

Lactose in processed foods: evaluating the availability of information regarding its amount

Raíssa Aparecida Borges Batista ¹

Dyessa Cardoso Bernardes Assunção ¹

Fernanda Rodrigues de Oliveira Penaforte ²

Camila Cremonesi Japur ³

Abstract *Patients with lactose intolerance, a high prevalence disease, should control the intake of food with lactose to avoid gastrointestinal symptoms. Since tolerance depends on the amount of lactose ingested, it is essential to discuss the availability of the amount of lactose information in processed foods, which is currently not mandatory. The study measured the availability of information on the amount of lactose on the labels of processed food that contained milk or lactose in the ingredient list. Then, we contacted the food industry to request this information. We evaluated 1,209 processed foods, of which 1,092 were traditional and 117 were diet/light/zero. Only 3,1% of the analyzed foods provided information on the amount of lactose in the labeled nutrition table. This information was more available in the diet/light/zero food group. Furthermore, of the 156 contacted companies, only 14 reported the amount of lactose contained in foods, 93 answered the request, but have not provided the amounts and 49 did not answer the request. We concluded that there is a low availability of information about the amount of lactose in processed foods.*

Key words *Lactose, Lactose intolerance, Consumer rights, Nutrition labeling*

¹ Curso de Nutrição, Faculdade de Medicina, Universidade Federal de Uberlândia. Av. Pará 1720/ bl. 2U/sl. 12, Umuarama. 38400-902 Uberlândia MG Brasil. raissaborges26@hotmail.com

² Curso de Nutrição, Instituto de Ciências da Saúde, Universidade Federal do Triângulo Mineiro. Uberaba MG Brasil.

³ Curso de Nutrição e Metabolismo, Departamento de Ciências da Saúde, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo. Ribeirão Preto SP Brasil.

Introduction

Lactose is the primary carbohydrate found in milk. It consists of two monosaccharides, glucose and galactose, characterizing a disaccharide. Lactose intolerance consists of poor digestion and absorption of lactose from the reduced activity of the β -galactosidase enzyme, also known as lactase, which can hydrolyze lactose to glucose and galactose¹. Individuals with lactose intolerance are unable to digest lactose, which will not consequently be absorbed into the small bowel. When reaching the colon, lactose is fermented, producing short-chain fatty acids and the formation of gases (carbon dioxide, hydrogen and methane) by the intestinal microbiota², which can cause gastrointestinal problems, discomfort and symptoms, such as nausea, colic, flatulence, diarrhea, bloating, abdominal pain, among others³. Usually, these symptoms start around 30 minutes to 2 hours after consumption of some food containing lactose⁴.

Lactose intolerance can be classified into three types: congenital, primary and secondary. The congenital is caused by the complete absence of jejunal lactase throughout the life of an individual and is detected at childbirth. The primary type can develop at any age and is caused by the declining concentration of lactase in the human body, genetically programmed (non-persistent lactase), from infancy to adulthood, leading to difficulties in the hydrolysis of lactose. The secondary type occurs due to the presence of intestinal lesions or diseases and is transient and reversible⁵.

The persistence of lactase (or lactose tolerance) in different populations seems to be associated with the domestication of dairy cattle and with the habit of consuming milk after weaning⁶ and, therefore, the prevalence of lactose intolerance varies according to the geographic region and habits of the population.

A study points that non-persistence of lactose, or lactose intolerance, is found in 65% of the world's population⁷, affecting around 2% to 15% of people of North European descent, 60 to 80% of blacks and Latinos, and 80% to 100% of Native Americans and Asians⁵. In Brazil, a study showed that the prevalence of primary lactose intolerance in adults in a sample of 567 subjects was 57% for whites and mulattos, 80% for blacks and 100% for Japanese⁸. Other studies indicate a high prevalence in the Brazilian population: 44.1% in 1,088 individuals in Southern Brazil⁹ and 60.8% in 115 individuals in Southeast Brazil, of which 53.2% in whites and 91.3% in nonwhites¹⁰.

A reduction of at least 50% of enzyme activity is required to trigger the symptoms resulting from the primary deficiency of lactase, which explains part of the variation in tolerance to small doses of lactose by individuals with lactose intolerance. Another possible explanation is the adaptation of the intestinal microbiota¹¹.

Studies show a variation in the amount tolerated between 7 and 15g of lactose per day¹¹⁻¹³. A study conducted by Vesa *et al.*¹⁴, showed that individuals with lactose poor digestion did not evidence gastrointestinal symptoms induced by the ingestion of low amounts of lactose (0.5 to 7.0 g/day).

