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Daily intake of dairy products in Brazil and contributions to nutrient intakes: a cross-sectional study

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Abstract

Objective: Dairy products are sources of protein and micronutrients important in a healthy diet. The purpose of the present analysis was to estimate consumption of dairy products by Brazilians and identify contributions of dairy products to nutrient intakes.

Design: Dairy consumption data were obtained from 24 h dietary records. Dairy products were defined as milk (including flavoured), cheese and yoghurt. Estimates of dairy product intakes were generated for all individuals, individuals in urban and rural households and for age groups 10–18 years, 19–59 years and ≥60 years. Contributions to nutrient intakes were estimated for the total sample and sub-populations.

Setting: Nationwide cross-sectional survey, 2008–2009.

Subjects: Nationally representative sample of individuals aged ≥10 years in the Individual Food Intake survey, a component of the Brazilian Household Budget Survey (*n* 34 003).

Results: Among individuals aged ≥10 years, per capita intake of dairy products was 142 (SE 2·1) g/d. Dairy product intake was higher among individuals in urban compared with rural areas and among groups 10–18 years and ≥60 years compared with adults aged 19–59 years. Dairy products accounted for 6·1 % of daily energy intake, 7·3 % of protein, 16·9 % of saturated fat, 11·1 % and 4·3 % of total and added sugars, respectively, and 10·2–37·9 % of daily Ca, vitamin D, P, vitamin A and K.

Conclusions: Dairy products were substantial contributors to daily intakes of selected nutrients of concern in Brazil, although mean daily dairy product consumption was less than a typical portion. Education efforts in Brazil to raise awareness about the nutritional role of dairy foods may serve to improve overall diet quality.

Keywords
Dairy products
Milk
Brazil
Dietary survey

Dairy products including milk and milk-derived foods are naturally rich sources of protein and micronutrients important for health, including Ca, Mg, P, K and vitamins A and B_{12}[1]. Several of the micronutrients concentrated in milk and dairy products have been identified as nutrients of concern in Brazil based on analyses of the first nationwide dietary survey conducted in 2008–2009 by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, IBGE). This recent survey revealed a high percentage of the population or sub-populations with intakes of Ca, vitamin A, P and Mg below recommended levels; dietary intakes of K and vitamin D were also suboptimal[2–5].

Low intake of dairy products has been associated with higher dietary inadequacy of some micronutrients including Ca, Mg and K[6–8]. In both Brazil and the USA, low consumption of milk and milk products has been identified as a factor in suboptimal diet quality[9,10].

The current Brazilian dietary guidelines, released in 2014, provide qualitative recommendations for making food choices that promote health and well-being[11]. The guidelines advise consumption of fresh and minimally processed foods as the basis of the diet with limited consumption of processed and ultra-processed foods. Dairy products including fluid and powdered milk and yoghurt without added sugar are examples of minimally processed foods encouraged for consumption, while cheese and sweetened and flavoured yoghurts and dairy drinks are among the processed or ultra-processed foods for which limited consumption is recommended.

The 2014 Brazilian dietary guidelines do not provide quantitative recommendations for intake of specific foods.

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However, the previous edition of the Brazilian dietary guidelines, released in 2006, was based in part on dietary guidelines from the USA and recommended intake of three portions of milk and dairy products per day to help meet nutrient needs, with additional guidance for adults to choose low-fat milk and dairy products[12,13].

To our knowledge there is not an analysis of total milk and dairy product intake in Brazil or information on the nutritional contributions of dairy products in the diet using the first nationwide dietary survey in Brazil. Such an analysis would provide important information on dairy consumption in Brazil, which in turn could help guide nutrition education efforts to support quantitative and qualitative shifts in intake of dairy foods. The purpose of the present data analysis was to estimate consumption of dairy products of specific sub-populations in Brazil and to identify the contributions of dairy products to overall nutrient intakes using recent nationally representative food consumption data.

