Dairy products consumption in Brazil is associated with socioeconomic and demographic factors: Results from the National Dietary Survey 2008-2009

Consumo de lácteos e derivados no Brasil está associado com fatores socioeconômicos e demográficos: resultados do Inquérito Nacional de Alimentação 2008-2009

Gabriela POSSA[1]
Michelle Alessandra de CASTRO[2]
Rosely SICHIERI[3]
Regina Mara FISBERG[2]
Mauro FISBERG[1]

A B S T R A C T

Objective

To estimate the consumption of dairy products in the Brazilian population.

Methods

Data from two non-consecutive food records from 34,003 individuals (aged ≥10 years) in the first Brazilian nationally representative dietary survey (2008-2009) were used to estimate the dairy products intake. Dairy products were divided into four major subgroups: cow's milk, cheese, yogurt and other dairy products. Absolute and relative frequencies of individuals in the population who reported consumption of dairy products in at least one of the two-day food record according to sex, age, geographic region and levels of *per capita* monthly family income were calculated. Moreover, the mean consumption of dairy products, as well as their nutritional contribution in total energy, protein, calcium, phosphorus and magnesium intake was estimated.

[1] Universidade Federal de São Paulo, Departamento de Pediatria, Programa de Pós-Graduação em Pediatria e Ciências Aplicadas à Pediatria. R. Botucatu, 715, Vila Clementino, 04023-062, São Paulo, SP, Brasil. *Correspondência para*/Correspondence to: G POSSA. E-mail: <gabipossa@gmail.com>.
[2] Universidade de São Paulo, Faculdade de Saúde Pública, Departamento de Nutrição. São Paulo, SP, Brasil.
[3] Universidade Estadual do Rio de Janeiro, Instituto de Medicina Social, Departamento de Epidemiologia. Rio de Janeiro, RJ, Brasil.

Results

It was observed that only 43.0% of the population reported consuming dairy products, being the milk subgroup the most frequently consumed (21.1%). The prevalence of consumption was higher among females, elderly, residents of the South region, and among individuals from higher *per capita* monthly family income. The nutritional contribution of dairy products was less than 10.0% of total energy intake and for most nutrients and the mean daily consumption are justified was 101.8g.

Conclusion

Therefore, in view of the low intake of dairy products by Brazilian population and the nutritional benefits associated with this food group, public health strategies to increase dairy consumption are justified.

Keywords: Dairy products. Food consumption. Nutrition.

R E S U M O

Objetivo

Estimar o consumo de produtos lácteos pela população brasileira.

Métodos

Dados de consumo alimentar obtidos por meio de registro alimentar de dois dias não-consecutivos de 34 003 indivíduos com 10 anos ou mais de idade participantes do Primeiro Inquérito Nacional de Alimentação (2008-2009) foram utilizados para estimar o consumo de produtos lácteos. Os produtos lácteos foram divididos em quatro subgrupos maiores: leite, queijo, iogurte e outros lácteos. Frequências absolutas e relativas de indivíduos da população que reportaram consumir os produtos lácteos em pelo menos um dos registros alimentares foram calculadas conforme sexo, idade, região geográfica e níveis de renda familiar mensal per capita. Além disso, estimou-se a quantidade média de consumo dos produtos lácteos, assim como sua contribuição para a ingestão de energia total, proteína, cálcio, fósforo e magnésio.

Resultados

Observou-se que apenas 43,0% da população consome produtos lácteos, sendo o leite o produto mais frequentemente consumido (21,1%). A prevalência de consumo foi superior entre o sexo feminino, os idosos e os indivíduos residentes na região Sul e pertencentes aos maiores estratos de renda familiar per capita. A contribuição nutricional dos produtos lácteos para a ingestão de energia e para a maioria dos nutrientes avaliados foi inferior a 10,0% e seu consumo médio diário foi de 101.8g.

Conclusão

Tendo em vista o baixo consumo de produtos lácteos pela população brasileira e os benefícios associados a este grupo de alimentos, justificam-se estratégias de saúde pública para o aumento do consumo deste grupo de alimentos.

Palavras-chave: *Produtos lácteos. Consumo de alimentos. Nutrição.*

I N T R O D U C T I O N

According to the Household Budget Survey (HBS) 2008-2009, Brazilians over the age of 10 ingest an inadequate intake of micronutrients. In the specific cases of vitamins A, C, D and E and calcium, inadequate intake surpasses the levels of 65%, 30%, 98%, 99% and 84%, respectively[1-3]. A recent change in feeding habits could help explain these findings. Brazilians have substituted highly nutritious staples for nutrient-poor processed foods that have high total fat, saturated fat, sodium and sugar contents[4]. For example, in the period between 2002 and 2009, the energy contribution from carbonated sodas to average Brazilian diet increased by 20 percentage points, while the contribution from milk and dairy products decreased by 10 percentage points[5,6].

An increasing number of reports have focused on dairy products including different types of milk, yogurts and cheeses as an important source of nutrients, such as vitamins A, B1, B2, B12, vitamin D in fortified products, and the

minerals potassium, phosphorus, magnesium, zinc, and calcium[7-11]. Moreover, the evidence suggests an association between the consumption of dairy products and decreased risk of developing non-transmissible chronic diseases[12-20], including osteoporosis[21], an important public health problem in Brazil. Low intake of calcium, a nutrient found in high concentrations in dairy products, increases the risk of osteoporosis-induced fractures[22].

