

# Comparison among experimentally analyzed fat levels and levels reported on the labels of *empanadas* sold in school cafeterias in Florianópolis, Santa Catarina, Brazil

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## Abstract

**Objective:** To analyze levels of total, saturated, monounsaturated, polyunsaturated, and trans fats of *empanadas* sold in school cafeterias, compared to their nutritional information. **Methods:** A total of 14 chicken, chicken and requeijão, four cheeses, and Brazilian calabresa sausage *empanadas* sold in school cafeterias in downtown Florianópolis, Santa Catarina state, Brazil, were analyzed. The total fat content (by Soxhlet extraction) and fatty acids profile (by gas chromatography) were determined. The results obtained were compared with the nutritional information on their respective labels. **Results:** All samples presented the obligatory nutritional labeling; however, there were some irregularities, according to the legislation (particularly in relation with trans fats). Hydrogenated vegetable fat, a source of trans fats, was the most cited ingredient in ingredient lists. Analysis results presented levels of (g/40g serving) of: total fat 2.7-6.4; saturated fat 0.61-2.9; monounsaturated fat 0.82-2.5; polyunsaturated fat 0.33-0.84; trans fats 0.51-2.1. All of the nine samples declaring zero trans fats per serving had levels above 0.2g/serving, beyond the limit permitted to be considered zero trans food. **Conclusion:** The *empanadas* analyzed showed nutritional information inconsistent with the norm, which hinders the healthy choice of food. Additionally, high amounts of trans fats and low percentages of polyunsaturated fats point towards an inadequacy of fats in these foods. The results serve as a warning against the nutritional quality of foods sold in school environments.

**Key words:** Trans fatty acid; Lipids; Nutritional labeling; School Feeding.

## Introduction

The high prevalence of overweight and obesity among children and adolescents in Brazil and in the world,<sup>1-3</sup> coupled with the fact that school cafeterias are important eating sites for this population,<sup>4-6</sup> indicate the need to offer healthy foods in these facilities.

In 2006, the Brazilian government established guidelines for promoting healthy eating in schools, including the restriction on trading foods and preparations with high levels of total fat (TF), saturated fat (SF), trans-fat (trans-fat), free sugar and salt in the school environment.<sup>7, 8</sup> Previously, some state, municipal and district governments had already regulated the sale of food by school cafeterias in general, prohibiting the sale of alcoholic beverages, junk food, soft drinks, artificial juices, industrialized snacks and popcorn and fried snacks.<sup>8</sup>

In this context, baked snacks emerge as one of the most common foods in school cafeterias, among which the empanadas.<sup>6,9</sup> In the Brazilian state of Santa Catarina, one study found that 93% of private school cafeterias would market baked snacks, representing the highest percentage among all surveyed food.<sup>4</sup>

Baked snacks, such as (stuffed bread or pastry baked or fried in many countries in Latin America) empanadas, are classified as bakery products, prepared mainly with flour, and they may be mixed with other ingredients like water, salt and fat.<sup>10</sup> Fats play important roles in baked goods, such as incorporation of air, lubrication, heat transfer, softness, moisture, flavor, aroma, structure and increased shelf life. There are several types of oils/fats which can be used, such as butter, margarine, hydrogenated vegetable fat, among others, with different properties for food and also nutritionally.<sup>11</sup>

Hydrogenated vegetable fat is noteworthy, a fat with good oxidative stability, good plasticity and ability to confer softness to the final product, besides being affordable.<sup>12</sup> However, it presents trans-fats in its composition and epidemiological evidence links its consumption to a number of chronic diseases, particularly cardiovascular ones.<sup>13,14</sup> The World Health Organization (WHO) recommends eliminating trans-fats from food and many countries have adopted strategies to comply with this recommendation.<sup>15-17</sup> In Brazil, stating on food labeling the content of TF, SF and trans-fat is mandatory.<sup>18</sup>

For WHO, the access to nutritional information provided on food labels strengthens the capacity of analysis and decision for consumers seeking a healthier diet.<sup>15</sup> In addition, it highlights the need for accurate, standardized and comprehensible information on the content of food, emphasizing that monitoring the nutritional content of processed foods and the information provided to consumers is essential to the effectiveness of strategies to promote healthy eating.<sup>15</sup>

Therefore, the objective of this research was to evaluate the levels of total, saturated, monounsaturated, polyunsaturated and trans fats in empanadas sold in school cafeterias located downtown in the Brazilian city of Florianópolis, SC, by laboratory analyses and compare them with the nutritional information expressed on the label.