Therefore, concerning nutritional treatment, it is recommended to avoid the consumption of products containing a high amount of lactose or to perform the ingestion of the enzyme lactase with dairy products. It is also possible to consume dairy products in which the amount of lactose has been reduced by fermentation, such as yogurt or curds, or excluded by industrial processes, such as processed foods without lactose^{15,16}. The inadequate nutritional planning or replacement of milk and dairy products with their respective lactose-free products may lead to a lower intake of calcium, phosphorus and vitamins¹⁵.

There is evidence of a high consumption of processed foods in contemporary society¹⁷, and a stimulus to the intake of diet/light/zero foods¹⁸. Thus, because of the tolerance of a certain amount of lactose by individuals with lactose intolerance, information on the presence and amount of lactose in processed food labels should be mandatory in Brazilian legislation on nutritional labeling of packaged foods. However, such legislation does not require the provision of such information¹⁹.

According to the National Health Surveillance Agency (ANVISA), lactose-free or low-lactose products should be labeled according to the specific regulations for special-purpose foods²⁰. However, even if classified as such, the ordinance does not provide for the possibility of using a notice on the front label, clearly informing the consumer that the product is lactose-free or that it contains a low amount of lactose¹, with the exception of processed soy-based food that, according to RDC 91/2000²¹, must state the following information: "Contains lactose", "Contains milk proteins" or "Contains lactose and milk proteins".

This study is justified by the need to map the availability of information on the amount of lactose in processed foods, since people affected by the lactase deficiency have difficulty in choosing

foods to control the symptoms and often exclude them without necessity, which may compromise their health-related quality of life, which refers to the impact of the intervention, i.e., food restriction on the perception of well-being²², and its nutritional status. Also, failure to report the amount of lactose hampers the nutritionist's calculation of diets and nutritional orientation of lactose-intolerant patients. Thus, the aim is to evaluate the availability of information on the amount of lactose in processed food labels and by the Customer Service Department (SAC).

Methods

This is a cross-sectional and quantitative observational study evaluating the availability of information for the population of the amount of lactose in traditional processed and diet/light/zero foods marketed in a hypermarket in the city of Uberlândia, Minas Gerais. The hypermarket was intentionally selected because it has an abundant supply of processed foods and is considered the second largest supermarket company in Brazil²³ by the Brazilian Supermarket Association (ABRAS).

The evaluation was carried out in two stages. In the first, a diagnosis was made concerning the presence of information on the amount of lactose in the labels of processed foods. In the second, food industries were contacted, when this was free, over the telephone, by e-mail or through company websites to request information on the amount of lactose in their products, clarifying that this information would be used for scientific research.

Data was collected in 2015, following a written authorization by the hypermarket's management. Information included processed foods that contained milk or lactose in different positions in the list of ingredients, of different brands and flavors. Foods with the above characteristics, with the same composition, but with different packaging sizes, were excluded. It is worth noting that the position in the list of ingredients indicates, in decreasing order, the amount of the ingredient in the final product of the processed food, that is, the ingredients with higher amounts²⁴ appear in the first positions.

The information was collected in this study by an instrument pre-tested by the researchers, with a sample of 20 foods to define the following items: technical name; trading name; brand; telephone or e-mail of the customer service (SAC);

position of lactose or milk in the list of ingredients; portion in grams and nutritional composition.

The foods were divided into two groups: traditional and diet/light/zero. In the latter, only diet foods were included, for nutrient-restricted diets or for controlled ingestion of nutrients (considered special purpose foods)²⁰ or with supplementary nutritional information (light, which is one with reduction of some nutrient compared to traditional and zero, which does not contain a particular nutrient)²⁵. Each group was subdivided into 17 and 11 categories, respectively, according to the Brazilian Food Classification System²⁶.

Following data collection and entry, a review of the information entered by two other researchers was carried out and descriptive statistical analysis was performed on the number and percentage of the results obtained. The comparison of the percentages of the declaration of the amount of lactose between traditional and diet/light/zero foods was performed using the chi-square test, with a significance level of 5%. The GraphPad InStat software version 3.05 was used for statistical analysis.

Results

The total sample of processed foods was 1,209, of which 1,092 (90.3%) were traditional foods and 117 (9.7%) corresponded to diet/light/zero foods. Foods properly classified and included in the analysis are described in Chart 1.