In face of these beneficial effects, health authorities in Brazil and other countries recommend the consumption of dairy products as part of a healthy diet[7,11,23,24]. In spite of official recommendations, previous work has shown that consumption of dairy products remains below the adequate, especially among lower socioeconomic classes. A study conducted with adult and elderly individuals in the Southern region of Brazil revealed that only 46.2% of the participants consumed dairy products daily. Consumption was higher among those individuals with more years of education[25]. Andrade *et al*.[26] and Fisberg *et al*.[27] observed, with the use of the Dietary Quality Index, low scores for milk and dairy products among teenagers and adults in the city of *São Paulo*. According to these authors, the individuals included in the surveys consumed one serving of dairy products per day or less. Again, lower scores were attributed to these products for individuals in worse socioeconomic conditions. Nevertheless, further studies should characterize in greater detail the demographic and socioeconomic patterns of dairy consumption among Brazilians. Thus, the present study aimed at estimating the consumption of dairy products and their nutritional contribution to the Brazilian population according demographic and socioeconomic factors.

METHODS

Study population and design

We analyzed 34,003 Brazilian individuals at the age of ten years or over, of both sexes, selected to participate in the population-based National Dietary Survey, a module of the 2008-2009 HBS. The HBS used a two-stage cluster sampling design. In the first stage, primary sampling units of the census were used, with probability proportional to the number of residences in each tract. In the second stage, the sample units were permanent private residences, selected using simple random sampling without replacement, from within each primary sampling unit. Of the 68,373 residences sampled, 13,569 (24.3%) were randomly selected for the National Dietary Survey. All inhabitants aged ten and over took part, totaling 34,003 individuals (22.4% adolescents, 64.9% adults and 12.7% elderly). More details on sampling, collection and processing of data were previously described[1].

Food intake data

Individual dietary data were obtained with a food-intake form filled out by survey participants in two non-consecutive days, randomly distributed within a one-week period. Thus, both weekdays and weekends were contemplated in the survey[6].

Study participants were instructed to take careful notes on the quantities, in common household units, of all foods and beverages consumed throughout the course of 24 hours, including how food was prepared, ingredients and commercial brands. In addition, participants described the times of day when meals took place and whether they ate at home or out. The forms were revised by survey agents along with the participants to detect potential mistakes and to make corrections as necessary. Subsequently, the data on the form was transferred to a specific application software developed by the *Instituto Brasileiro de Geografia e Estatística*, which includes a pre-formatted list containing 1,500 foods and beverages, 16 options of cooking methods, and 106 types of portions and measurements as well as items which were compulsory such as the place and time of consumption. Any food or beverage consumed that was not listed in the application was added

by the survey agent. During the survey, a total of 1,120 foods and beverages were reported[6].

Tables of nutrition composition[28] and portion sizes[29], specially created to analyze food and dishes cited in the 2008-2009 HBS, were used to convert the reported food items into values for micronutrients. The nutritional composition tables were constructed based on data from the *Tabela Brasileira de Composição de Alimentos* (Taco, Brazilian Table of Food Composition)[30], as well as the Nutrition Data System for Research (NDS-R, version 2008, Nutrition Coordinating Center, University of Minnesota, Minneapolis, United States of America). The Nutrition Data System uses, as a primary source of data, the National Nutrient Database of the United States Department of Agriculture (USDA).

Dairy products consumption

The Household Budget Survey database provides information on the consumption of all kinds milk (whole, skimmed and semi-skimmed), cheeses (white or yellow), yogurt (whole or diet/light, natural or with fruit), and other dairy beverages (fermented milks, fruit vitamins). In the present study, these items were distributed into four categories: milk, cheese, yogurt, and other dairy products.

Socioeconomic and demographic variables

The variables evaluated were sex (male/female), age group (adolescent: 10-19 years, adult 20-59 years, elderly: 60 or more), geographic region (North, Northeast, Midwest, Southeast, South) and family monthly income *per capita*. The latter corresponded to the sum of gross monetary and non-monetary incomes of each family member divided by the number of family members. Income was calculated as the number of Minimum Wages (MW) *per capita* at the time of the study, when the minimum wage was approximately US$ 220,00 per month[6]. Seven

segments of family income *per capita* were defined (≤1 MW; 1-2 MW; 2-3 MW; 3-6 MW; 6-10 MW; 10-15 MW; >15 MW).

Statistical analysis

Descriptive analysis of mean, percentage and 95% Confidence Intervals (95%CI) was performed in Stata® software (Statistics/Data Analysis, version 12.0, College Station, Texas, United States of America) considering the complex sampling design (*svy* commands) and significance level of 5%.

Were calculated absolute (n) and relative frequencies (%) of individuals in the population who reported consumption of each dairy product in at least one of the two-day food record according to sex (male and female), age (adolescents: 10-19 years, adult 20-59 years, elderly: 60 or more), geographic region (North, Northeast, Southeast, South and Middle-West) and levels of *per capita* monthly family income (in minimum wages). Differences in prevalence were evaluated through Pearson's Chi-square test, adjusted for the complex sampling design.

Furthermore, we calculated the mean and 95% confidence interval of dairy products consumption (g/day) and the nutritional contribution of dairy products to daily total energy, protein, calcium, phosphorus and magnesium intake according to the same variables (sex, age, geographic region and levels of *per capita* monthly Family income). Difference of means was tested through lincom command (for two- group comparison) and pwcompare command after *svy* regress estimation. The Bonferroni's multiple comparison test was applied as an option of the pwcompare command for comparisons among three or more groups.