## Methods

A cross-sectional study was conducted in private school cafeterias downtown in Florianópolis, SC, in June/July 2014. By telephone, brands and flavors of empanadas more often marketed have been identified. In total, 14 samples of raw and frozen empanadas were collected in school cafeterias or directly from suppliers and transported in an insulated box to the Analytical Laboratory of the Department of Food Science and Technology of Universidade Federal de Santa Catarina.

For the analysis of TF, the method advocated by Brazilian analytical laboratory Instituto Adolfo Lutz<sup>19</sup> was used, via laboratory apparatus Soxhlet extractor. In the analysis of fatty acids, a gas chromatograph (Shimadzu, model 2014), Ce IF 96 method for trans fatty acids and 996.06 method for the other fatty acids<sup>20, 21</sup> were used. The analysis conditions were: temperature 260 °C, column of 105 m with an internal diameter of 0.25 mm and film of 0.20 µm; initial temperature of the column 140 °C; oven temperature increased gradually from 2.5 to 2.5 °C until 240 °C; total run time of 60 minutes; software *GC Solution*.

The empanadas labels were analyzed according to determinations by Resolutions nos. 359 and 360/2003<sup>18, 22</sup> for the presence of label, list of ingredients, serving size and nutritional information, with emphasis on levels of TF, SF and trans-fat. The type of oil/fat in the ingredients list was also analyzed.

The contents of TF, SF and trans-fat obtained by chemical analysis were compared to those found on the labels. Differences greater than or less than 20% were considered noncompliant in accordance with the law.<sup>18</sup>

For the TF and SF (symmetrical) data, t-test was used for matched data. For trans-fats (asymmetrical data), the Wilcoxon signed-rank test for matched data was applied and presented as median and magnitude. Statistical analyses were performed with the software Stata v.11.0 (Stata Corp, College Station, TX, USA). The value of  $p < 0.05$  indicating statistical significance was considered.

## Results

Empanada flavors of chicken, chicken and (milk-derived product, produced in Portugal and Brazil) requeijão, four cheeses and Brazilian calabresa sausage were analyzed from five different manufacturers identified by letters (A), (B), (C), (D) and (E). Table 1 shows the contents of TF, SF, trans-fat, MUFAs (monounsaturated fatty acids) and PUFAs (polyunsaturated fatty acids) determined in the laboratory, the ones declared in the nutrition information on labels, as well as the types of fat used in the manufacture of empanadas listed in the list of ingredients.

**Table 1.** Type of fat of the ingredients list, total fat content, saturated and trans-fats (g/serving) stated on the nutrition information labels and determined in laboratories, and content of monounsaturated and polyunsaturated fats determined in laboratories for *empanadas* sold in private schools cafeterias in the Brazilian city of Florianópolis-SC, 2014.

Empanada (Brand)	Fat (list of ingredients)	Fats (g/serving of 40 g)							
		Total		Saturated		Trans fat		Monoun- saturated fat	Polyunsatu- rated fat
		Label	Laboratory analysis	Label	Laboratory analysis	Label	Laboratory analysis	Laboratory analysis	Laboratory analysis
Chicken and requeijão (A)	PUFAs <sup>a</sup>	4	4.1	1.7	1.3	0	1.2	1.3	0.38
Brazilian calabresa sausage (A)	PUFAs	6	6.3	2	1.9	0	2.1	1.6	0.76
Chicken (A)	PUF	3.7	4.4	1.2	1.3	0	1.3	1.5	0.40
Chicken (B)	HVF <sup>b</sup>	4.5	3.8	0.87	1.1	0	1.0	1.2	0.44
Four cheeses (B)	HVF	6.5	6.4	2.1	2.9	0	1.2	1.9	0.38
Chicken and requeijão (B)	HVF	5.1	2.7	1.4	0.81	0	0.63	0.82	0.46
Four cheeses (C)	HVF	7.3	4.3	3.2	1.3	1.1	0.51	1.8	0.62
Chicken and requeijão (C)	HVF	5.3	3.6	1.6	1.3	1.2	0.58	1.2	0.49