The total percentage of the declaration of the amount of lactose in the nutritional table of processed food labels was 3.1%. The declaration was more frequent ($p < 0.0001$) in the diet/light/zero food group (30%) than in the traditional food group (0.2%) (Table 1). Among the products that reported the amount of lactose ($n = 38$), 36 (95.0%) were diet/light/zero, of which 30.6% stated that the amount of lactose was equal to zero, and the remaining 2 (5.0%) were traditional foods.

Table 2 described foods that contained the milk in the first two positions of the list of ingredients and that probably are foods with a more considerable amount of lactose. Processed foods with the highest frequency of milk/lactose in the last positions in the list of ingredients and those that did not have a significant number of foods within the same category were not shown.

Among the foods that presented lactose as the main ingredient in its formulation, the most

Chart 1. Description of food by food category.

Food categories	Food included
Milk	UHT cow milk (whole, skimmed, semi-skimmed); cow's milk powder (whole, skimmed, semi-skimmed); goat milk (whole, skimmed, semi-skimmed); and pasteurized whole cow's milk.
Oils and fats	Margarine; and butter and margarine-derived foods.
Edible iced products	Ice cream and powders for ice cream preparation.
Candy, confectionery, bonbons, chocolates and the like	Confectionery (almonds, cashew nuts, chips, sticks, among others); bonbons (with milk chocolate, stuffed with coconut, chocolate with peanuts, and others); hazelnut creams (hazelnut with cocoa, chocolate and hazelnut with wafer); condensed milk; toppings; nougats; chocolates (white, half bitter, aerated with milk, milk, among others); and candies (caramel of milk with cappuccino, caramel of milk stuffed with coconut, among others).
Cereals and cereal or cereal-based products	Cereal bars; morning cereals; milk flours and pasta.
Bakery products and biscuits	Toast; cheese breads; cookies; breads; cakes; bagels; corn-bread; mixes for the preparation of bakery products; pies; cookies and crackers.
Meat and meat products	Sausages; breaded chicken breast; Spanish sirloin and lamb meat.
Sugar and honey	Dietetic sweeteners.
Soups and broths	Corn cream; mixes for the preparation of soups; polenta and bean soup with pasta.
Sauces and seasonings	Sauces (cheese and tomato with ricotta) and pates (pork, turkey breast and ham).
Protein products yeasts	Dairy drinks; curds; milk creams; cheese creams; cheese products; cheeses; curd cheeses; yogurts; infant formulas; dairy compounds and food with isolated soy protein and milk.
Beverages	Liquors; mixes and powders for the preparation of cappuccino or instant milk and coffee-based beverages.
Snacks	Salty and sweet snacks.
Desserts and powders for desserts	Sweets and mixes for the preparation of desserts such as flans, puddings, mousses, among others.
Processed cookery preparations	Lasagna; shepherd's pies; rice; balls; chicken dumplings; vol-au-vents; purees; sandwiches; baby food; pizzas; pancakes; salted cakes; stroganoffs; pies; among others.
Nutrition supplements	Food supplements; protein bars; nutritional supplement and powders for the preparation of beverages for weight loss diet and powders for the preparation of enriched drinks.
Preparations to add to milk	Powdered chocolate drink and powders for the preparation of beverages, for example, milkshakes, among others.

important are the infant formulas, in which 50% contained lactose in the first position (n=8) and 19% in the second position (n = 3).

Of the 257 food industries responsible for the production of food evaluated, 156 (60.7%) provide access to the free SAC and were contacted. Among them, only 14 (9.0%) reported the amount of lactose contained in the requested foods. Ninety-three companies (59.6%) responded to the request but did not report the amounts. Of these, 61 (65.6%) replied that such information is a secret formulation and cannot be provided due to internal policy, and 32 (34.4%) re-

ported that they could not make this information available, since they do not perform the analysis of sugars separately as the declaration on the food label is not mandatory, and 49 companies (31.4%) did not respond to the request.

Discussion

The main contribution of the study was to show the low availability of information on the amount of lactose in processed foods, either on labels or through the Customer Service Depart-

Table 1. Percentage of processed foods containing the declaration of the amount of lactose in the nutritional table of traditional and diet/light / zero food labels.