Methods

Sample

The study population for the current assessment was a sample of individuals aged ≥10 years who participated in the first nationwide dietary survey in Brazil. The dietary survey, or Individual Food Intake component, was conducted by the IBGE and completed as part of the Brazilian Household Budget Survey in 2008–2009. A probabilistic sample of 55 970 permanent private households participated in the Household Budget Survey from May 2008 to May 2009; a randomly selected sub-sample of 13 569 households from the Household Budget Survey participated in the Individual Food Intake component. A total of 34 003 individuals provided individual food intake data via dietary records. The survey was conducted in accordance with Federal Law number 5534 (14 November 1968) which guarantees confidentiality of the gathered information.

Dietary intake data

Each individual participating in the dietary survey component completed 24 h dietary records of all foods consumed on two non-consecutive days. Respondents were instructed to maintain a record of each food consumed, along with the method of preparation, the amount of food consumed in common measures, and the time and place of intake (at home or away). The respondents were provided manuals with detailed instructions, including pictures of household measures, to guide in the estimation of food portions in the records. Additionally, respondents completed a separate questionnaire on typical use of sugar or sugar substitutes (sugar, artificial sweetener, both or none). Following completion of the dietary records, survey participants subsequently attended an interview in which trained survey staff reviewed the dietary records and inquired about any additional foods and beverages that may have been consumed. The record review included probes of intervals of at least 3 h in which no food or beverage was recorded and days on which fewer than five foods were recorded to confirm the information was correct. The survey data release provides the amount of each food consumed in units as reported and in units of gram weight. Conversions to gram weights were made by IBGE using a database of portion weight measures compiled for foods reported in the survey. The current analysis was based on the first day of food records.

Identification of dairy products and dairy portions

All foods reported consumed in the dietary survey were categorized by IBGE into one of twenty-one food groups; within each food group, similar food items were categorized into subgroups. IBGE's dairy food group includes fluid and powdered milk (whole, reduced-fat and non-fat forms), milk-based grain preparations (e.g. porridge), cream, cheese, yoghurt, milk drinks (e.g. dairy and fruit smoothies; kefir, fermented milk) and diet or light versions of these foods. For the current analysis all items in the IBGE dairy group other than cream were classified as dairy products. Items from other food groups classified as dairy products in the current analysis include flavoured milk (e.g. chocolate milk), milk consumed with coffee (i.e. 'coffee with milk') and cheese sauce. Based on the nutrient composition data, 50 % of the weight of each reported intake of coffee with milk was assumed to be milk (whole milk, with 3·5–4 % fat). Total milk represented fluid and powdered milk, milk drinks, flavoured milk, milk consumed in coffee and grains cooked in milk. Milk-based desserts were not categorized as dairy products in the current analysis. Total dairy products were defined as total milk, cheese and yoghurt.

With the exception of 'coffee with milk', mixtures were not disaggregated as the survey documentation does not include recipes for disaggregating all mixtures into component ingredients. This classification of dairy products therefore did not capture the dairy component of mixtures containing milk, cheese or yoghurt, such as cheese on pizza, cheeseburgers or sandwiches, or milk in a creamed soup. These foods are not among the most commonly consumed foods in Brazil. Pizza, for example, was reported consumed by just 2 % of the population[14]. Contributions of these mixtures to total dairy consumption were therefore presumably small.

Guideline 5 in the 2006 Brazilian dietary guidelines recommends daily intake of three portions of milk and dairy for all individuals[12]. The Brazilian dietary guidelines include a reference table of gram weights for portions of dairy products[12]; these reference data along with the IBGE database of portion weight measures for 'one portion' were used to identify a gram weight per portion of each type of dairy product reported consumed[5]. The gram weight portion size assumed for fluid milk, flavoured

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milk and most milk drinks in the current analysis was 182 g, which is approximately 200 ml. The portion size assumed for milk-based smoothies was 171 g based on the reported reference weight for these beverages. For milk-based grain preparations, 195 g was counted as one portion. The gram weight portion size used for ricotta cheese was 100 g and the portion size for other types of cheese ranged from 30 to 50 g, or approximately 1 to 1½ slices. The gram weight portion size used for yoghurt was 165 g.