Empanada (Brand)	Fat (list of ingredients)	Fats (g/serving of 40 g)							
		Total		Saturated		Trans fat		Monoun- saturated fat	Polyunsatu- rated fat
		Label	Laboratory analysis	Label	Laboratory analysis	Label	Laboratory analysis	Laboratory analysis	Laboratory analysis
Chicken ( <b>D</b> )	NI <sup>c</sup>	4.6	2.7	1.3	0.61	0	0.63	1.1	0.33
Chicken and requeijão ( <b>D</b> )	NI	4.6	3.2	1.3	0.76	0	0.67	1.3	0.44
Brazilian calabresa sausage ( <b>D</b> )	NI	4.6	4.9	1.3	1.3	0	1.9	1.1	0.65
Chicken and requeijão ( <b>E</b> )	HVF	8	3.8	2.4	1.2	1.6	0.81	1.4	0.40
Brazilian calabresa sausage ( <b>E</b> )	HVF	8.6	5.9	2.4	1.8	1.7	0.70	2.5	0.84
Chicken ( <b>E</b> )	HVF	7	3.9	1.8	1.2	1.6	0.81	1.4	0.47
Means*		<b>5.7 ± 1.6</b>	<b>4.3 ± 1.2<sup>#</sup></b>	<b>1.7 ± 0.63</b>	<b>1.4 ± 0.56<sup>#</sup></b>	<b>0 (0-1.7)</b>	<b>0.81 (0.51-2.1)</b>	<b>1.5 ± 0.40</b>	<b>0.50 ± 0.15</b>

<sup>a</sup>GP – Palm Fat; <sup>b</sup>HVF – Hydrogenated Vegetable Fat; <sup>c</sup>NI – Not informed.

\*Total and Saturated Fat: Data presented as means and standard deviation. T-test for matched data. Trans fat: Data presented as median and magnitude (minimum and maximum). The Wilcoxon signed-rank test for unmatched data. # p < 0.05

All samples of empanadas showed the mandatory nutrition labeling. However, in three samples from manufacturer D the lists of ingredients was omitted and in the three samples from manufacturer A (flavors chicken, calabresa and chicken and requeijão) the same list of ingredients was used. In a sample the amount of dietary fiber was not stated.

From the five manufacturers analyzed, only two (A and C) use as an average serving the amount established by (ANVISA (National Health Surveillance Agency of the Brazilian Ministry of Health)] law RDC no. 359/2003], which for stuffed bakery products is 40 g.<sup>22</sup> The others were using servings ranging from 115 g to 200 g.

Comparing the levels of fats declared on labels with the laboratory tests results it is possible to observe in Table 1 that all samples showed some noncompliance, i.e., in at least one of the items measured the variation was located outside of the tolerable 20% (for more or less), as admitted by RDC no. 360/2003,<sup>18</sup> specially in relation to trans-fat.

**Chart 1.** Classification of the samples of empanadas sold in downtown private schools cafeterias in Brazilian city Florianópolis, SC, regarding the compliance among the laboratory analyses results and the labels information. Florianópolis-SC, 2014

<b>Empanada</b>	<b>General evaluation</b>	<b>TF</b>	<b>SF</b>	<b>Trans-fat</b>
Chicken and requeijão (A)	NC	C	PNC	NNC
Brazilian calabresa sausage (A)	NC	C	C	NNC
Chicken (A)	NC	C	C	NNC
Chicken (B)	NC	C	NNC	NNC
Four cheeses (B)	NC	C	NNC	NNC
Chicken and requeijão (B)	NC	PNC	PNC	NNC
Four cheeses (C)	NC	PNC	PNC	PNC
Chicken and requeijão (C)	NC	PNC	PNC	PNC
Chicken (D)	NC	PNC	PNC	NNC
Chicken and requeijão (D)	NC	PNC	PNC	NNC
Brazilian calabresa sausage (D)	NC	C	C	NNC
Chicken and requeijão (E)	NC	PNC	PNC	PNC
Brazilian calabresa sausage (E)	NC	PNC	PNC	PNC
Chicken (E)	NC	PNC	PNC	PNC

**C** – Compliant – variation between the laboratory analysis value and the label within what is permitted by law (20%).

**NC** – Noncompliant – variation between the laboratory analysis value and the top label at 20% in at least one of the items evaluated.