Food group	Total food evaluated	Traditional food		Diet/light/zero food	
		Total evaluated	Total declared	Total evaluated	Total declared
		§	n (%) £	§	n (%) £
Milk	56	50	0 (0.0%)	6	3 (50.0%)*
Oils and fats	12	10	0 (0.0%)	2	0 (0.0%)
Edible iced products	74	72	0 (0.0%)	2	0 (0.0%)
Candy, confectionery, bonbons, chocolates and the like	123	114	0 (0.0%)	9	5 (56.0%)*
Cereals and cereal or cereal-based products	49	41	0 (0.0%)	8	0 (0.0%)
Bakery products and biscuits	165	160	0 (0.0%)	5	0 (0.0%)
Meat and meat products	12	12	0 (0.0%)	0	0 (0.0%)
Sugar and honey	8	8	0 (0.0%)	0	0 (0.0%)
Soups and broths	8	8	0 (0.0%)	0	0 (0.0%)
Sauces and seasonings	10	10	0 (0.0%)	0	0 (0.0%)
Protein products yeasts	461	396	2 (0.5%)	65	18 (28.0%)*
Beverages	23	19	0 (0.0%)	4	2 (50.0%)**
Snacks	13	13	0 (0.0%)	0	0 (0.0%)
Desserts and powders for desserts	74	65	0 (0.0%)	9	8 (89.0%)*
Processed cookery preparations	82	82	0 (0.0%)	0	0 (0.0%)
Nutrition supplements	14	8	0 (0.0%)	6	0 (0.0%)
Preparations to add to milk	25	24	0 (0.0%)	1	0 (0.0%)
Total	1209	1092	2 (0.2%)	117	36 (30.0%)*

* P-value < 0.0001; ** P-value < 0.05; § Total evaluated: total number of traditional processed and diet / light / zero foods evaluated in this study; £ Total declared: total number of traditional processed and diet / light / zero foods declaring the amount of lactose in the nutritional table of food labels.

Table 2. Processed foods with milk in the first or second positions.

Processed foods	Total evaluated	Milk position in the list of ingredients	
		First	Second
		n §	n (%) £
UHT cow milk	44	44 (100%)	0 (0%)
Powder milk	8	8 (100%)	0 (0%)
Condensed milk	5	5 (100%)	0 (0%)
Curds	5	5 (100%)	0 (0%)
Yogurts	121	120 (99%)	1 (1%)
Fermented milk	43	42 (98%)	0 (0%)
Cheese Products	17	15 (95%)	1 (6%)
Cheese	131	125 (95%)	0 (0%)
Desserts	62	56 (90%)	4 (6%)
Dairy drinks	70	57 (81%)	12 (17%)
Dairy compounds	5	4 (80%)	1 (20%)
Curd cheese	38	22 (58%)	15 (39%)
Mixes for the preparation of coffee and milk-based beverages	16	8 (50%)	7 (44%)
Powders for the preparation of enriched beverages	22	11 (50%)	1 (5%)
Sauces	5	2 (40%)	1 (20%)
Infant formulas	15	6 (40%)	2 (13%)
Powders for the preparation of coffee and milk-based beverages	4	1 (25%)	3 (75%)
Chocolates	77	6 (8%)	24 (31%)

§ Total number of evaluated foods; £ Total number and percentage of foods with milk in the first position against the total evaluated foods; ‡ Total number and percentage of foods with milk in the second position against the total evaluated foods.

ment (SAC). Only 3.0% of the processed foods analyzed showed lactose content on the nutritional table of their label, and only 9.0% of the industries contacted provided such information. Traditional foods had a lower percentage of declaration of lactose content in nutritional tables when compared to diet/light/zero foods.

It is worth mentioning that most of the diet/light/zero foods that reported the amount of lactose were foods with controlled intake of sugar, lactose-free or lactose-restricted. These data indeed show the compliance by the industries with the specific legislation, such as Ordinance N° 29/1998²⁰ and RDC N° 54/2012²⁵, which provide, respectively, foods with controlled intake of sugars and those with complementary nutritional information concerning sugars, which in turn, require the declaration of the amount of sugars in the nutritional information table when a Supplementary Nutrition Information is performed. However, not all diet/light/zero foods contained a declaration of the amount of lactose.

The lack of access to information on the amount of lactose in the label of processed foods violates consumers' fundamental right to information, which consequently impairs their autonomy through the nutritional orientation received and freedom of choice concerning the food consumption¹⁶. On the other hand, it hinders the nutritionist's work in the calculation and advice on lactose controlled amounts to ensure tolerance, since some people tolerate around 11g (corresponding to 240 ml of milk per day), while others evidence intolerance symptoms¹² with the ingestion of small amounts (2 to 3 g of lactose, corresponding to a small chocolate tablet). The appearance of symptoms depends on the amount of lactose ingested, the type of food in which the lactose was consumed and the degree of lactase deficiency²⁷.

