

## Physicochemical characterization and label comparison among diet yogurts sold in the city of Limoeiro do Norte – CE

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### Abstract

This work aimed at analyzing labels (based on the current legislation) and confirm the nutritional information given on the label of five brands of diet yogurt. The physicochemical analyses carried out were: moisture, minerals, proteins, lipids, reducing carbohydrates in lactose, non-reducing carbohydrates in sucrose, total carbohydrates, acidity and pH. All brands of diet yogurt had mandatory nutritional information on their label. As for content, only brands B and C are compliant with the current legal demands. The numbers found in the analyses for protein and carbohydrates were higher than the percentages shown on the labels in all brands. There were no numbers for lipids. Despite the differences found on the labels, all brands of diet yogurt are in accordance with the Identity and Quality Standards for Fermented Milk as for protein, acidity and fat content. There was a significant difference in the complementary analyses for moisture, minerals and acidity. Nevertheless, the numbers assigned to carbohydrates and protein were lower than the actual values determined in lab and, in some brands, carbohydrates were three times higher. Thus, despite presenting all the necessary information on the label, the companies are not concerned about showing the correct nutritional data to consumers.

**Keywords:** fermented milk; lacteous products; centesimal composition; labeling.

**Practical Application:** This paper highlights the importance to investigate what foods actually contain and check whether this mandatory information on the labels are true and placed in accordance with national demands. The products chosen for analysis were diet yogurts, whose label information was investigated based on specific legislation and physicochemical analyses that are highly necessary to verify whether the centesimal composition of yogurts sold to consumers is real, given that every consumer is entitled to correct and true information.

### 1 Introduction

According to the Ministry of Agriculture and Supply, Normative Instruction No. 16, of 23 August 2005, there is a regulation that characterizes identity and quality of fermented milk, in order to standardize the minimum demands to be complied with and serve the consumer well. According to this Normative Instruction, dairy products are all of those products obtained from any kind of milk processing and that may have dietary additives and other ingredients necessary to their processing. Yogurt is within this category (Brasil, 2005a).

Fermented milk is regarded as products with or without dietary substances that are obtained from milk coagulation and decrease in their pH, or reconstituted milk added with (or not) other lacteous products which, in both cases, are submitted to lactic fermentation by the action of specific microorganisms that must remain viable, active and abundant up to the expiration date. This group comprises yogurts, fermented milk and curd (Brasil, 2007).

Yogurt is a product derived from milk fermented by lactic bacteria (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*).

These bacteria use part of lactose, which is the sugar found in milk, and transform it into lactic acid and aromatic compounds that characterize yogurts (Silva, 2013). For yogurts, the optional non-lacteous ingredients must be at a maximum proportion of 30% (m/m) of the final product (Brasil, 2007).

Normative Instruction No. 22, of 24 November 2005, which covers industrial and sanitary inspection of animal products (Brasil, 2005b) to elaborate packed animal products, says that representations must not lead to errors or bring insufficient information. Data on milk processing methods and the kind of milk as to fat content are not mandatorily on the sales, but may lead the consumer to have questions.

Labels, especially the nutritional table, must provide the consumers with all information necessary to help choosing the product based on their needs. Moreover, labeling foods of animal origin must comply with the legal standards. Given the above, this work aimed at analyzing labels, in accordance with the Law, and confirm the nutritional data, as to physicochemical aspects, provided on labels of five different brands of diet yogurt.

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## 2 Materials and methods

### 2.1 Choosing diet yogurts

In order to carry out the label analysis and confirm the information provided on the nutritional table by means of standard physicochemical analyses, we selected in supermarkets in Limoeiro do Norte (Ceará, Brazil), five diet yogurts from different brands, being brands A, B and C with natural flavor and D and E with strawberry flavor. The unviolated samples were acquired and refrigerated at the same conditions as they were exposed to the consumer. Afterwards, they were taken to the Laboratory of Food Biochemistry at the Instituto Federal de Educação, Ciência e Tecnologia do Ceará – Campus Limoeiro do Norte, for further analyses.

### 2.2 Physicochemical characterization and label analysis

We ran analyses to determine dry residues at 105°C and calcination (minerals), proteins by Kjeldahl's classic method, lipids by Gerber's, non-reducing carbohydrates in sucrose, reducing carbohydrates in lactose, total carbohydrates (by summing up reducing and non-reducing carbohydrates), acidity in lactic acid and pH (using a bench pHmeter), following the methodology for food analysis described by Instituto Adolfo Lutz (2008). Label analysis was compared to Normative Instruction No. 22, of 24 November 2005, Normative Instruction No. 46 of 23 October 2007, Resolution RDC No. 360, of 23 December 2003, and RDC No. 359, of 23 December 2003.