**PNC** – Positive noncompliant (or by overestimation) – higher label values (beyond the 20% tolerated) than the laboratory analysis values.

**NNC** – Negative noncompliant (or by underestimation) – lower label values (beyond the 20% tolerated) than the laboratory analysis values.

Only six samples (42.9%) for TF and three (21.4%) for SF showed conformity between the value stated on the label and the laboratory analysis and the most frequent failure was the overestimation of the values declared.

For trans-fat, no sample had compliance and the most frequent failure was the underestimation of the values declared. From the nine samples stating to have zero trans-fat in the serving, all had a level above the limit allowed to be considered zero trans-fat (0.2 g/serving).<sup>18</sup> On the other hand, the five samples stating to have some level of trans-fat overestimated the values in up to 140%.

## Discussion

In a study evaluating school cafeterias in Brazilian Federal District, Porto et al.<sup>9</sup> have also found a wide range of baked snacks with cured dry food, cheese and chicken, as observed in this research. Cured dry food such as calabresa, one of the most marketed flavors among the cafeterias under study, has a high content of sodium and saturated fat.<sup>8</sup> Therefore, they are not recommended as a healthy meal for children and adolescents.

In the lists of ingredients in empanadas, hydrogenated vegetable fat (HVF) was the most frequent. Bakery products are usually produced with this type of fat, due to its excellent performance,<sup>12</sup> but it is a relevant source of trans-fat.<sup>23</sup>

Literature reviews have shown a positive relationship between the consumption of industrial trans-fat, such as the one from HVF, and detriments to health, among them: insulin resistance,<sup>13,24</sup> male and female infertility, obesity, depression and especially the development of cardiovascular diseases.<sup>12,13,24,25</sup> According to Uauy and Dangour,<sup>26</sup> food rich in HVF must be avoided by children and adolescents.

It should be noted that not all trans fatty acids have negative effects on health. Those produced from the fermentation of bacteria present in the rumen of animals – the so-called conjugated linoleic acid (CLA) – have anticarcinogenic effects, for example.<sup>27</sup> Meat and dairy products may contain small amounts of this fatty acid, from 0.002 to 0.005 g/g of total fat.<sup>27</sup>

The list of ingredients of empanadas of brand A states the use of palm fat, which is used to replace HVF due to being free from trans-fat, but having a high level of SF.<sup>28</sup> However, empanadas of brand A showed the highest amounts of trans-fats, indicating the use of a source of trans-fats. Brand D has not informed the type of fat used, but by the level of trans-fats found in the analyses it is possible to infer that it has used some type of fat having trans-fats.

In the study by Hissanaga-Himmelstein et al.,<sup>29</sup> analysis of trans-fats was performed for nine types of crackers and three types of bread, comparing the amounts informed on the labels. The results showed that 92% of the products had trans-fats, although only 33% had informed this on their labels. However, stating zero trans-fats in the serving is allowed when the level of trans-fats is lower than 0.2 g/serving and the products are analyzed according to law RDC no. 360/2003.<sup>18</sup>

When consuming an entire *empanada* (155 g), a person ingests on average 16.7 g of TF; 5.4 g of SF; from 2 to 8.1 g of trans-fats; 5.8 g of MUFAs and 1.9 g of PUFAs. According to Uauy and Dangour, the consumption of trans-fats must be reduced to less than 1% of the total energy consumed daily, which in a 2000 Kcal diet would result in 2 g/day.<sup>26</sup> Therefore, it is observed that *empanadas* are nutritionally inadequate due to being food with high levels of trans-fats.

