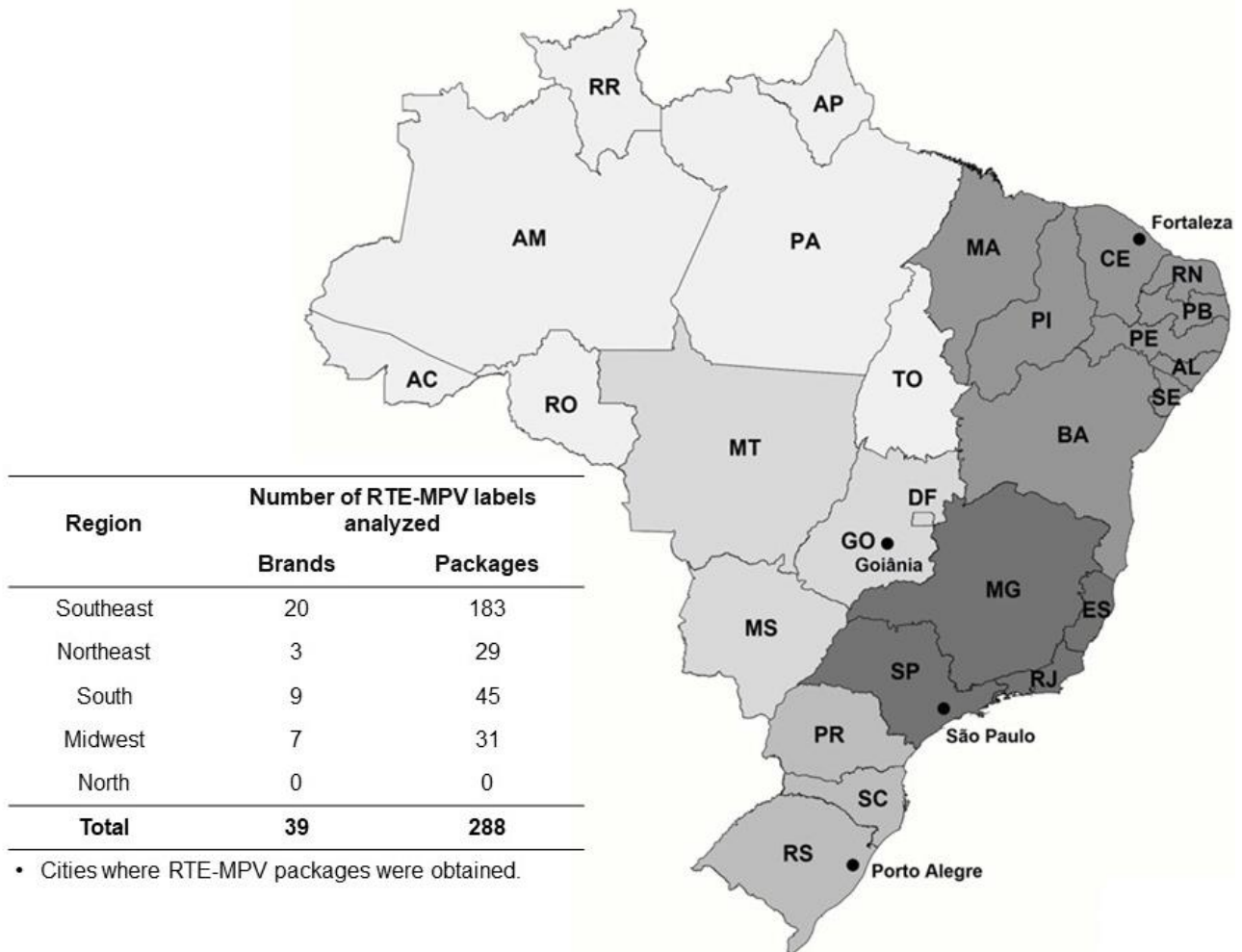
Even though the present study considered the different types of legislation in force during the period of its execution, some of them have been updated over the past few years. For instance, RDC n° 429 from October 8th, 2020 (Nutritional labeling

of packaged foods)<sup>23</sup> complemented by the Normative Instruction (IN) n° 75 from October 8th, 2020 (Technical requirements for nutrition labeling declaration on packaged foods)<sup>24</sup>, revoking RDC n° 359/2003 and RDC n° 360/2003. According to this new legislation, the deadline to meet the requirements in products that are already in the market is October 9th, 2023 (for food companies) and October 9th, 2024 (for small-scale farming businesses and homemade food producers). In addition to the changes in nutritional labeling, there was the publication of RDC n° 727 from July 1st, 2022 (Labeling of packaged foods)<sup>25</sup>, which consolidated aspects concerning packaged food labeling in a single document, revoking their respective resolutions, among which was the RDC n° 259/2002. Since the present study was conducted prior to the implementation of these legislative changes, they were not taken into consideration. Nevertheless, the criteria adopted in the analysis would not change as the modifications were related to improving the clarity and readability of the labels, as well as the need to include additional information not applicable to RTE-MPV.