Lack of knowledge of the amount of lactose in food may trigger symptoms in the individual, and is a source of distress for the family (especially for mothers of children with this clinical condition)²⁸. Therefore, this theme transcends the nutritionist professional practice core and includes a broader field, in which health professionals will have to address the physical and emotional care of the individual and the family, and promote health education, acting in a complementary way²⁹.

Other diseases whose fundamental part of the treatment is the total exclusion of some nutrients to avoid the emergence of symptoms and more severe health consequences, such as phe-

nylketonuria and celiac disease, already have specific regulations for the declaration of presence on the label, which in these specific cases are for phenylalanine and gluten, respectively³⁰⁻³⁴. However, there are still gaps in the legislation to regulate nutritional labeling for the declaration of essential nutrients for the dietary treatment of some diseases, such as galactosemia and fructose intolerance, inborn metabolism errors that imply the restriction of the substrate (galactose and fructose, respectively) for disease control³⁵.

Concerning lactose, Law N° 13.305 of July 4, 2016 was recently approved and mandates the declaration of the presence of lactose on the labels of food containing lactose and the remaining lactose content in foods whose original lactose content has changed³⁶. However, it does not require the declaration of the amount of lactose in foods that have not undergone any change, essential information for patients with lactose intolerance, since lactose must not necessarily be excluded but restricted according to tolerance.

Currently, RDC N° 26/2015³⁷ was approved and establishes the requirements for mandatory labeling of the main foods that cause food allergies, including milk, and will also assist individuals with lactose intolerance in the choice of food, but will still not provide the amount of lactose for the appropriate adjustment to individual tolerance. It is worth mentioning that allergy to milk protein and lactose intolerance are different clinical situations. In the former, the individual evidences an immunological response to the presence of milk protein (caseins and whey proteins), whereas poor digestion of milk carbohydrate, namely, lactose¹⁶, is found in lactose intolerance.

Another critical factor is that even foods that are recommended and more tolerated by patients with lactose intolerance, such as yogurts, may evidence varying amounts (2.1 to 6.4 g of lactose per 100g of yogurt) depending on their form (liquid, flavored or with pieces)³⁸, which can cause symptoms in those who consume them. It is worth mentioning that yogurts are recommended because they theoretically have low lactose concentration, because of their hydrolysis in the fermentation process due to the participation of microorganisms, which reduces the amount of lactose in the final product³⁹.

Some industrial food processing may require the addition of milk or lactose because of its influence on the viscosity, texture and role played by proteins that contribute to softness, lower humidity and higher shelf life of foods^{40,41}.

Besides, lactose has a low sweetening power when compared to sucrose. However, its hydrolysis is an alternative for the acquisition of a sweetener syrup containing glucose and galactose, which is a useful process to the food industry, since it allows the production of fermented products (yogurt), it facilitates its use in the formulation of foods without harming the natural flavor of other components and provides technological advantages insofar as it reduces crystallization risks in dairy products and increases sweetening power⁴²⁻⁴⁴. Another useful and promising feature for the industry, especially in the case of infant formulas, is that lactose can promote the absorption of calcium and phosphorus⁴⁴.

As the food industry widely uses them due to the properties mentioned above, these foods can be consumed by people with lactose intolerance, without being aware of the presence and quantity of milk or lactose, which can lead to the appearance of symptoms, since this information is currently not stated on food labels. Thus, it is necessary to alert consumers, especially the lactose intolerant, concerning the consumption of these products.

This study filled a gap in the discussion on lactose labeling in processed foods, as no previous scientific studies were found to verify the availability of information to consumers, es-

pecially those with lactose intolerance, on the amount of food lactose.

However, it has been considered that the declaration of milk or lactose in the list of ingredients necessarily implies the presence of lactose in the final product, which is a limitation, since the processing of milk and dairy products and the animal race influence nutritional composition, and especially lactose concentration^{45,46}.

Conclusion

There is low availability of information on the amount of lactose in processed foods. This was evidenced in this study by the low percentage of traditional and diet/light/zero foods that directly inform the amount of lactose in food labels and the high proportion of companies that do not provide such data when required.

Thus, it becomes indispensable to standardize and supervise the nutritional labeling of lactose effectively for the general population and, in particular, for individuals with lactose intolerance. The lack of information violates consumers' right to information and can compromise the food and nutritional security of those requiring lactose intake control, as well as impairs the independent choice of food and hampers professional nutritional counseling.