RESULTS

The overall prevalence of dairy product intake was 43.0%, and the main dairy products

consumed were milk and cheese at the frequencies of 21.1% and 20.7%, respectively. Yogurt and other dairy products were both consumed with a frequency of approximately 7.0% (Tables 1 and 2). Prevalence of consumption of all dairy subgroups was significantly higher among females, except for "other dairy products". Regarding age, the group of elderly subjects had the highest percentage of total dairy intake (49.4%), milk (26.5%) and cheese (25.2%), while adolescents displayed the highest frequency of yogurt consumption (8.3%) ($p<0.05$). Stratified analysis by geographic regions revealed that the Northern region had the lowest percentage of dairy, milk, cheese and yogurt intakes. The Southern region had the higher intake of dairy (53.1%), cheese (30.2%) and yogurt (8.3%), while the Midwest was the region with highest milk intake (26.4%) ($p<0.05$).

Significant differences in the prevalence of dairy product intake were observed among income classes for all product subgroups. Dairy products consumption ranged from 31.1% in the lowest income class (≤1 MW *per capita*) to 85.4% in the highest (>15 MW), while cheese and yogurt intake ranged from 9.5% in the lowest to 59.9% in the highest income class and from 4.2% in the lowest to 26.0% in the highest income class, respectively. Dairy products contribution very little to total energy intake (3.8%) and for the protein, phosphorus and magnesium intake (4.5%, 8.6% and 3.9%, respectively). The food group contributed more heavily to calcium intake (16.3%) (Table 3).

Dairy products represented a higher percentage of total energy and nutrient intake among females, the elderly, inhabitants of the Southern region and those individuals in the

Table 1. Prevalence of dairy and milk intake according to demographic and socioeconomic variables, Household Budget Survey. Brazil, 2008-2009.

Variables	Dairy products				Milk		
	n	%	95%CI	p-value	%	95%CI	p-value
Overall	34 003	43.0	41.7-44.3	-	21.1	20.1-22.1	-
Sex							
Male	15 700	39.5	37.9-41.1	<0.001	19.2	18.1-20.4	<0.001
Female	18 303	46.3	44.8-47.8		22.9	21.7-24.1	
Age group							
Adolescents	7 613	39.5	37.3-41.8		20.2	18.5-18.5	
Adults	22 068	42.9	41.5-44.3	<0.001	20.3	19.2-21.4	<0.001
Elderly	4 322	49.4	46.6-52.2		26.5	24.2-29.0	
Geographic region							
North	5 274	30.8	28.4-33.3		17.3	15.4-19.5	
Northeast	12 615	39.8	37.9-41.8		21.4	19.9-23.0	
Southeast	7 302	43.6	41.2-46.1	<0.001	20.2	18.4-22.1	<0.001
South	4 167	53.1	50.1-56.0		22.4	20.3-24.7	
Midwest	4 645	44.0	41.3-46.7		26.4	24.2-28.7	
Per capita family income							
≤1 MW	17 010	31.1	29.5-32.7		18.6	17.4-20.0	
>1 to 2 MW	9 126	42.7	40.6-44.9		21.5	20.0-23.2	
>2 to 3 MW	3 464	52.5	49.0-55.8		24.4	21.6-27.4	
>3 to 6 MW	2 975	59.0	55.1-62.7	<0.001	23.1	20.0-26.5	<0.001
>6 to 10 MW	892	72.4	67.2-77.0		24.4	19.5-30.0	
>10 to 15 MW	345	72.2	62.5-80.2		22.7	16.1-31.1	
>15 MW	191	85.4	78.3-90.4		31.2	21.8-42.4	

Note: Pearson's Chi-square test; 1 MW, about US$ 220.00.

MW: Minimum Wage.

Table 2. Prevalence of cheese, yogurt and other dairy products intake according to demographic and socioeconomic variables, Household Budget Survey. Brazil, 2008-2009.

Variables	Cheese			Yogurt			Other dairy products		
	%	95%CI	*p*-value	%	95%CI	*p*-value	%	95%CI	*p*-value
Overall	20.7	19.6-21.9	-	7.0	6.4-7.6	-	7.2	6.5-7.9	-
Sex									
Male	19.0	17.7-20.3	<0.001	5.6	4.9-6.3	<0.001	3.3	2.9-3.7	*p*=0.050
Female	22.4	21.1-23.7		8.3	7.5-9.0		3.9	3.5-4.3	
Age group									
Adolescents	14.2	12.8-15.8		8.3	7.2-9.5		1.6	1.4-1.9	
Adults	22.0	20.7-23.3	<0.001	6.8	6.1-7.5	<0.001	4.5	4.1-5.0	*p*=0.215
Elderly	25.2	22.7-27.8		5.9	4.8-7.2		1.0	0.8-1.3	
Geographic region									
North	9.8	8.2-11.7		4.0	3.2-4.9		0.5	0.4-0.6	
Northeast	15.1	13.8-16.5		5.8	5.1-6.6		2.3	2.0-2.6	
Southeast	23.8	21.7-26.0	<0.001	7.7	6.6-9.0	<0.001	2.5	2.0-3.1	<0.001
South	30.2	27.5-33.1		8.3	7.1-9.8		1.5	1.2-1.8	
Midwest	16.4	14.3-18.7		7.5	6.2-9.2		0.4	0.3-0.5	
*Per capita family income**									
≤1 MW	9.5	8.5-10.5		4.2	3.6-5.0		2.3	1.9-2.6	
>1 to 2 MW	19.4	17.6-21.3		5.8	4.9-6.7		2.0	1.6-2.4	
>2 to 3 MW	29.8	26.7-33.0		6.9	5.5-8.7		0.9	0.7-1.2	
>3 to 6 MW	36.5	32.5-40.7	<0.001	13.2	10.9-15.9	<0.001	1.1	1.1-1.4	<0.001
>6 to 10 MW	51.0	45.0-57.1		17.2	12.7-22.7		0.5	0.4-0.7	
>10 to 15 MW	55.3	46.3-64.0		17.5	12.7-23.6		0.2	0.1-0.3	
>15 MW	59.9	48.7-70.2		26.0	18.2-35.5		0.2	0.1-0.4	

Note: Pearson's Chi-square test; 1 MW, about US$ 220.00.