Nutrient composition data

Dietary intakes of total energy, protein, carbohydrate, total sugars, added sugars, total fat, saturated fat, cholesterol, vitamin A, riboflavin, vitamin B_6, vitamin B_{12}, vitamin D, Ca, P, Mg, Zn, Na and K were estimated from total dairy products and also from milk, cheese and yoghurt. Estimates of nutrient intakes were calculated with nutrient data in the food composition data tables compiled explicitly for use with the dietary survey and for estimating nutrient intakes, including prevalence of inadequacy[5]. Nutrient values in these food composition tables were compiled by IBGE primarily from the Brazilian Food Composition Table (Tabela Brasileria de Composição de Alimentos Campinas, TACO) and supplemented with values from the Nutrition Data System for Research (NDSR) of the University of Minnesota (vitamins B_{12} and D, total and added sugars) and additional data sources[14]. The food composition tables provide nutrient values per 100 g edible portion of food by specific method of preparation for most although not all foods. We did not impute values for any unquantified nutrient values in the food composition tables; these values were assumed to be zero in estimates of nutrient intakes.

Statistical analysis

Using the first day of food records from each respondent, mean daily intake of milk, cheese, yoghurt and all dairy products combined was estimated in units of grams and portions. Estimates of total dietary nutrient intakes included standardized adjustments for fried meats to account for typical addition of oil. Levels of sugar added to commonly sweetened beverages such as coffee, tea and fruit-based drinks were estimated as 10 % of the beverage weight for typical users of sugar and 5 % of the beverage weight for typical users of a combination of sugar and sugar substitutes. Percentage nutrient contributions provided by dairy products were estimated using the population proportion method[15]. Estimates were developed for the population aged ≥10 years; sub-populations by location of residence, i.e. urban and rural; and sub-populations by age, i.e. adolescents aged 10–18 years, adults aged 19–59 years and adults aged ≥60 years.

Estimates were based on one day of food intake, an approach appropriate to estimate mean intakes by a population[16,17]. All estimates were calculated with sampling weights and adjusted for the complex sampling design. Statistical analyses of dairy product intakes (g/d and portions/d) were carried out in the statistical software package STATA version 12·1. Intakes in different regions were compared using the adjusted Wald test. Mean intakes of dairy products by age group were compared using the adjusted Wald test and pairwise *post hoc* comparisons. Level of significance was defined as $P < 0{\cdot}05$. *P* values of the pairwise *post hoc* analyses were adjusted for multiple comparisons using the Sidak method.

Results

Proportion of the population reporting consumption of dairy products

Dairy products as defined in this analysis were consumed by the majority of the Brazilians aged ≥10 years (Table 1). Milk, including plain milk (as a beverage, in coffee or in cooked cereal), flavoured milk and milk drinks, was the most common type of dairy product consumed, with 56 %

Table 1 Percentage of consumers and per capita intake of dairy products in the Brazilian population aged ≥10 years by location of household. Individual Food Intake 2008–2009; first day of intake

				Location of household						
	Brazil (*n* 34 003)			Urban (*n* 25 753)			Rural (*n* 8250)			
	%	Mean	SE	%	Mean	SE	%	Mean	SE	*P* value
Total dairy* (g/d)	62	142	2·1	64	147	2·4	51	114	4·4	<0·001
Milk† (g/d)	56	124	1·9	58	127	2·1	48	105	4·1	<0·001
Cheese (g/d)	14	7	0·3	15	8	0·3	8	4	0·4	<0·001
Yoghurt (g/d)	4	11	0·6	5	12	0·7	2	5	0·6	<0·001
Total dairy*,‡ (portions/d)	62	0·9	0·01	64	1·0	0·01	51	0·7	0·01	<0·001
Milk†,‡ (portions/d)	56	0·7	0·01	58	0·7	0·01	48	0·6	0·01	<0·001
Cheese‡ (portions/d)	14	0·2	0·01	15	0·2	0·01	8	0·1	0·01	<0·001
Yoghurt‡ (portions/d)	4	0·1	<0·005	5	0·1	<0·005	2	<0·05	<0·005	<0·001