### 2.3 Statistical analysis

The results were submitted to statistical analysis ran on the statistical software STATISTICA 7, where we obtained averages, standard deviation, analysis of variance and average test at 5% of probability (Tukey).

All analyses were carried out in triplicates with three repetitions for each sample, a batch for each repetition, a total of three batches of each sample aiming at better and trustworthy results.

## 3 Results and discussion

According to Normative Instruction No. 22, of 24 November 2005, animal products must be labeled with their sale denomination, the list of ingredients, the establishment's address, the Federal Inspection's official stamp, product conservation, lot identification, date of manufacture and date of expiration. All brands of diet yogurt had this mandatory information, being compliant with all the demands from the current Normative Instruction (Brasil, 2005b).

All five brands were labeled with the mandatory nutritional information, in accordance with RDC No. 360, of 23 December 2003, which regulates the nutritional labeling of packed foods (Brasil, 2003b).

Content, i.e., the average amount of food that must be consumed by healthy people is determined by RDC No. 359, which defines that, for yogurt, the amount is 200 g. Only brands D and E (net amount, 500 and 1000g, respectively) had a nutritional table based on portions of 200 g. Brands A, B and C (in fractioned

pot of 160, 170 and 160g, respectively) had nutritional charts based on their respective individual portions, which is divergent from what the Resolution states (Brasil, 2003a).

According to Grandi & Rossi (2010), the information related to the package content in standardized portions makes it easier for the consumer to understand and decreases difficulties in analyzing and comparing products.

The results for physicochemical analyses in comparison to the numbers displayed on the labels are described on Table 1.

Equal lowercase letters in the same column show that there was no significant difference among the brands under analysis and equal uppercase letters in the same row, for the same parameter, mean that there was no significant difference between the label and the result found, in accordance with Tukey Test ( $p < 0.05$ ).

According to Normative Instruction No. 46, of 23 October 2007 (Brasil, 2007), issued by the Ministry of Agriculture and Supply (in Portuguese, Ministério da Agricultura, Pecuária e Abastecimento – MAPA), which determines Identity and Quality Standards for Fermented Milk (PIQ), these must be compliant with a minimum percentage of 2.9% of lacteous proteins. The percentage in both labels and results found for this aspect are in accordance with the Law, except for the number presented on label E (2.70%). Nevertheless, the numbers in all labels are statistically inferior to the results found, which are ranging between 3.74% and 4.59% of proteins in yogurt. Still on proteins, the percentages available on the labels were significantly different from each other, but, observing the numbers obtained from our analyses, brands A and B differed statistically from brands D and E, whereas brand C was similar to the others.

Venturoso et al. (2007), while studying the physicochemical composition of lacteous products in commerce, had low percentages for proteins (1.75 to 1.99%) in three brands of diet yogurt. Cunha et al. (2005) found results (4.17 to 4.74%) that were similar to this work's, while analyzing whole, standardized and skim yogurts, produced with bubaline milk.

The current legislation does not provide the percentage of carbohydrates that may be added to diet yogurt. The results on carbohydrates for the brands we assessed varied between 6.72 to 15.59% of carbohydrates, which shows that all brands inform amounts much lower to what they actually have. Comparing brands with the percentage of carbohydrates we obtained, from

**Table 1.** Physicochemical analyses compared to the percentages of protein, carbohydrates and lipids founds on labels of diet yogurts (natural and strawberry flavor).

Brands	Parameters (%)					
	Proteins		Carbohydrates		Lipids	
	Label	Result	Label	Result	Label	Result
A	4 <sup>eA</sup> ± 0.2	5 <sup>bb</sup> ± 1	6 <sup>eA</sup> ± 0.2	7 <sup>ab</sup> ± 1	0	0
B	3.5 <sup>cA</sup> ± 0.1	5 <sup>bb</sup> ± 1	5 <sup>dA</sup> ± 0.3	16 <sup>db</sup> ± 0.7	0	0
C	4 <sup>dA</sup> ± 0.5	4 <sup>abb</sup> ± 1	5 <sup>eA</sup> ± 0.2	13 <sup>cb</sup> ± 0.7	0	0
D	3 <sup>bA</sup> ± 0.1	4 <sup>ab</sup> ± 1	5 <sup>bA</sup> ± 0.5	7 <sup>ab</sup> ± 1	0	0
E	3 <sup>aA</sup> ± 0.3	4 <sup>ab</sup> ± 1	4 <sup>aA</sup> ± 0.3	11 <sup>bb</sup> ± 1	0	0

Brands A, B and C: Natural yogurt; Brands D and E: Strawberry flavor.

labels and analyses, brands B, C and E differed statistically, which confirms the lack of standardization for this parameter.

