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Reliability of food labels from products marketed in the city of São Paulo, Southeastern Brazil

ABSTRACT

OBJECTIVE: To assess reliability of information about nutritional facts stated on labels of industrialized foods.

METHODS: A total of 153 industrialized foods, usually consumed by children and adolescents and marketed in the city of São Paulo, Southeastern Brazil, between 2001 and 2005, were analyzed. Nutrient contents stated on labels were compared to the results obtained from official (physical-chemical) analytical methods, considering the 20% variability tolerated by the current legislation to approve or reject samples. Means, standard deviations, 95% confidence intervals for the nutrients analyzed, and the distribution of percentage frequency of samples rejected were calculated.

RESULTS: All salty products analyzed showed non-compliance of dietary fiber, sodium and saturated fat content. Sweet products showed variation between zero and 36% of rejection due to their dietary fiber content. More than half (52%) of cookies were rejected due to their saturated fat content. Nutrients associated with obesity and its health problems were those showing the highest proportions of non-compliance. Lack of reliability of label information in the samples analyzed violates the regulations of the Resolution of the Collegiate Board of Directors RDC 360/03 and the rights guaranteed by the Nutritional and Food Safety Law and Consumer Protection Code.

CONCLUSIONS: High indices of non-compliance of nutritional data were found on labels of foods aimed at children and adolescents, indicating the urgent need for surveillance practices and other nutritional labeling measures.

DESCRIPTORS: Food Labeling. Nutritional Facts. Industrialized Foods. Legislation, Food.

INTRODUCTION

Greater contribution of industrialized foods, rich in sugar and fat, in the Brazilian family diet, to the detriment of basic foods that are sources of complex carbohydrates and dietary fiber, is a relevant characteristic of food pattern changes in the last decades.[10] In Brazil, patterns and tendencies of food availability at home are consistent with the increasing magnitude of non-communicable chronic diseases in the morbimortality profile, as well as with the continuous rise in the prevalence of overweight in this country.[1,a]

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[a] Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2002-2003: análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil. Rio de Janeiro; 2004.

Governmental actions in Brazil include seeking to guarantee both Nutrition and Food Safety,[a] in accordance with the WHO Global Strategy on Diet, Physical Activity and Health.[13] Assuring the presence of useful and reliable information on food labels is a right guaranteed by the Brazilian Consumer Protection Code.[b]

Food labeling entitles the consumer to obtain nutritional information as well as to access quality and safety food parameters. Access to this information meets the requirements of the legislation and, at the same time, encourages companies to invest in the nutritional improvement of their products, whose explicit composition may influence the consumer towards purchase.[8] A reflection on the historical evolution of food label legislation in Brazil, compared to other countries, has recently been published.[8] According to Ferreira & Lanfer-Marquez,[8] the international food market progress and the recognition of consumer rights are among the factors that require standardization of regulations and constant improvement of nutrition label norms.

In 1999, when the *Agência Nacional de Vigilância Sanitária* (*ANVISA* – National Health Surveillance Agency) was founded, nutritional labeling of foods became mandatory in Brazil. The main pieces of legislation concerning manufactured food labeling in Brazil are the following: RDC (Resolution of the Collegiate Board of Directors) 259/02,[c] which defines and establishes measures and serving sizes, including cooking measures and its corresponding serving sizes in grams or milliliters, and details the utensils commonly used in the kitchen, their approximate dimensions and capacities; RDC 360/03,[d] which establishes, among other specifications, the mandatory inclusion of the energy value and protein, carbohydrate, total fat, saturated fat, trans fat, dietary fiber and sodium contents on manufactured food labels. This legislation enables: a criterion for rounding numbers; a 20% variability in nutrition information; and also the gathering of nutrient data by means of physical-chemical analyses, theoretical calculations based on the product formula, data compiled from food composition tables or data provided by raw material manufacturers.

Tolerance of 20% for non-compliance (plus or minus) between the data stated on the label and the "actual" data does not meet the Consumer Protection Code.[b] However, it considers the inevitable variation of raw material composition as well as the changes that occur due to food processing, and the gathering of food composition data from other countries, for certain foods/dishes.