*Total dairy values may not equal sum of milk, cheese and yoghurt values due to rounding.
†Milk includes plain and flavoured milk, milk drinks, grains cooked in milk and milk in coffee.
‡Weight per portion: milk, 182 g; milk-based smoothies, 171 g; grains cooked in milk, 195 g; powdered milk, 26 or 34·5 g; cheese, 30 to 50 g, 100 g for ricotta cheese; yoghurt, 165 g.

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of Brazilians reporting intake of milk on the day of recall. Milk in coffee was the most common form of milk intake for most individuals. Coffee with milk was reported consumed by 36 % of the total population in contrast to 14 % of the population consuming fluid plain milk, 10 % consuming flavoured milk or a milk drink, and 2 % consuming grains cooked in milk (data not shown). Fluid milk (excluding milk in coffee with milk) was consumed predominantly as whole milk (12 % consumers *v.* 2 % consumers of reduced-fat or non-fat milk).

Per capita intake of dairy products

Among all Brazilians, per capita intake of total dairy products was 142 (SE 2·1) g/d, or approximately one portion per day as milk accounted for the majority of total dairy intake (Table 1). Compared with residents in rural areas of Brazil, urban residents consumed a greater number of milk, cheese, yoghurt and total dairy product portions per day ($P < 0·001$). Among all Brazilians, adolescents and the elderly consumed more milk and total dairy products (g/d and portions/d) than adults aged 19–59 years ($P < 0·001$; Table 2). Cheese consumption (portions/d) was comparable between adults and the elderly, although higher than intake by adolescents ($P < 0·001$). Yoghurt provided 0·1 dairy portions/d for Brazilians.

Nutrients from dairy products

On a per capita basis, dairy products accounted for 6·1 % of total energy intake in the population aged ≥10 years and a generally comparable percentage of protein, carbohydrate, added sugars and cholesterol (Table 3). Dairy products accounted for slightly over one-third of daily intakes of dietary Ca (37·9 %) and vitamin D (35·9 %), and 10·2–18·7 % of riboflavin, P, vitamin B_{12}, vitamin A and K. In the population aged ≥10 years, dairy products also accounted for 16·9 % of saturated fat, 11·1 % of total sugars and 4·3 % of added sugars.

Although percentage nutrient contributions across location of household (i.e. urban *v.* rural) or age were not compared statistically, dairy products appeared to account for a lower percentage of total dietary nutrient intakes by individuals living in rural areas compared with urban areas, which is consistent with the lower overall dairy product intake by rural residents (Table 3). Percentage contributions of dairy products to nutrient intakes by age group are shown in Table 4. Compared with adolescents and adults, dairy products appeared to account for a higher percentage of total nutrient intakes in the elderly.

Discussion

Results of the present study provide nationally representative estimates of dairy product consumption in Brazil and contributions of dairy products to intakes of macronutrients and key micronutrients based on dietary records collected from 34 003 individuals aged ≥10 years in the first Individual Food Intake component of the Brazilian Household Budget Survey (2008–2009).

The 2006 Brazilian dietary guidelines recommend daily intake of three portions of milk and dairy products[12,13]. Mean intake of total dairy products was estimated at 0·9 portions/d among Brazilians aged ≥10 years, and from 0·7 to 1·1 portions/d among sub-populations defined by location of household or age. Results from this assessment show that per capita intake of dairy products is well below the 2006 recommended intake for all Brazilians, regardless of household location or age.