MW: Minimum Wage.

higher income categories. The only exception to this pattern regarded the contribution to magnesium ingestion, which was higher among adults. We also highlight the steep increase in the contribution of dairy products to energy and calcium intake with increasing family income. In the highest income class these contributions were, respectively, 3.3- and 2.7-fold greater than in the lowest income class (Table 3).

The average intake of dairy products in the study population was 101.8g, where milk represented an average of 54.5g. The highest intake averages for dairy products in general and milk were those of women, the elderly, Midwesterners, and those of individuals in the highest income class, whose average intake of dairy products was 3.3-fold higher than that of the lowest-income individuals (263.54g *versus* 79.2g). The average intake of cheese was higher among the elderly, Southeasterners, and in the

highest income classes. Regarding yogurt, intake increased in the higher income class, among women, teenagers and Southerners (Tables 4 and 5).

DISCUSSION

The prevalence of individuals who consumed dairy products in Brazil was only 43.0%, with significant variations depending on the demographic and socioeconomic variables evaluated. The highest percentages were found among women, the elderly, Southerners, and among those with highest income. Moreover, the average daily intake of these products was approximately 110g and their contribution to energy, protein, phosphorus and magnesium was below 10.0%. Dairy products contributed more intensely to the intake of calcium, with 16.3%.

Table 3. Nutritional contribution of dairy products to daily total energy and nutrients intake according to demographic and socioeconomic variables. Household Budget Survey. Brazil, 2008-2009.

Variables	Energy (kcal)		Protein (g)		Calcium (mg)		Phosphorus (mg)		Magnesium (mg)	
	Mean	95%CI	Mean	95%CI	Mean	95%CI	Mean	95%CI	Mean	95%CI
Overall	3.8	3.7-4.0	4.5	4.3-4.7	16.3	15.8-16.9	8.6	8.2-8.9	3.9	3.8-4.1
Sex										
Male	3.4	3.2-3.6*	3.9	3.7-4.1*	14.7	14.0-15.4*	7.5	7.1-7.9*	3.4	3.2-3.7*
Female	4.3	4.1-4.5	5.1	4.9-5.3	17.8	17.2-18.5	9.6	9.2-10.0	4.4	4.2-4.6
Age group										
Adolescents	3.4	3.1-3.6[a]	4.0	3.7-4.3[d]	14.5	13.6-15.4[a]	7.5	7.0-8.0[a]	3.8	3.5-4.1[d]
Adults	3.7	3.5-3.9	4.3	4.1-4.1	16.1	15.4-16.7	8.3	7.9-8.7	3.7	3.6-3.9
Elderly	5.1	4.7-5.5	6.2	5.7-6.6	20.5	19.2-21.9	11.7	10.8-12.6	5.0	4.6-5.3
Geographic region										
North[b]	2.3	2.1-2.5[b]	2.4	2.2-2.7[b]	10.7	9.8-11.6[b]	4.8	4.3-5.2[b]	2.5	2.3-2.8[b]
Northeast	4.1	3.8-4.4	4.6	4.3-4.9	17.3	16.3-18.3	8.3	7.8-8.8	4.1	3.8-4.3
Southeast	3.8	3.5-4.1	4.6	4.3-5.0	16.0	14.9-17.1	9.1	8.5-9.8	4.0	3.7-4.3
South	4.2	3.9-4.5	5.2	4.8-5.6	18.0	16.7-19.2	9.4	8.7-10.2	4.0	3.7-4.4
Midwest	3.8	3.4-4.1	4.4	4.0-4.8	17.2	15.9-18.4	8.8	8-9.5	4.2	3.8-4.5
Per capita *family* income										
≤1 MW	2.9	2.6-3.1[c]	3.3	3.0-3.5[c]	12.7	11.9-13.4[c]	6.3	5.9-6.7[c]	3.1	2.8-3.3[c]
>1 to 2 MW	3.7	3.5-4.0	4.5	4.2-4.8	16.1	15.2-17.0	8.6	8.0-9.1	3.8	3.6-4.1
>2 to 3 MW	4.3	3.9-4.7	5.3	4.8-5.8	18.8	17.3-20.3	10.1	9.2-11.0	4.4	4-4.8.0
>3 to 6 MW	5.2	4.6-5.8	6.2	5.6-6.8	21.5	19.6-23.5	11.7	10.6-12.9	5.3	4.6-6.0
>6 to 10 MW	6.5	5.2-7.8	7.3	6.0-8.6	24.0	20.8-27.3	13.6	11.3-16.0	5.9	4.6-7.2
>10 to 15 MW	7.4	6.3-8.4	8.5	7.0-10.0	28.3	25.1-31.6	15.7	13.3-18.2	6.7	5.7-7.8
>15 MW	9.6	7.7-11.5	10.4	8.5-12.3	34.5	30.2-38.9	19.2	16.2-22.2	8.4	6.7-10.2

Note: *p<0.001; Lincom test (two-group comparison) Bonferroni's multiple comparison test (for comparisons among three or more groups); [a]Significant differences across age groups (p<0.001); [b]Significant differences between North and the other regions (p<0.001); [c]Significant differences between ≤1 MW and the other categories of family income (p<0.001); [d]Significant differences between older adults and the other age groups (p<0.001). MW: Minimum Wage 1 MW, about US$ 220.00.