Nutritional labeling must provide reliable information so that this instrument may be able to fulfill its purpose of helping consumers with their choices, and also supporting health professionals to offer guidance on diet composition.

The Brazilian situation concerning fulfillment of nutrition label legislation is still discouraging. This situation is corroborated by research conducted between 1997 and 2004, which shows how often the legislation is disobeyed.[5]

The present study aimed to assess the reliability of nutrition information stated on food labeling of industrialized foods.

METHODS

This study deals with the assessment of nutritional value data, stated on nutritional labeling of pre-packaged foods by law. These data were compared to those obtained from physical-chemical analyses performed in laboratory.

Sampling plan was comprised by industrialized salty and sweet foods, which are described as often consumed by children and adolescents.[4,e] These products were purchased in the city of São Paulo, Southeastern Brazil, between 2001 and 2005. Samples were gathered using the Health Surveillance Agency standard inspection procedure, in accordance with the current legislation,[f] and subsequently sent to the *Instituto Adolfo Lutz* (Adolfo Lutz Institute) for analysis.

A total of 153 samples of industrialized products from 84 different brands were analyzed. Among the salty products, 56 products and 34 brands were analyzed, while among sweet products, 97 products from 50 distinct brands were analyzed. Samples were divided into sweet products (cookies, wafers, milk chocolate, white chocolate, chocolates) and salty products (corn snacks, wheat snacks, potato chips, peanuts) with different flavors and from distinct brands, disregarding the format established by the manufacturer or the product lot number (Table 1). Samples of products were collected in duplicate for the analyses,[15] homogenized in a domestic processor, stored

[a] Brasil. Lei nº 11.346, de 15 de setembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o direito humano à alimentação adequada e dá outras providências. *Diário Oficial da União*. 18 set 2006.
[b] Brasil. Lei nº 8078, de 11 de setembro de 1990. Dispõe sobre a proteção do consumidor e dá outras providências. *Diário Oficial da União*. 12 set 1990.
[c] Agência Nacional de Vigilância Sanitária. Resolução RDC nº 259, de 20 de setembro de 2002. Aprova o Regulamento Técnico sobre Rotulagem de Alimentos Embalados. *Diário Oficial da União*. 23 set 2002.
[d] Agência Nacional de Vigilância Sanitária. Resolução RDC nº 360, de 23 de dezembro de 2003. Aprova o Regulamento Técnico sobre Rotulagem Nutricional de Alimentos Embalados, tornando obrigatória a rotulagem nutricional. *Diário Oficial da União*. 23 dez 2003.
[e] Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2002-2003: análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil. Rio de Janeiro; 2004.
[f] Brasil. Decreto-Lei Federal nº 986, de 21 de outubro de 1969. Institui normas básicas sobre alimentos. *Diário Oficial da União*. 21 out 1969.

in sealed glass containers (250g) at room temperature (≈25°C), and immediately analyzed.

Moisture, ashes, proteins, total fat, saturated fat, dietary fiber, and sodium chloride (in salty products) were determined according to the Physical-Chemical Methods of the *Instituto Adolfo Lutz*.[10]

- moisture: gravimetric technique, determined in a drying oven at 105°C (method 012/IV);
- ashes: gravimetric technique, determined in an oven at 550°C (method 018/IV);
- protein: *Kjedahl* method was used to determine total nitrogen (method 036/IV), using 6.25 or 5.46 (for peanuts) as protein conversion factor;
- dietary fiber: Association of Official Analytical Chemists enzymatic-gravimetric method modified by Lee (1992) was used, using a MÊS-TRIS buffer (method 045/IV);
- sodium chloride: titration with silver nitrate (method 028/IV);
- fat: extraction technique with ethyl ether in a Soxhlet apparatus (method 032/IV);
- composition of fatty acids: gas-chromatography. The fat fraction extracted with Soxhlet/ ethyl ether was submitted to transesterification to form methyl esters (IUPAC 2301 / method 344/IV). Methyl esters were analyzed in a Shimadzu GC-17A gas chromatograph equipped with flame ionization detector. Compounds were separated in fused silica capillary column with the stationary phase of 60 cm DB 23 cyanopropyl polysiloxan with 0.25 mm in inner diameter and 0.20 μm in film thickness. Conditions for operation were as follows: programmed column temperature: 60°C (2 min), heating rate of 15°C/min until 135°C (1 min), heating rate of 3°C/min until 215°C (10 min); injector temperature of 230°C; detector temperature of 240°C; carrier gas: hydrogen; carrier gas linear speed of 20 cm/s; sample division ratio 1:50. Fatty acid methyl esters were identified by comparing retention times to authentic standards of fatty acid methyl esters injected under the same chromatographic conditions. Next, their relative percentages in fat were determined. The mass percentage obtained for each fatty acid methyl ester was multiplied by the sample fat content and by the theoretical conversion factor for fatty acids (0.956)[10]
- the carbohydrate content was obtained by the difference between a hundred and the sum of values of moisture, ashes, proteins, total fat and dietary fiber.
- To calculate the energy value, 4 kcal per gram of carbohydrates and proteins and 9 kcal per gram of total fat were considered.