Findings from the current analysis of nationally representative data are consistent with studies showing that dairy intake by adolescents and adults within selected areas in Brazil do not meet recommended levels as quantified in the 2006 guidance[18–22]. For example, in a recent study of adults 18–60 years of age in Northeastern Brazil, the average intake of dairy products was 1·14

Table 2 Percentage of consumers and per capita intake of dairy products in the Brazilian population aged ≥10 years by age group. Individual Food Intake 2008–2009; first day of intake

	Adolescents 10–18 years (*n* 6939) (1)			Adults 19–59 years (*n* 22 742) (2)			Elderly ≥60 years (*n* 4322) (3)			*P* value			
										Overall	Pairwise		
	%	Mean	SE	%	Mean	SE	%	Mean	SE	1 *v.* 2 *v.* 3	1 *v.* 2	1 *v.* 3	2 *v.* 3
Total dairy* (g/d)	64	162	4·3	60	131	2·4	69	165	5·5	<0·001	<0·001	0·977	<0·001
Milk† (g/d)	59	145	4·2	54	113	2·1	62	148	5·2	<0·001	<0·001	0·951	<0·001
Cheese (g/d)	9	4	0·3	15	7	0·4	18	9	0·7	<0·001	<0·001	<0·001	0·030
Yoghurt (g/d)	5	14	1·3	4	10	0·8	4	8	1·0	<0·001	0·063	<0·001	0·043
Total dairy*,‡ (portions/d)	64	1·0	0·03	60	0·9	0·02	69	1·1	0·04	<0·05	<0·001	0·084	<0·001
Milk†,‡ (portions/d)	59	0·8	0·02	54	0·6	0·01	62	0·8	0·03	<0·05	<0·001	0·963	<0·001
Cheese‡ (portions/d)	9	0·1	0·01	15	0·2	0·01	18	0·2	0·02	<0·05	<0·001	<0·001	0·088
Yoghurt‡ (portions/d)	5	0·1	0·01	4	0·1	<0·05	4	0·1	0·01	<0·05	0·105	0·003	0·129

*Total dairy values may not equal sum of milk, cheese and yoghurt values due to rounding.
†Milk includes plain and flavoured milk, milk drinks, grains cooked in milk and milk in coffee.
‡Weight per portion: milk, 182 g; milk-based smoothies, 171 g; grains cooked in milk, 195 g; powdered milk, 26 or 34·5 g; cheese, 30 to 50 g, 100 g for ricotta cheese; yoghurt, 165 g.

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Table 3 Percentage contributions of dairy products to total nutrient intakes in the Brazilian population aged ≥10 years, overall and by household location. Individual Food Intake 2008–2009; first day of intake