Collaborations

RAB Batista performed the bibliographic review, data collection and analysis, interpretation of the results and drafting of the paper. DCB Assunção participated in data collection, and critically reviewed and approved the final version of the paper. FRO Penaforte performed data statistical analysis, and critically reviewed and approved the final version of the paper. CC Japur idealized and guided the writing and development of the paper (conception, design, analysis and interpretation of data), critically reviewed the writing and approved the final version of the paper.

Acknowledgments

We are grateful to the Federal University of Uberlândia Institutional Scientific Initiation Scholarship Program (PIBIC), which together with the Minas Gerais Research Support Foundation (FAPEMIG) granted a scientific initiation scholarship, and to the management of the hypermarket, which authorized data collection within the establishment.

References

1. Pereira MCS, Brumano LP, Kamiyama CM, Pereira JPF, Rodarte MP, Pinto MAO. Látceos com baixo teor de lactose: uma necessidade para portadores de má digestão da lactose e um nicho de mercado. *Rev. Inst. Latic.* "Cândido Tostes" 2012; 67(389):57-65.
2. Mattar R, Mazo DFdeC. Intolerância à lactose: mudança de paradigmas com a biologia molecular. *Rev Assoc Med Bras* 2010; 56(2):230-236.
3. Frye RE. Lactose intolerance. *Clínica Fellow*, Departamento de Neurologia, Hospital de Crianças de Boston, Escola Médica Harvard. 2002.
4. Baudin B. Les intolerances héréditaires aux disaccharides ou aux oses simples. *Revue Francophone des Laboratoires*.2010; 425:31-38.
5. Swagerty DL, Walling AD, Klein RM. Lactose Intolerance. *Am Fam Physician* 2002; 65(9):1845-1851.
6. Deng Y, Misselwitz B, Dai N, Fox M. Lactose Intolerance in Adults: Biological Mechanism and Dietary Management. *Nutrients* 2015; 7(9):8020-8035.
7. Ingram CJE, Mulcare CA, Itan Y, Thomas MG, Swallow DM. Lactose digestion and the evolutionary genetics of lactase persistence. *Hum Genet* 2009; 124(6):579-591.
8. Mattar R, Monteiro MS, Villares CA, Santos AF, Silva JMK, Carrilho FJ. Frequency of LCT -13910C>T single nucleotide polymorphism associated with adult-type hypolactasia/lactase persistence among Brazilians of different ethnic groups. *Nutrition Journal* 2009; 8:46.
9. Pereira Filho D, Furlan SA. Prevalência de intolerância à lactose em função da faixa etária e do sexo: experiência do laboratório Dona Francisca, Joinville (SC). *Revista Saúde e Ambiente* 2004; 1(5):24-30.
10. Escoboza PML, Fernandes MIM, Peres LC, Einerhand AWC, Galvão LC. Adult-type Hypolactasia: Clinical, Morphologic and Functional Characteristics in Brazilian Patients at a University Hospital. *J Pediatr Gastroenterol Nutr* 2004; 39(4):361-365.
11. Shaukat A, Levitt MD, Taylor BC, MacDonald R, Shamliyan TA, Kane RL, Wilt TJ. Systematic review: effective management strategies for lactose intolerance. *Ann Intern Med* 2010; 152(12):797-803.
12. Hayder H, Mueller U, Bartholomaeus A. Examen de reactions d'intolerance aux aliments et aux additifs alimentaires. *Int Food Risk Anal* 2011; 1(2):25-36.
13. Hertzler SR, Huynh BL, Savaiano DA. How Much Lactose is Low Lactose? *J Am Diet Assoc* 1996; 96(3):243-246.
14. Vesa TH, Korpela RA, Sahi T. Tolerance to small amounts of lactose in lactose maldigesters. *Am J Clin Nutr* 1996; 64(2):197-201.
15. Barbosa CR, Andreazzi MA. Intolerância à lactose e suas consequências no metabolismo do cálcio. *Revista Saúde e Pesquisa*. 2011; 4(1):81-86.