In the present study, we estimated the prevalence of dairy product consumers (%) as well as the amounts consumed, always looking at the overall product category and 4 subgroups. Previous studies also evaluated the intake of dairy products in different populations, using distinct methods[10,25,31-34]. Regardless of methodological differences, all this studies, including the present study point to the low consumption of dairy products. In one work where global, national and regional estimates of milk and dairy beverage consumption were presented, the global daily average was similar to that found here (137mL/day). Higher values were found for citizens of wealthier countries (high income: 173mL/day; low-income: 72mL/day), and the elderly, especially women (163mL/day in women age 60 and over and 122mL/day in men aged 20-39). They explained the higher intake among elderly women as the possible result of medical recommendations, which prescribe milk intake as a way of avoiding bone loss and osteoporosis. For Brazil, these authors reported an average intake of 120mL/day. The Central Latin America was the region with highest milk intake (266mL/day). In Latin America (Southern), the milk consumption among adults averaged 112.8mL/day (95%CI=79.2, 160.8)[31].

In another study conducted in Switzerland, the authors observed that adults and the elderly did not consume the recommended amount of three to four servings of dairy products per day. The average number of servings found was 2.6, without significant differences between socioeconomic and demographic groups

Table 4. Mean and 95% Confidence Interval (95%CI) of dairy products and milk intake according to demographic and socioeconomic variables, Household Budget Survey. Brazil, 2008-2009.

Variables	n	Dairy products			Milk		
		Mean	95%CI	p-value	Mean	95%CI	p-value
Overall	34.003	101.8	97.5-106.2	-	54.5	51.6-57.4	-
Sex							
Male	15.700	97.0	91.4-102.5	0.002	51.3	47.8-54.8	0.003
Female	18.303	106.4	101.4-111.3		57.5	54.0-60.9	
Age group							
Adolescents (10-19y)	7.613	103.8	95.5-112.0		53.6	48.0-59.2	
Adults (20-59y)	22.068	98.2	93.4-103.0	<0.001[a]	51.6	48.5-54.7	<0.001[a]
Elderly (≥60y)	4.322	116.4	106.7-126.2		70.0	62.6-77.5	
Geographic region							
North	5.274	66.0	58.7-73.4		31.0	26.5-35.5	
Northeast	12.615	103.9	96.4-111.3		52.5	47.8-57.1	
Southeast	7.302	103.6	95.5-111.7	<0.001[b]	55.6	50.2-60.9	<0.001[b]
South	4.167	106.9	98.5-115.4		59.5	53.2-65.8	
Midwest	4.645	110.9	101.1-120.7		70.4	63.6-77.2	
Per capita family income*							
≤1 MW	17.010	79.2	73.1-85.3		47.0	43.0-51.0	
>1 to 2 MW	9.126	98.4	91.9-104.8		56.0	51.3-60.7	
>2 to 3 MW	3.464	116.3	105.1-127.6		67.9	58.5-76.8	
>3 to 6 MW	2.975	134.5	120.7-148.2	<0.001[c]	59.9	50.7-69.2	0.001[d]
>6 to 10 MW	892	156.2	123.3-189.1		58.2	44.2-72.2	
>10 to 15 MW	345	164.2	137.7-190.7		54.5	35.3-73.6	
>15 MW	191	263.4	195.7-331.2		86.5	52.0-120.9	

Note: Lincom test (two-group comparison); Bonferroni's multiple comparison test (for comparisons among three or more groups); *MW: Minimum Wage; 1 MW, about US$ 220.00; [a]Significant differences between adults and older adults; [b]Significant differences between North and the other regions; [c]Significant differences between ≤1 MW and the other categories of family income; [d]Significant difference between ≤1 MW and >2 to 3 MW.

considered. Moreover, 25.0% of the individuals reported reducing dairy consumption to decrease the ingestion of fat or cholesterol[34]. In a study based on data from the National Health and Nutrition Examination Survey (NHANES 2001-2004), the authors found that more than half of the Americans consume than the minimum recommended amount of three daily servings of dairy products[32]. In addition, Huth et al.[33], who also worked with NHANES (2003-2006) data, observed that the energetic contribution of milk and cheese to the average North American diet was 9.2%. Regarding the contribution of these products to protein, calcium and magnesium intake the values corresponded to 17.1%, 46.3% and 7.9%, respectively, which are higher than found in the present study.

The Institute of Medicine recommends levels of daily calcium intake[35] that the average Brazilian would have difficulty consuming. A representative sample from the municipality of São Paulo showed that Brazilians consume dairy products only during breakfast, or at dinner by individuals who replace the meal with coffee and milk[36]. Another work conducted in the city of Campinas, near São Paulo, found that adolescents who reported sleeping less than seven hours per day ingested significantly more calcium than those who had more hours of sleep, probably because the former had breakfast with higher frequency[37]. Adolescents often skip their first meal of the day. Indeed, Leal et al.[38] observed that 21.0% of the adolescents evaluated did not have breakfast on

Table 5. Mean and 95% Confidence Interval of cheese, yogurt and other dairy products intake according to demographic and socioeconomic variables, Household Budget Survey. Brazil, 2008-2009.