## RESULTS AND DISCUSSION

The labels of 288 RTE-MPV packages, belonging to 39 brands, sold in the four most populous capitals located in different Brazilian regions (Southeast, South, Midwest, and Northeast) were analyzed in this study (Figure 1). Most of the analyzed brands (20; 51.3%) were found in supermarkets and grocery stores located in the southeastern region. Only four of the 39 brands evaluated were found in more than one region of the country and none of them was found in all regions. Interestingly, RTE-MPV were not found in any of the several establishments visited by the team in the capital selected for the North region of Brazil, so data from this region were not obtained.

**Figure 1.** Number of RTE-MPV labels analyzed according to Brazilian region. The map was created on MapChart. Southeast (ES: Espírito Santo, MG: Minas Gerais, RJ: Rio de Janeiro, SP: Sao Paulo); South (PR: Parana, SC: Santa Catarina, RS: Rio Grande do Sul); Northeast (AL: Alagoas, BA: Bahia, CE: Ceara, MA: Maranhao, PB: Paraíba, PE: Pernambuco, PI: Piaui, RN: Rio Grande do Norte, SE: Sergipe); Midwest (DF: Distrito Federal, GO: Goias, MT: Mato Grosso, MS: Mato Grosso do Sul); North (AC: Acre, AM: Amazonas, AP: Amapa, PA: Para, RO: Rondonia, RR: Roraima, TO: Tocantins).



Source: Authors.

Studies addressing RTE-MPV labels are scarce in the literature. To the best of our knowledge, this is the first study that evaluates the labels of RTE-MPV sold in different Brazilian regions. Yet, a local study carried out by Prado *et al.*<sup>26</sup> analyzed the labels of 70 samples of RTE-MPV sold in the city of Ribeirao Preto, SP, and found that most of them fall short on the lack of information about the place of origin (country) (91.4%) and absence of complete address (82.9%). Other studies that evaluated the

label of different foods also found lack of information about list of ingredients, nutritional content, and expiration date<sup>15,27,28</sup>.

The results obtained in the present study revealed that among the 39 brands analyzed, 32 (82%) had at least one aspect that was not in accordance with the legislation, such as the lack of information about the place of origin (8; 20.5%) and

the presence or absence of gluten (7; 17.9%) (Table 2).

**Table 2.** Number of brands (%) sold in different Brazilian regions in disagreement with the food labeling legislation in force in 2021.

| Information in disagreement  | Brazilian regions |              |                |                  |               |
|--|-------------------|--------------|----------------|------------------|---------------|
|  | Southeast<br>n=20 | South<br>n=9 | Midwest<br>n=7 | Northeast<br>n=2 | Total<br>n=39 |
| <b>RDC nº 259/2002</b>   |                   |              |                |                  |               |
| List of ingredients  | 5 (25 %)          | 0            | 0              | 0                | 5 (12.8%)     |
| Lack of the expression: "ingredients" or "ingr."                       | 4 (20%)           | 1 (11.1%)    | 1 (14.3%)      | 0                | 6 (15.4%)     |
| Place of origin  | 6 (30%)           | 1 (11.1%)    | 1 (14.3%)      | 0                | 8 (20.5%)     |
| Address  | 3 (15%)           | 0            | 0              | 0                | 3 (7.7%)      |
| Registration number or CNPJ  | 2 (10%)           | 0            | 0              | 0                | 2 (5.1%)      |
| Lack of the expressions: "made in...", "product..." or "industry..."   | 5 (25%)           | 0            | 0              | 0                | 5 (12.8%)     |
| Lack of conservation specifications                                    | 0                 | 1 (11.1%)    | 1 (14.3%)      | 0                | 2 (5.1%)      |
| <b>RDC nº 359/2003</b>   |                   |              |                |                  |               |
| Household measures   | 9 (45%)           | 4 (44.4%)    | 1 (14.3%)      | 0 (0%)           | 14 (35.9%)    |
| <b>RDC nº 360/2003</b>   |                   |              |                |                  |               |
| No units of measure from the nutritional table                         | 5 (25%)           | 0            | 0              | 0                | 5 (12.8%)     |
| No nutritional table   | 1 (5%)            | 0            | 0              | 0                | 1 (2.6%)      |
| Lack of some nutrient(s) on the nutritional table                      | 3 (15%)           | 2 (22.2%)    | 0              | 0                | 5 (12.8%)     |
| <b>Law nº 10,674/2003</b>  |                   |              |                |                  |               |
| Lack of the expression: "contains gluten" or "does not contain gluten" | 2 (10%)           | 3 (33.3%)    | 2 (28.6%)      | 0                | 7 (17.9%)     |

**Note:** RDC nº 259 and Law nº 10,674 were mandatory, while RDC nº 359 and RDC nº 360 were optional for RTE-MPV.

**Source:** Authors.

Regarding these nonconformities, it is important to highlight that the absence of information about the place of origin (and even complete address) of the RTE-MPV packages indicates lack of transparency concerning the product's manufacturer. Concerning the information about the presence or absence of gluten, this has been mandatory in Brazil since 2003 through Law nº 10,674. Thus, all food companies must include either "contains gluten" or "does not contain gluten" on their food labels, as a preventive measure for the control of celiac disease<sup>18</sup>.