Results of nutritional composition were expressed in g/100g. Samples were approved or rejected by comparing the values obtained experimentally to the amounts of nutrients stated on labels. Thus, for each sample analyzed, the serving size (in grams) stated on the label was calculated, considering the 20% variability tolerated by the RDC 360/03. The interval of rejection considered, or percentage range of each nutrient, consists in the frequency of non-compliance variation in the samples.

Descriptive data analysis was performed and the 95% confidence interval for the mean value of each nutrient was calculated. The Minitab software, version 13.0, was used for statistical treatment of data.

RESULTS

As regards nutritional composition (Table 2), all products analyzed showed high energy value, as well as fat and sodium contents. In contrast, dietary fiber values were low (mean values between 1.36 and 2.87g/ 100g), except for peanut samples (6.14g/ 100g).

All samples analyzed showed some non-compliance of the nutrition information stated on the food label (Table 3).

Among salty products, 0 to 50% of the samples were rejected due to their protein content, of which samples of potato chips showed the highest percentage (50%) among the products analyzed. For carbohydrates, variation of non-compliance was between 0 and 40%, and wheat snacks were the only product that did not show samples rejected for this nutrient. None of the samples of salty products was approved in terms of their dietary fiber, sodium and saturated fat contents. Corn snacks showed the highest frequency of samples rejected: 69% for dietary fiber, 72% for sodium, 85% for total fat and 41% for saturated fat.

Among sweet products, 10% to 40% were rejected due to their protein content. The frequency of samples rejected, in relation to the total fat content, varied between 0 and 75% in the case of chocolates and milk chocolate.

None of the cookie samples showed non-compliance for total fat. However, the saturated fat content data obtained in laboratory was not found to be in conformity with that stated on the label in 52% of the cookie samples. For almost all the products (except for white chocolate), there was between 6% and 36% of rejection in terms of the dietary fiber content. The frequency of rejection for dietary fiber content was high in the case of chocolates (29%), milk chocolate (29%) and cookies (36%). Chocolates were the sweet product with the highest frequencies of samples showing non-compliance of nutrients, as 40% of the samples were rejected for their protein content, 75% for total fat, 14% for saturated fat and 29% for dietary fiber.

Table 1. Samples and brands of salty and sweet foods analyzed. City of São Paulo, Southeastern Brazil, 2001-2005.

Product	Number of samples	Number of brands
Corn snack (flavor)		
Cheese	17	4
Cream cheese	3	2
Pizza	3	3
Bacon	2	2
Wheat snack (flavor)		
Bacon	7	4
Cheese	3	2
Potato chips (flavor)		
Barbecue	2	1
Cheese	2	1
Onion	2	2
Others[a]	5	3
Peanuts		
Roasted	2	2
Salted	3	3
Roasted and salted	2	2
Others[b]	3	3
Cookies (flavor)		
Strawberry	8	7
Chocolate	13	8
Peanuts	2	2
Vanilla	2	1
Vanilla and chocolate chips	2	2
Others[c]	6	4
Wafers (flavor)		
Coconut	2	1
White chocolate	3	3
Vanilla	5	2
Chocolate	2	2
Strawberry	3	3
Lemon	2	1
Others[d]	6	2
White chocolate with filling	11	2
Milk chocolate with filling	14	5
Chocolates with filling	19	5
Total	156	84