Variables	Cheese (g)			Yogurt (g)			Other dairy products (g)		
	Mean	95%CI	*p*-value	Mean	95%CI	*p*-value	Mean	95%CI	*p*-value
Overall	10.9	10.1-11.6	-	16.9	15.3-18.5	-	19.6	17.3-21.8	-
Sex									
Male	10.5	9.6-11.4	0.207	13.9	12.0-15.8	<0.001	21.2	18.1-24.3	0.050
Female	11.2	10.2-12.1		19.7	17.7-21.6		18.0	15.7-20.4	
Age group									
Adolescents (10-19y)	6.5	5.7-7.3	<0.001[e]	21.0	17.8-24.1	<0.001[f]	22.7	18-27.3	0.215
Adults (20-59y)	11.6	10.6-12.6		16.4	14.5-18.2		18.6	16.3-21	
Elderly (≥60y)	14.2	12.3-16.0		13.1	10.4-15.7		19.1	14.2-24	
Geographic region									
North	3.6	2.9-4.3	<0.001[b]	10.5	8.3-12.8	<0.001[g]	20.9	16.1-25.7	<0.001[h]
Northeast	9.2	8.2-10.3		14.5	12.4-16.6		27.7	23.3-32.1	
Southeast	13.0	11.5-14.6		17.9	14.9-20.9		17.1	13-21.1	
South	12.9	11.2-14.6		21.7	17.6-25.7		12.8	9.6-16.1	
Midwest	7.3	6.1-8.5		17.4	13.5-21.3		15.9	15.9-20.6	
*Per capita family income**									
≤1 MW	5.2	4.5-5.9	<0.001[c]	10.1	8.4-11.8	<0.001[c]	16.9	13.5-20.2	0.187
>1 to 2 MW	10.3	8.9-11.8		14.2	11.8-16.6		17.9	14.5-21.2	
>2 to 3 MW	14.1	12.1-16		16.4	12.9-12.9		18.3	12.8-23.7	
>3 to 6 MW	18.3	15.5-21.0		32.3	25.2-39.4		24.0	18.4-29.5	
>6 to 10 MW	26.2	20.1-32.4		41.9	26.7-57.1		29.9	20.7-39.1	
>10 to 15 MW	33.5	25.0-42.0		43.4	28.2-58.7		32.8	14.2-51.3	
>15 MW	35.9	24.6-47.3		63.3	37.1-89.4		77.8	17.9-137.6	

Note: Lincom test (two-group comparison); Bonferroni's multiple comparison test (for comparisons among three or more groups); *MW: Minimum Wage 1 MW, about US$ 220.00; [b]Significant differences between North and the other regions; [c]Significant differences between ≤1 MW and the other categories of family income; [e]Significant differences across age groups; [f]Significant differences between older adults and the other age groups; [g]Significant differences between North and Southeast, South and Middle-West regions; [h]Significant differences between Northeast and Southeast, South and Middle-West regions.

a frequent basis[38]. Some factors help explain this pattern, including an exaggerated concern with body image, lack of time, lack of appetite during this period of the day, and lack of incentives from the family[39]. Breakfast and snacks offer an opportunity when the intake of foods that are not always provided in the large meals, such as milk and dairy products, should be prioritized.

In Brazil, the cost of dairy products[40], unfamiliarity with the health benefits associated with their consumption[41] and current eating habits[4,42,43] are some factors that may be related to low intake of dairy products. The importance of family income to consumption of certain foods and food groups, including dairy products, is well documented[40,44]. Levy-Costa *et al.*[44] observed an increase in milk participation in Brazilian's diet with increasing household income, reaching a three-fold difference in the comparison between the highest and the lowest income groups[44]. In the present study, we observed similar behavior, especially for the consumption of cheese and yogurt. Moreover, when comparing the percentage of consumption of these foods among the most economically developed regions (South, Southeast and Midwest) to less developed (North and Northeast), differences were also striking.

Dietary intake of Brazilians is often far from the nutritional recommendations, characterized by a low intake of fiber, vitamins and other minerals and high intake of saturated fat, added sugar and sodium[1-3,6]. In fact, several studies

showed a low intake of fruits and vegetables and high intake of foods and beverages with high energetic value and low nutrient density as snacks, pizzas and sugar-sweetened beverages (sodas, soft drinks and juices) in Brazil[4,45,46]. The presence of these drinks, in addition, has been associated with low dairy products intake by the population[45,47], which is worrying considering the substantial increase in consumption of soft drinks primarily in last years[44]. In addition, meals important to consumption of dairy products, like breakfast and intermediary snacks, have been omitted[38] or tend to have a predominance of foods and beverages with low nutritional value such sugar-sweetened beverages, sweets and desserts[46].

The present study has a few limitations, including intrapersonal variability in the consumption of dairy products and potential errors built into consumption estimates, especially due to imprecisions in the calculations of energy intake, as previously discussed[48]. These imprecisions highlight the need for questionnaires that yield more accurate answers. Despite these limitations, the study is a representative sample of the Brazilian population and allows for a deeper understanding of dairy consumption among different population subgroups in different regions.

The results generate concern, given the nutritional importance of dairy products[7,9,23] and the health benefits associated to their consumption, including improved bone health, reduce risk of osteoporosis development[21] and the prevention of chronic disease such as obesity, diabetes, hypertension and cardiovascular disease. Moreover, the results unveil some of the reasons underlying the inadequate intake of nutrients such as calcium, magnesium and phosphorus observed among Brazilians[1-3].

CONCLUSION

The present study provides further indication of the low intake of dairy products by the Brazilian population. The diffusion of knowledge about the benefits associated with milk and dairy intake, the guidance on the different forms of consumption of these foods items and wider dissemination of the recommendations proposed by the Ministry of Health for consumption of less processed foods such as cow's milk, cheese curds and plain yogurt in versions without fat or with less fat[23] represent important strategies to increase the intake of dairy products Brazil. Further studies evaluating factors that are associated with the consumption of these foods, will enable the establishment of strategies to encourage and promote consumption to specific segments of the population.