16. Palomo KGS. *Vulnerabilidade do consumidor brasileiro com distúrbio metabólico decorrente de alergia a proteína de leite de vaca e intolerância à lactose* [monografia]. Brasília: Centro Universitário de Brasília; 2011.
17. Martins APB, Levy RB, Claro RM, Moubarac JC, Monteiro CA. Participação crescente de produtos ultraprocessados na dieta brasileira (1987-2009). *Rev Saude Publica* 2013; 47(4):656-665.
18. Marins BR, Araujo IS, Jacob SC. A propaganda de alimentos: orientação, ou apenas estímulo ao consumo? *Cien Saude Colet* 2011; 16(9):3873-3882.
19. Brasil. Secretaria de Vigilância Sanitária (Anvisa). Regulamento técnico sobre rotulagem de alimentos embalados. Resolução RDC nº 360, de 23 de dezembro de 2003 [Internet]. Brasília, DF; 2003. [acessado 2014 Dez 16]. Disponível em: http://portal.anvisa.gov.br/wps/wcm/connect/ec3966804ac02cf1962abfa337aba-e9d/Resolucao_RDC_n_360de_23_de_dezembro_de_2003.pdf?MOD=AJPERES.
20. Brasil. Secretaria de Vigilância Sanitária (Anvisa). Regulamento técnico para fixação de identidade e qualidade de alimentos para fins especiais. Portaria nº 29, de 13 de janeiro de 1998 [Internet]. Brasília, DF; 1998. [acessado 2014 Dez 16]. Disponível em: http://portal.anvisa.gov.br/wps/wcm/connect/2a1d950047458eca-97dbd73fbc4c6735/PORTARIA_29_1998.pdf?MOD=AJPERES.
21. Brasil. Secretaria de Vigilância Sanitária (Anvisa). Regulamento técnico para fixação de identidade e qualidade de alimento com soja. Resolução RDC nº 91, de 18 de outubro de 2000 [Internet]. Brasília, DF; 2000. [acessado 2015 Jan 7]. Disponível em: http://portal.anvisa.gov.br/wps/wcm/connect/c2e95a80474588a-39265d63fbc4c6735/RDC_91_2000.pdf?MOD=AJPERES.
22. Seild EMF, Zannon CMLC. Qualidade de vida e saúde: aspectos conceituais e metodológicos. *Cad Saude Publica* 2004; 20(2):580-588.
23. Associação Brasileira de Supermercados (ABRAS). Ranking ABRAS/SuperHiper 2014 apresenta as 20 maiores supermercadista do país [Internet]. Brasil: SuperHiper; 26 março 2014. [acessado 2015 Jan 7]. Disponível em: <http://www.abras.com.br/clipping.php?area=20&clipping=44032>.
24. Brasil. Secretaria de Vigilância Sanitária (Anvisa). Regulamento técnico para rotulagem de alimentos embalados. Portaria nº 42 de 14 de janeiro de 1998 [Internet]. Brasília, DF; 1998. [acessado 2015 Jan 7]. Disponível em: <http://barretos.sp.gov.br/procon/imagens/legislacao/geral/alimentos/Portaria%20n%2042.pdf>.
25. Brasil. Secretaria de Vigilância Sanitária (Anvisa). Regulamento técnico sobre informação nutricional complementar. Resolução RDC nº 54 de 12 de novembro de 2012 [Internet]. Brasília, DF; 2012. [acessado 2016 Abr 19]. Disponível em: http://portal.anvisa.gov.br/wps/wcm/connect/630a98804d7065b981f1e1c116238c3b/Resolucao+RDC+n.+54_2012.pdf?MOD=AJPERES.
26. Brasil. Secretária de Vigilância Sanitária (Anvisa). *Guia de procedimentos para pedidos de inclusão e extensão de uso de aditivos alimentares e coadjuvantes de tecnologia de fabricação na legislação brasileira*. Brasília: Anvisa; 2009.
27. Heyman MB. Lactose intolerance in infants, children and adolescents. *Pediatrics* 2006; 118(3):1279-1286.
28. Porto CPC, Thofehrn MB, Sousa AS, Cecagno D. Experiência vivenciada por mães de crianças com intolerância à lactose. *Fam. Saúde Desenv.* 2000; 7(3):250-256.
29. Campos GWS. Saúde pública e saúde coletiva: campo e núcleo de saberes e práticas. *Cien Saude Colet* 2000; 5(2):219-230.
30. Nobre SR, Silva T, Cabral JEP. Doença celíaca revisitada. *J. Port. Gastroenterol.* 2007; 14(4):184-193.