The recommendation for healthy meals for children and adolescents includes a diet with approximately 30% of TF (in relation to the total energy value), being up to 10% of SF; between 5 and 15% of PUFAs and minimum of 10% of MUFAs. Therefore, it may be concluded that the *empanadas* analyzed are low in PUFAs, a source of essential fatty acids such as omegas 3 and 6, essential for an adequate diet.<sup>26</sup>

When classifying this food using the “Nutrition Traffic Lights” methodology, adapted from UK *Traffic Light Labelling* by Longo-Silva et al.,<sup>30</sup> one has amber signal (a nutrient present in medium amount) for TF and SF and red signal (excessive amount) for trans-fats. Therefore, it is not appropriate for school lunches.

Amorim et al.<sup>31</sup> have established a system of analysis and evaluation of the products sold in school cafeterias for the classification of foods in healthier or less healthy. However, the presence or absence of trans-fats was restricted to the existence of hydrogenated vegetable fat among the ingredients. Thus, baked snacks were considered as one of the healthiest foods from the ones offered. However, ingredients such as margarine, vegetable fat and vegetable cream, which can be used in the preparation of these foods,<sup>11</sup> may also be trans-fat sources, as warned by Silveira et al.<sup>32</sup>

As an alternative to these sources of trans-fats, Zelman suggests using liquid vegetable oils whenever possible, especially if they are sources of monounsaturated and polyunsaturated fats, and when solid fats are necessary, using trans-fats-free products.<sup>33</sup> Calderelli et al.,<sup>34</sup> when replacing HVF by soybean oil in a type of bread, obtained good results regarding the product acceptability. However, it is assumed that this substitution is not always satisfactory from a technological point of view. Hence the importance of making adjustments to the products formulations, followed by sensory evaluations.

The irregularities found in the lists of ingredients and serving sizes show the difficulty that the consumer faces when choosing their products by the information available on labels. Finding the same list of ingredients in different empanadas of distinct flavors denotes the fragility of the data available to customers. Moreover, all the empanadas had, in at least one of the nutrients stated, data above or below the acceptable percentage of variation compared to the values found in the laboratory analyses. It should be highlighted that correct and reliable labeling is essential for consumers to properly choose their food.<sup>15,35</sup> Serving size standardization is important to assist consumers in comparing the nutritional value of different manufacturers' products and thus to assess the most appropriate product to their nutritional needs.

In a study of labels of 1,102 manufactured foods for sale in a supermarket in southern Brazil, researchers found that 28% of the labels analyzed were not in agreement with the reference serving defined by Brazilian law. Besides, they considered that the information on serving and home measurement on the labels of Brazilian manufactured products are not precise or standardized, causing difficulty in understanding and using this information by consumers.<sup>36</sup>

According to Câmara et al.,<sup>37</sup> studies have pointed out the problem of lack of reliability of nutrition information on food labels in Brazil. Lobanco et al.,<sup>38</sup> in their study with processed foods commonly consumed by children and adolescents, have found 100% of non-conformity among salty foods, especially in relation to dietary fiber values, sodium and saturated fats informed. According to the authors, this discrepancy may be related to analytical issues, such as methods of total and partial fat extraction or the calculation of nutritional value from food composition tables based on raw material or product ingredients, but that would be within the 20% tolerance accepted by the legislation.

## Conclusion

All samples showed nutrition labeling, but with some variation of nutrient content beyond the tolerance allowed by law. The empanadas analyzed showed high amounts of trans-fats and low percentage of PUFAs, demonstrating nutritional imbalance with respect to these fats in these foods.

The results serve as a warning about the nutritional quality of foods released for sale in school cafeterias. In addition, they point out the need to conduct further studies with larger samples; the importance of empowering the cafeteria owners (and other actors in school management) for identification and selection of healthy foods, reducing access to unhealthy diet; the need for a possible improvement in legislation for school cafeterias to limit ingredients like partially hydrogenated fats, margarine/vegetable creams manufactured by partial hydrogenation (trans-fat source) and cured dry food; and the need for monitoring/inspecting the information stated on food labels.

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