[a] Spices and lemon, cream cheese, onion and parsley, natural, Parmesan cheese.
[b] Coated, Japanese-style, fried
[c] Fruits with oats, tutti-frutti, coconut, white chocolate, *doce de leite* (condensed milk candy) and *brigadeiro* (chocolate powder and condensed milk candy)
[d] *Brigadeiro*, peanuts and *doce de leite*

DISCUSSION

To compare nutrient analytical quantification data with those stated on food labels, some factors that may interfere with the sampling plan and result interpretation should be considered. Among these are the following: number of samples, raw material control, type of manufacturing process adopted, storage, quality control procedures employed, analytical methods or food composition tables used by companies to determine nutritional information of products.[15] In this study, some of these factors could not be strictly controlled, as samples were randomly collected and sent to the Health Surveillance Agency for analysis.[a] One limitation to this study was associated with the lack of differentiation of samples whose nutrient values were either overestimated or underestimated, because only the 20% variability for non-compliance allowed by the current legislation was considered for statistical purposes.

Discrepancy between nutrient data obtained in laboratory and those stated on the label by the manufacturer, in the case of the products analyzed, could be explained by: a) analytical matters related to: extraction methods for total fat and fractions, interference of the food matrix composition with fiber analytical determination or differences associated with ingredient composition, such as products with several fillings;[15] or b) the nutritional value calculation from food composition tables, based on the product's ingredients or raw materials. However, these differences, regardless of their cause, must not surpass the 20% variability (plus or minus) tolerated by the current legislation (RDC 360/03 Resolution).

The food groups analyzed were selected due to children's and adolescents' preferences and also due to their high fat and sodium contents and low dietary fiber content, which may have an impact on morbimortality indices.[3,4,14] In the present study, these nutrients showed the highest proportions of non-compliance of samples.

Food labeling, by informing consumers about the quality and amount of nutritional constituents of products, must contribute to promote appropriate food choices and be used as a nutritional education tool for the population.[6,9] Thus, legitimacy of information is mandatory.

Another important implication of the high frequency of rejected label data is associated with epidemiological studies, as assessment of food consumption is based on nutritional data provided by food labels.[3,11,12,14] Lack of reliability of nutritional information on labels may become bias when estimating consumption data and also compromise the identification of associations between diet factors and physiopathological factors involved with obesity and non-communicable chronic diseases.

[a] Agência Nacional de Vigilância Sanitária. Resolução RDC nº 259, de 20 de setembro de 2002. Aprova o Regulamento Técnico sobre Rotulagem de Alimentos Embalados. *Diário Oficial da União*. 23 set 2002.

Table 2. Mean, standard-deviation, and 95% confidence interval of nutritional composition (g/100g) of salty and sweet food samples. City of São Paulo, Southeastern Brazil, 2001-2005.