Although optional, nutritional labeling was adopted by most brands (38; 97.4%), but the information was incomplete in ten of them. Brazil and some other Latin American countries such as Argentina, Paraguay and Uruguay have implemented similar food labeling legislation, requiring that the amount of the product (portion) in household measures (e.g., spoon, cup, slice, units etc.), in

addition to grams or milliliters, should be mandatory information<sup>19,29,30</sup>. The food industry is responsible for defining the most appropriate household measure<sup>19,30</sup>. RTE-MPV is exempt from information about household measure; however, it was observed in 25 (64.1%) of the brands analyzed in the present study.

The brands sold in the city of Sao Paulo (n=20) were also analyzed according to the Resolution SAA nº 42/2009, including technical standards for RTE-MPV. Only five out of the 20 brands fully met this resolution, while the others showed the following nonconformities: lack of information about product sanitation (12; 60%), expiration date after opening the product (10; 50%) and vacuum-packed products without this information (3; 15%) (Table 3). Nonetheless, among these five brands, one deemed non-compliant with the federal legislation, RDC nº 259 (mandatory), due to the absence of list of ingredients.

**Table 3.** Number of brands (%) sold in the city of Sao Paulo in disagreement with technical standards for RTE-MPV.

| Information in disagreement                     |    |    |
|---|----|----|
| SAA nº 42/2009                                  | n  | %  |
| Information on product sanitation               | 12 | 60 |
| Expiration date after opening the product       | 10 | 50 |
| Vacuum-packed products without this information | 3  | 15 |

Source: Authors.

To be sold as RTE, vegetables must go through a disinfection step, aiming to reduce the microbial load and to eliminate pathogenic microorganisms that may be present. Therefore, it is essential that this information is present on the label. Nonetheless, several studies published in recent years have detected the presence of microbial pathogens in RTE-MPV, causing consumer distrust in the microbiological safety associated with its consumption<sup>8,31,32,33,34,35,36</sup>.

Information about the expiration date is also essential. Studies have shown that the expiration date is the main (and sometimes the only) information that consumers look for on labels<sup>37,38</sup>. Vacuum packaging (VP), as well as modified atmosphere packaging (MAP), have been widely used to maintain the safety and extend the shelf life of RTE-MPV. While VP consists in completely removing the air present from the pack, MAP provides alterations of atmospheric gas concentrations in the pack<sup>2,39,40</sup>. According to Resolution SAA nº 42/2009<sup>21</sup>, if RTE-

MPV are vacuum-packed, this information must appear on the label, including a warning so that the product is not consumed if it is not in this condition.

Consumers have the right to access information about the products they are purchasing, so labels are extremely important. However, sometimes consumers may find it difficult to understand the information conveyed in food labels, resulting in decreased importance on labeling<sup>37</sup>. Cavada *et al.*<sup>11</sup> conducted a study aiming to evaluate the habit of reading labels among consumers in a supermarket chain in Pelotas, RS, Southern Brazil. They observed that among 241 participants, 116 (48.1%) used to evaluate food labels - mostly women, young people, and university graduates. In addition, they found a significant association between reading habits and its influence on the purchase of products, revealing the importance of labeling as a tool for purchase.

A recent study conducted by Finger *et al.*<sup>41</sup> had the objective of examining the characteristics of Brazilian consumers of RTE-MPV. Among the 685 participants surveyed, 280 (40.9%) indicated that they consistently checked labels when buying RTE-MPV, whereas 44 (6.4%) never did so. The label items that garnered the most attention included the expiration date (84.1%), the manufacturing date (61.3%), and details related to hygiene or washing (42.5%).

## CONCLUSION

Overall, all RTE-MPV brands analyzed in the present study presented labeling, but only eight (20.5%) of them fully met all the criteria established by the analyzed legislation. Moreover, the results indicate flaws in the labeling of RTE-MPV in Brazil, emphasizing the need for manufacturers to adapt and comply with the requirements. Although optional, nutritional labeling was adopted by most brands, which is significantly important for consumers to have additional information about what they consume.

## ACKNOWLEDGMENTS

Pinto UM acknowledges the National Council for Scientific and Technological Development, CNPq-Brazil, (grant #422242/2018-

7) for financial support. Finger JAFF acknowledges the CNPq-Brazil (grant #168279/2017-7) for scholarship. Costa DA acknowledges the USP's Unified Scholarship Program.

## FUNDING

The Sao Paulo Research Foundation (FAPESP, Brazil) provided funding through grant #2013/07914-8 to the Food Research Center.

## CONFLICTS OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## AUTHOR CONTRIBUTIONS

Jéssica de Aragão Freire Ferreira Finger: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. Daniela Amaral Costa: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. Virgínia Farias Alves: Investigation, Writing – review & editing. Wilma Stella Giffoni Vieira Baroni: Investigation, Writing – review & editing. Patrícia da Silva Malheiros: Investigation, Writing – review & editing. Enrique Anastácio Alves: Investigation, Writing – review & editing. Daniele Fernanda Maffei: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. Uelinton Manoel Pinto: Writing – review & editing, Supervision, Project administration.

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