CONTRIBUTORS

G POSSA participated in the analysis and interpretation of the data and elaboration of the article. R FISBERG contributed in the interpretation of the data, revision and approval of the final version of the article. MA CASTRO participated in the analysis and interpretation of the data and in the review and final approval of the article. R SICHIERI and M FISBERG participated in the review and final approval of the article.

REFERENCES

1. Fisberg RM, Marchioni DML, Castro MA, Verly Junior E, Araújo MC, Bezerra IN, *et al*. Ingestão inadequada de nutrientes na população de idosos do Brasil: inquérito Nacional de Alimentação 2008-2009. Rev Saúde Pública. 2013;47(Supl.1):222s-30s.

2. Araujo MC, Bezerra IN, Barbosa FS, Junger WL, Yokoo EM, Pereira, RA, *et al*. Consumo de macronutrientes e ingestão inadequada de micronutrientes em adultos. Rev Saúde Pública. 2013;47(Supl.1):177s-89s.

3. Veiga GV, Costa RS, Araújo MC, Souza AM, Bezerra IN, Barbosa FS, *et al*. Inadequação do consumo de nutrientes entre adolescentes brasileiros. Rev Saúde Pública. 2013;47(Supl.1):212s-21s.

4. Souza ADM, Pereira RA, Yokoo EM, Levy RB, Sichieri R. Most consumed foods in Brazil: National Dietary Survey 2008-2009. Rev Saúde Pública. 2013;47(Supl.1):190s-9s.

5. Instituto Brasileiro de Geografia e Estatística. Pesquisa de orçamentos familiares 2002-2003: análise da disponibilidade alimentar de alimentos e estado nutricional no Brasil. Rio de Janeiro: IBGE; 2004.

6. Instituto Brasileiro de Geografia e Estatística. Pesquisa de orçamentos familiares 2008-2009: análise do consumo alimentar pessoal no Brasil. Rio de Janeiro: IBGE; 2011.

7. Food and Agriculture Organization of the United Nations. Milk and dairy products in human nutrition. Rome: FAO; 2013.

8. Fungwe T, Bente L, Hiza H. Nutrient content of the U.S. food supply, 2005. Washington (DC): Department of Agriculture; 2008.

9. Gaucheron F. Milk and dairy products: A unique micronutrient combination. J Am Coll Nutr. 2011;30(5Suppl.1):400s-9s.

10. Murphy MM, Barraj LM, Toth LD, Harkness LS, Bolster DR. Daily intake of dairy products in Brazil and contributions to nutrient intakes: A cross-sectional study. Public Health Nutr. 2015;19(3):393-400.

11. Dietary guidelines for Americans 2015-2020. 8th ed. Washington (DC): Departament of Health and Human Services; 2015.

12. Rice BH, Quann EE, Miller GD. Meeting and exceeding dairy recommendations: Effects of dairy consumption on nutrient intakes and risk of chronic disease. Nutr Rev. 2013;71(4):209-23.

13. Ivey KL, Lewis JR, Hodgson JM, Zhu K, Dhaliwal SS, Thompson PL, et al. Association between yogurt, milk, and cheese consumption and common carotid artery intima-media thickness and cardiovascular disease risk factors in elderly women. Am J Clin Nutr. 2011;94(1):234-9.

14. Aune D, Norat T, Romundstad P, Vatten LJ. Dairy products and the risk of type 2 diabetes: A systematic review and dose-response meta-analysis of cohort studies. Am J Clin Nutr. 2013;98(4):1066-83.

15. Drehmer M, Pereira MA, Schmidt MI, Del Carmen BMM, Alvim S, Lotufo PA, et al. Associations of dairy intake with glycemia and insulinemia, independent of obesity, in Brazilian adults: The Brazilian longitudinal study of adult health (ELSA-Brasil). Am J Clin Nutr. 2015;101(4):775-82.

16. Forouhi NG. Association between consumption of dairy products and incident type 2 diabetes-insights from the European Prospective Investigation into Cancer study. Nutr Rev. 2015;73(Suppl.1):15-22.

17. Chen M, Sun Q, Giovannucci E, Mozaffarian D, Manson JE, Willett WC, et al. Dairy consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis. BMC Med. 2014;25(12):215.

18. Crichton GE, Alkerwi A. Dairy food intake is positively associated with cardiovascular health: Findings from Observation of Cardiovascular Risk Factors in Luxembourg study. Nutr Res. 2014;34(12):1036-44.

19. Babio N, Becerra-Tomas N, Martinez-Gonzalez MA, Corella D, Estruch R, Ros E, et al. Consumption of Yogurt, Low-Fat Milk, and Other Low-Fat Dairy Products Is Associated with Lower Risk of Metabolic Syndrome Incidence in an Elderly Mediterranean Population. J Nutr. 2015;145(10):2308-16.

20. Wang H, Fox CS, Troy LM, McKeown NM, Jacques PF. Longitudinal association of dairy consumption with the changes in blood pressure and the risk of incident hypertension: The Framingham Heart Study. Br J Nutr. 2015;114(11):1887-99.

21. Wadolowska L, Sobas K, Szczepanska JW, Slowinska MA, Czlapka-Matyasik M, Niedzwiedzka E. Dairy products, dietary calcium and bone health: Possibility of prevention of osteoporosis in women: The polish experience. Nutrients. 2013;5(7):2684-707.

22. Pinheiro MM, Ciconelli RM, Martini LA, Ferraz MB. Clinical risk factors for osteoporotic fractures in Brazilian women and men: The Brazilian Osteoporosis Study (BRAZOS). Osteoporos Int. 2009;20(3):399-408.