Still on carbohydrates, the values found on brands B, C and E were twice as higher as what the labels indicate. Even though the product is in compliance with PIQ, the label shows incorrect information to the consumer. Cavada et al. (2012) say that labels are made to inform the consumers as to the compounds in the food, helping them have healthy dietary choices. However, this does not mean that consumers are using them as a tool to choose foods that will take part in their diet and, thus, reduce dietary excesses and damages to health. An incorrect label hampers communication, makes it hard for the consumer to have a proper diet and breaks the trust between product and consumer.

While comparing yogurts sold in the Brazilian market with yogurts produced with nonfat soy extract, Miguel et al. (2010) obtained carbohydrate percentages that were higher than this study's, varying between 66.90 and 80.22%, including yogurts from the Brazilian market.

Lacteous fat matter for skimmed fermented milk should be 0.5%, at most (Brasil, 2000, 2007). From the analyses of lipids in all five brands of diet yogurt, the absence of fat matter in their composition was confirmed. Thus, the information provided on the labels is in accordance with the analysis and the law. Venturoso et al. (2007) found the same result in diet fermented milks.

Table 2 described the complementary physicochemical analyses that are not provided on the labels and yet are highly important to characterize diet yogurts.

The complementary physicochemical parameters assessed in this work differed statistically among the brands, except for pH (average 4). Several studies on yogurt elaboration and characterization and brand comparison also had similar results for pH, which is approximately 4 (Braga et al., 2012; Cunha et al., 2005; Giese, et al., 2010; Martins et al., 2013; Miguel et al., 2010).

High moisture percentages make the food proper to develop undesired microorganisms, which may cause rapid deterioration. Brands A and D did not differ statistically and had the highest moisture percentages (87.21 and 87.87%, respectively) in relation to the other brands. Brands B, C and E differed statistically; however, all brands have high moisture percentages, which is normal for this kind of product.

**Table 2.** Complementary results for the physicochemical analyses of strawberry and natural diet yogurts.

Brands	Parameters			
	Moisture (%)	Minerals (%)	Acidity (% of lactic acid)	pH
A	88 <sup>d</sup> ± 1	1 <sup>b</sup> ± 0.2	1 <sup>c</sup> ± 0.2	4 <sup>a</sup> ± 0.1
B	79 <sup>a</sup> ± 0.5	1 <sup>b</sup> ± 0.2	1 <sup>d</sup> ± 0.1	4 <sup>a</sup> ± 0.1
C	82 <sup>b</sup> ± 1	1 <sup>b</sup> ± 0.2	1 <sup>c</sup> ± 0.02	4 <sup>a</sup> ± 0.1
D	88 <sup>d</sup> ± 1	0.7 <sup>a</sup> ± 0.01	1 <sup>b</sup> ± 0.1	4 <sup>a</sup> ± 0.1
E	85 <sup>c</sup> ± 1	0.6 <sup>a</sup> ± 0.02	0.7 <sup>a</sup> ± 0.05	4 <sup>a</sup> ± 0.1

Brands A, B and C: Natural yogurt; Brands D and E: Strawberry flavor. Equal lowercase letters in the same column show that there was no significant difference among the brands under analysis, in accordance with Tukey Test ( $p < 0.05$ ).

In a study with yogurts added with mangosteen pulp, Braga et al. (2012) had results for moisture (78.80%) similar to brand B and lower than the other brands of diet yogurt in this study. Martins et al. (2013) obtained 85.18% of moisture for yogurts made with hydrosoluble soy extract, which is in accordance with brands A, C, D and E.

As for minerals, brands A, B and C were similar, with numbers around 0.8%, and brands D and E, around 0.6%. Braga et al. (2012) found 0.8% of minerals in yogurt made with mangosteen pulp (result similar to brands A, B and C, in this study). Still on minerals, Martins et al. (2013) had lower values (0.48%) while studying yogurt elaborated with hydrosoluble soy extract.

In all five brands of diet yogurt, acidity differed statistically, varying between 0.69% and 1.17% of lactic acid. Samples D and E, which are strawberry flavored had the lowest acidity percentages (0.69% and 0.90%, respectively). Despite that, all brands comply with the Identity and Quality Standards for Fermented Milks (Brasil, 2000, 2007) as for acidity in lactic acid, which demands a minimum content of 0.6% and a maximum of 2.0%.

Thus, in a general analysis of the physicochemical parameters, only lipid content was correctly informed on the labels. Protein, acidity and lipid content are within the current legal demands. The brands of diet yogurt we assessed had different results for complementary analyses (moisture, minerals and acidity), whereas pH was the same for all of them.

## 4 Conclusions

Given the results in this study, the information on the labels are compliant with the current legal demands, except for the portions displayed on their nutritional charts of the brands analyzed and for the fact that there were significant differences for most physicochemical parameters under analysis.

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