	Brazil (*n* 34 003)					Urban (*n* 25 753)					Rural (*n* 8250)				
		% from					% from					% from			
Nutrient	Total intake	Total dairy*	Milk	Cheese	Yoghurt	Total intake	Total dairy*	Milk	Cheese	Yoghurt	Total intake	Total dairy*	Milk	Cheese	Yoghurt
Energy (kJ)	8033	6·1	4·5	1·1	0·5	8017	6·4	4·6	1·2	0·6	8100	4·6	3·7	0·7	0·2
Energy (kcal)	1920	6·1	4·5	1·1	0·5	1916	6·4	4·6	1·2	0·6	1936	4·6	3·7	0·7	0·2
Protein (g)	80·2	7·3	5·0	1·8	0·5	79·1	7·7	5·3	1·9	0·5	86·0	5·3	4·1	1·0	0·2
Carbohydrate (g)	266	4·0	3·3	0·1	0·6	265	4·3	3·5	0·1	0·6	273	2·8	2·5	0·1	0·2
Total sugars (g)	94·2	11·1	9·3	0·3	1·4	96·3	11·4	9·5	0·4	1·6	83·3	9·1	8·3	0·2	0·6
Added sugars (g)	64·9	4·3	3·2	0·0	1·1	66·4	4·6	3·4	0·0	1·2	57·6	2·4	2·0	0·0	0·4
Total fat (g)	58·5	10·0	6·8	2·6	0·6	59·2	10·3	6·8	2·8	0·7	54·9	8·4	6·3	1·8	0·3
Saturated fat (g)	20·3	16·9	11·1	4·8	1·0	20·7	17·2	11·1	5·0	1·1	18·0	14·9	11·0	3·4	0·5
Cholesterol (mg)	248	7·4	4·9	2·0	0·4	242	7·9	5·2	2·2	0·5	275	5·2	3·8	1·1	0·2
Vitamin A (μg RAE)	500	11·1	7·4	3·1	0·6	515	11·3	7·4	3·3	0·7	425	9·8	7·3	2·2	0·3
Riboflavin (mg)	1·62	18·7	15·9	1·6	1·3	1·65	19·0	16·0	1·7	1·4	1·48	16·9	15·2	1·1	0·6
Vitamin B_6 (mg)	1·49	4·3	3·7	0·3	0·3	1·52	4·4	3·8	0·4	0·3	1·36	3·8	3·4	0·2	0·1
Vitamin B_{12} (μg)	5·08	12·6	10·3	1·4	1·0	5·04	13·2	10·6	1·5	1·1	5·31	9·8	8·6	0·8	0·4
Vitamin D (μg)	3·22	35·9	35·3	0·4	0·2	3·00	40·9	40·2	0·5	0·2	4·34	18·5	18·3	0·2	0·1
Ca (mg)	516	37·9	27·6	7·7	2·6	522	38·9	28·0	8·1	2·8	483	32·0	25·5	5·3	1·2
P (mg)	976	17·0	12·1	3·8	1·1	970	17·9	12·5	4·1	1·2	1011	12·7	10·0	2·3	0·4
Mg (mg)	243	7·6	6·3	0·7	0·5	239	8·0	6·6	0·8	0·6	267	5·5	4·8	0·4	0·2
Zn (mg)	11·3	6·6	4·6	1·5	0·5	11·2	6·9	4·8	1·6	0·5	11·5	5·1	3·9	1·0	0·2
Na (mg)	3190	4·4	2·3	1·9	0·2	3178	4·6	2·3	2·1	0·2	3248	3·4	2·1	1·2	0·1
K (mg)	2390	10·2	9·0	0·5	0·7	2365	10·8	9·4	0·5	0·8	2517	7·8	7·3	0·3	0·3

RAE, retinol activity equivalents.
*Total dairy products include milk (plain and flavoured milk, milk drinks, grains cooked in milk and milk in coffee), cheese and yoghurt.

servings/d, with the majority of servings consumed as whole milk[22]. Based on an assessment of diet quality among adults in São Paulo, intake of milk and dairy products was estimated at approximately 0·7 portions/d[9].

Dietary guidance for Americans aged ≥9 years recommends consumption of three cup-equivalents of fat-free or low-fat milk and milk products daily[23]. Mean consumption of dairy products by adult men and women aged ≥20 years based on data collected in 2009–2010 was 1·95 and 1·50 cup-equivalents, respectively, with fluid milk accounting for half of total dairy intake and cheese largely accounting for the balance[24]. Results from the current analysis suggest that the gap between reported and recommended intake of dairy servings may be larger for Brazilians than Americans. Lack of knowledge about the milk food group recommendations and portion sizes of milk products has been identified as a core barrier for consumer adherence to dietary guidance for this food group in the USA[25]. Efforts to educate the Brazilian population about dairy recommendations, including qualitative information about minimally *v.* more processed dairy products and quantitative information on dairy product portions, could provide a useful strategy to improve diet quality through increased consumption of nutrient-dense dairy products.