23. Brasil. Ministério da Saúde. Guia alimentar para a população brasileira. Brasília: Ministério da Saúde; 2014.

24. Societe Swiss de Nutrition. Swiss Food Pyramid. Bern: SGE; 2011.

25. Muniz LC, Madruga SW, Araújo CL. Consumption of dairy products by adults and the elderly in the south of Brazil: A population-based study. Ciênc Saúde Coletiva. 2013;18(12):3515-22.

26. Andrade SC, Barros MBA, Carandina L, Goldbaum M, Cesar CL, Fisberg RM. Dietary quality index and associated factors among adolescents of the state of São Paulo, Brazil. J Pediatr. 2010;156(3):456-60.

27. Fisberg RM, Morimoto JM, Slater B, Barros MB, Carandina L, Goldbaum M, et al. Dietary quality and associated factors among adults living in the state of São Paulo, Brazil. J Am Diet Assoc. 2006;106(12):2067-72.

28. Instituto Brasileiro de Geografia e Estatística. Pesquisa de orçamentos familiares 2008-2009: tabela de composição nutricional dos alimentos consumidos no Brasil. Rio de Janeiro: IBGE; 2011.

29. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2008-2009: tabela de medidas referidas para os alimentos consumidos no Brasil. Rio de Janeiro: IBGE; 2011.

30. Universidade Estadual de Campinas. Núcleo de Estudos em Pesquisas em Alimentação. Tabela Brasi-

leira de Composição de Alimentos (Taco). 2ª ed. Campinas: Unicamp; 2006.

31. Singh GM, Micha R, Khatibzadeh S, Shi P, Lim S, Andrews KG, et al. Global, regional, and national consumption of sugar-sweetened beverages, fruit juices, and Milk: A systematic assessment of beverage intake in 187 Countries. PLoS One. 2015;10(8):E0124845.

32. Krebs-Smith SM, Guenther PM, Subar AF, Kirkpatrick SI, Dodd KW. Americans do not meet federal dietary recommendations. J Nutr. 2010;140(10):1832-8.

33. Huth P, FulgonilII V, Keast D, Park K, Auestad N. Major food sources of calories, added sugars, and saturated fat and their contribution to essential nutrient intakes in the U.S. diet: Data from the national health and nutrition examination survey (2003-2006). Nutr J. 2013;12(116).

34. Chollet M, Gille D, Piccinali P, Butikofer U, Schmid A, Stoffers H, et al. Short communication: Dairy consumption among middle-aged and elderly adults in Switzerland. J Dairy Sci. 2014;97(9):5387-92.

35. Institute Of Medicine. Dietary reference intakes for calcium and vitamin D. Washington (DC): IOM; 2010.

36. Santos RO, Fisberg RM, Marchioni DM, Baltar VT. Dietary patterns for meals of Brazilian adults. Br J Nutr. 2015;114(5):822-8.

37. Assumpcao D, Dias MR, Azevedo Barros MB, Fisberg RM, Barros Filho AA. Calcium intake by adolescents: A population-based health survey. J Pediatr. 2015;92(3):251-9.

38. Leal GV, Philippi ST, Matsudo SM, Toassa EC. Consumo alimentar e padrão de refeições de adolescentes, São Paulo, Brasil. Rev Bras Epidemiol. 2010;13(3):457-67.

39. Trancoso SC, Cavalli SB, Proença RPC. Breakfast: Characterization, consumption and importance for health. Rev Nutr. 2010;23(5):859-69. https://doi.org/10.1590/S1415-52732010000500016

40. Ricardo CZ, Claro RM. Cost and energy density of diet in Brazil, 2008-2009. Cad Saúde Pública. 2012;28(12):2349-61.

41. Pereira GAP, Genaro PS, Pinheiro MM, Szejnfeld, VL, Martini, LA. Cálcio dietético: estratégias para otimizar o consumo. Rev Bras Reumatol. 2009;49(2):165-80.

42. Bezerra IN, Souza AM, Pereira RA, Sichieri R. Consumption of foods away from home in Brazil. Rev Saude Pública. 2013;47(Suppl.1):200s-11s.

43. Peters BS, Verly Jr E, Marchioni DM, Fisberg M, Martini LA. The influence of breakfast and dairy products on dietary calcium and vitamin D intake in postpubertal adolescents and young adults. J Hum Nutr Diet. 2012;25(1):69-74.

44. Levy-Costa RB, Sichieri R, Pontes NS, Monteiro CA. Disponibilidade domiciliar de alimentos no Brasil: distribuição e evolução (1974-2003). Rev Saúde Pública. 2005;39(4):530-40.

45. Mathias KC, Slining MM, Popkin BM. Foods and beverages associated with higher intake of sugar-sweetened beverages. Am J Prev Med. 2013;44(4):351-7.

46. Duffey KJ, Pereira RA, Popkin BM. Prevalence and energy intake from snacking in Brazil: Analysis of the first nationwide individual survey. Eur J Clin Nutr. 2013;67(8):868-74.

47. Keller KL, Kirzner J, Pietrobelli A, St-Onge MP, Faith MS. Increased sweetened beverage intake is associated with reduced milk and calcium intake in 3- to 7-year-old children at multi-item laboratory lunches. J Am Diet Assoc. 2009;109(3):497-501.

48. Avelino GF, Castro MA, Marchioni DML, Fisberg RM. Underreporting of energy intake and associated factors in a population-based study. Cad Saúde Pública. 2014;30(3):663-8.

ERRATA

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Table 4, "%" should read "Mean".