31. Ciacci C, Ciclitira P, Hadjivassiliou M, Kaukinen K, Ludvigsson JF, McGough N, Sanders DS, Woodward J, Leonard JN, Swift GL. The gluten-free diet and its current application in coeliac disease and dermatitis herpetiformis. *United European Gastroenterol J* 2015; 3(2):121-135.
32. Mira NVM, Marquez UML. Importância do diagnóstico e tratamento da fenilcetonúria. *Rev Saude Publica* 2000; 34(1):86-96.
33. Brasil. Secretária de Vigilância Sanitária (Anvisa). Resolução RDC nº 19, de 5 de maio de 2010. Dispõe sobre a obrigatoriedade das empresas informarem à Anvisa a quantidade de fenilalanina, proteína e umidade de alimentos, para elaboração de tabela do conteúdo de fenilalanina em alimentos, assim como disponibilizar as informações nos sítios eletrônicos das empresas ou serviço de atendimento ao consumidor (SAC). *Diário Oficial da União* 2010; 6 maio.
34. Brasil. Secretária de Vigilância Sanitária (Anvisa). Regulamento Técnico para rotulagem de alimentos e bebidas embalados que contenham glúten. Resolução - RDC nº 40, de 8 de fevereiro de 2002 [Internet]. Brasília, DF; 2002. [acesso em 14 de julho de 2016]. Disponível em: <http://www.ivegetal.com.br/Anvisa/Resolu%C3%A7%C3%A3o%20RDC%20N%C2%BA%2040%20de%2008%20de%20fevereiro%20de%202002.pdf>.
35. Husny ASE, Fernandes-Caldato MC. Erros inatos do metabolismo: revisão de literatura. *Revista Paraense de Medicina* 2006; 20(2):41-45.
36. Brasil. Lei nº 13.305, de 4 de julho de 2016. Dispõe sobre a rotulagem de alimentos que contenham lactose. [Internet]. Brasília, DF; 2016. [acesso 31 julho 2016]. Disponível em: http://www.planalto.gov.br/ccivil_03/_Ato2015-2018/2016/Lei/L13305.htm
37. Brasil. Secretaria de Vigilância Sanitária (Anvisa). Regulamento técnico sobre rotulagem de alimentos embalados. Resolução RDC nº 26 de 02 de julho de 2015 [Internet]. Brasília, DF; 2015. [acessado 2016 Abr 19]. Disponível em: http://portal.anvisa.gov.br/wps/wcm/connect/9f73ec80490b18caa3e6bb05df47c43c/RD-C+26_2015+Rotulagem+de+alimentos+alergenicos.pdf?MOD=AJPERES.
38. Borges T, Ferreira I, Pinho O, Trindade E, Pissarra S, Amil J. Quanta lactose há no meu iogurte? *Acta Pediátrica Portuguesa* 2010; 41(2):75-78.
39. Montalto M, Curigliano V, Santoro L, Vastola M, Cammarota G, Manna R, Gasbarrini A, Gasbarrini G. Management and treatment of lactose malabsorption. *World J Gastroenterol* 2006; 12(2):187-191.
40. Pereira J, Ciacco CF, Vilela ER, Pereira RGFA. Função dos ingredientes na consistência da massa e nas características do pão de queijo. *Ciênc. Tecnol. Aliment.* 2004; 24(4):494-500.
41. Richter M, Lannes SCdaS. Ingredientes usados na indústria de chocolates. *Rev. Bras. Ciênc. Farm.* 2007; 43(3):357-369.
42. Ladero M, Santos A, Garcia-Ochoa F. Kinetic modeling of lactose hydrolysis by a β -galactosidase from *Kluyveromyces fragilis*. *Enzyme and Microbial Technology* 2000; 27(8):558-567.
43. Obón JM, Castellar MR, Iborra JL, Manjón A. β -Galactosidase immobilization for milk lactose hydrolysis: a simple experimental and modeling study of batch and continuous reactors. *Biochemical Education* 2000; 28(1):64-168.
44. Kirkpatrick KJ, Fenwick RM. Manufacture and general properties of dairy ingredients. *Food Technology* 1987; 41(10):58-65.
45. Braga LPM, Palhares DB. Efeito da evaporação e pasteurização na composição bioquímica e imunológica do leite humano. *J Pediatr* 2007; 83(1):59-63.
46. Brito MAVP, Brito JRF. Qualidade do leite. In: Madalena FE, Matos LL, Holanda Júnior EV. *Produção de leite e sociedade: uma análise crítica da cadeia do leite no Brasil*. Belo Horizonte: Fundação de Estudo e Pesquisa em Medicina Veterinária e Zootecnia; 2001. p.61-74.

Article submitted 04/08/2016

Approved 23/11/2016

Final version submitted 25/11/2016