Product	Energy value (kcal)	Proteins (g)	Carbohydrates (g)	Total fat (g)	Saturated fat (g)	Dietary fiber (g)	Sodium (mg)
Corn snack (n =25)	468 ± 38 (452;484)	6.25 ± 0.70 (5.96;6.54)	66.01 ± 6.58 (63.30;68.73)	20.05 ± 7.28 (17.05;23.06)	8.76 ± 3.69 (7.24;10.29)	2.01 ± 0.98 (1.78;2.66)	88.82 ± 27.71 (77.12;100.53)
Wheat snack (n= 10)	521 ± 39 (493;549)	8.21 ± 1.33 (7.25;9.16)	53.59 ± 3.88 (50.81;56.33)	30.46 ± 6.00 (26.17;34.76)	10.47 ± 5.83 (5.98;14.95)	2.01 ± 0.98 (1.31;2.71)	75.40 ± 34.04 (49.23;101.56)
Potato chips (n=11)	557 ± 24 (541;574)	6.33 ± 0.98 (5.67;6.99)	48.29 ± 4.90 (45.00;51.58)	37.67 ± 4.82 (34.43;40.92)	16.02 ± 2.35 (14.44;17.60)	2.18 ± 1.01 (1.50;2.86)	62.33 ± 17.52 (50.55;74.11)
Peanuts (n=10)	566 ± 63 (521;611)	24.83 ± 7.97 (19.27;30.39)	22.10 ± 18.39 (8.95;35.26)	42.00 ± 11.91 (33.49;50.53)	8.49 ± 2.39 (6.78;10.20)	6.14 ± 2.01 (4.70;7.58)	66.40 ± 46.94 (32.82;99.98)
Cookies (n=20)	456 ± 33 (441;471)	6.96 ± 1.11 (6.44;7.48)	68.78 ± 3.46 (67.16;70.41)	16.61 ± 3.88 (14.78;18.43)	4.86 ± 1.84 (4.00;5.72)	2.39 ± 1.17 (1.84;2.94)	nd
Wafer (n=11)	500 ± 33 (479;522)	4.69 ± 0.14 (4.02;5.36)	64.96 ± 2.92 (62.99;66.93)	24.40 ± 4.11 (21.88;27.17)	8.52 ± 3.40 (6.24;10.81)	1.71 ± 0.58 (1.32;2.10)	nd
White chocolate with filling (n=5)	530 ± 4 (525;536)	7.36 ± 0.78 (6.39;8.33)	56.72 ± 2.69 (53.38;60.06)	30.42 ± 0.97 (29.22;31.62)	16.62 ± 1.38 (14.90;18.33)	1.36 ± 0.89 (0.26;2.47)	nd
Milk chocolate with filling (n=9)	528 ± 26 (508;548)	6.97 ± 1.44 (5.86;8.08)	55.92 ± 4.52 (52.44;59.40)	30.72 ± 3.72 (27.86;33.58)	16.52 ± 1.82 (15.12;17.92)	2.62 ± 1.33 (1.56;3.64)	nd
Chocolates (n=9)	480 ± 60 (449;511)	4.93 ± 2.25 (3.77;6.09)	62.13 ± 10.65 (56.66;67.61)	23.18 ± 10.16 (17.95;28.40)	10.91 ± 5.42 (8.12;13.70)	2.87 ± 1.22 (2.24;3.50)	nd

nd= not determined.

Table 3. Distribution of sweet and salty food samples rejected, according to nutrient content stated on nutritional label. City of São Paulo, Southeastern Brazil, 2001-2005.

Nutrient	Salty product				Sweet product				
	Corn snack (%)	Wheat snack (%)	Potato chips (%)	Peanuts (%)	Cookies (%)	Wafers (%)	Milk chocolate (%)	White chocolate (%)	Chocolates (%)
Protein	25	25	50	0	10	20	20	10	40
Carbohydrate	40	0	20	40	0	0	0	0	0
Fiber	69	8	8	15	36	6	29	0	29
Sodium	72	4	12	12	nd	nd	nd	nd	nd
Total fat	85	0	15	0	0	0	25	0	75
Saturated fat	41	12	26	21	52	29	0	5	14

nd = not determined

Non-compliance of nutritional data stated on labels violates RDC 360/03 regulations and the rights guaranteed by nutritional and food safety[a] and consumer protection laws.[b] Suspension of product sales and/or manufacturing is exclusively designated as the sixth penalty norm, after warning, fine, confiscation and ban of product.[c]

The results found corroborate other studies which show that, despite progress in food labeling legislation, data available on nutritional labeling of foods in Brazil reveals non-compliance.[2,5,7,8] The present study was the first to assess compliance of labels of foods such as cookies, snack foods and chocolate, products aimed at and preferably consumed by children and adolescents.

It is essential to assure that consumers have the opportunity to choose healthier foods based on reliable information. To achieve this, it is necessary to intensify surveillance practices, as well as to identify and correct mistakes when designing food labels.

[a] Brasil. Lei nº 11.346, de 15 de setembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o direito humano à alimentação adequada e dá outras providências. *Diário Oficial da União*. 18 set 2006.
[b] Brasil. Lei nº 8078, de 11 de setembro de 1990. Dispõe sobre a proteção do consumidor e dá outras providências. *Diário Oficial da União*. 12 set 1990.
[c] Brasil. Lei nº 6437, de 20 de agosto de 1977. Configura infrações à legislação sanitária federal, estabelece as sanções respectivas, e dá outras providências. *Diário Oficial da União*. 24 ago 1977.

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