The relatively high overall contributions of dairy products to nutrient intakes among Brazilians indicate that dairy products are an important source of several nutrients in the diet, including nutrients with a high prevalence of inadequate or suboptimal intakes, namely Ca, vitamin A, vitamin D, Mg, P and K[2–5]. These findings are consistent with analyses of diets in other countries in North America and Europe showing that dairy products are a substantial source of Ca and other nutrients such as K, Mg and P[26–29]. Analyses of nutrient intakes based on dietary pattern modelling in the USA have shown that daily consumption of multiple portions of dairy products is important for meeting recommended intakes of Ca along with other nutrients in the diet[30,31].

Across all age groups, and in particular elderly adults, dairy products accounted for a large proportion of total saturated fat intake. The dietary guidelines in Brazil encourage low-fat products for adults to minimize consumption of saturated fat[11,12]. Although the evidence has been inconsistent, some meta-analyses have not found adverse effects of high-fat dairy intake on cardiovascular risk[32,33]. In a recent longitudinal study of adults in Brazil, total dairy intake (the majority of which was full-fat) was inversely associated with measures of glycaemia and insulinaemia[34], results potentially attributed to SFA in the dairy products. Nutrition education efforts could help guide consumers to lower-fat dairy products such as milk and yoghurt in place of cheese while further research clarifies the specific role of dairy fats in health.

Dairy products accounted for approximately 4 % of added sugars in the diets of adults and the elderly, and approximately 6 % in the diets of adolescents. Consistent with the current study, previous research has indicated

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Table 4 Percentage contributions of dairy products to total nutrient intakes in the Brazilian population aged ≥10 years by age group. Individual Food Intake 2008–2009; first day of intake

	Adolescents 10–18 years (*n* 6939)					Adults 19–59 years (*n* 22 742)					Elderly ≥60 years (*n* 4322)				
		% from					% from					% from			
Nutrient	Total intake	Total dairy*	Milk	Cheese	Yoghurt	Total intake	Total dairy*	Milk	Cheese	Yoghurt	Total intake	Total dairy*	Milk	Cheese	Yoghurt
Energy (kJ)	8569	6·4	5·1	0·6	0·7	8109	5·7	4·0	1·1	0·5	6853	8·1	6·0	1·7	0·4
Energy (kcal)	2048	6·4	5·1	0·6	0·7	1938	5·7	4·0	1·1	0·5	1638	8·1	6·0	1·7	0·4
Protein (g)	79·9	7·4	5·8	1·0	0·6	82·2	6·8	4·5	1·9	0·5	71·2	9·8	6·8	2·7	0·4
Carbohydrate (g)	290	4·7	4·0	0·0	0·7	267	3·6	2·9	0·1	0·6	228	5·0	4·3	0·2	0·4
Total sugars (g)	109·5	12·1	10·4	0·1	1·6	93·3	10·2	8·4	0·4	1·4	76·4	14·3	12·6	0·7	1·1
Added sugars (g)	79·4	5·7	4·5	0·0	1·2	64·4	3·8	2·7	0·0	1·1	46·3	4·3	3·4	0·0	0·9
Total fat (g)	63·6	9·5	7·4	1·4	0·8	59·0	9·5	6·1	2·8	0·6	48·9	13·9	9·3	4·1	0·5
Saturated fat (g)	22·3	15·9	12·1	2·6	1·2	20·4	16·1	10·1	5·0	0·9	17·1	23·1	14·9	7·4	0·8
Cholesterol (mg)	255	7·5	5·8	1·1	0·6	253	7·0	4·4	2·1	0·4	212	9·9	6·4	3·1	0·4
Vitamin A (μg RAE)	469	11·4	8·8	1·8	0·9	508	10·5	6·6	3·3	0·6	507	13·8	9·1	4·3	0·4
Riboflavin (mg)	1·69	19·1	16·7	0·8	1·6	1·62	17·6	14·7	1·7	1·2	1·50	24·5	21·1	2·4	0·9
Vitamin B_6 (mg)	1·49	4·9	4·4	0·2	0·4	1·52	4·0	3·3	0·4	0·3	1·36	5·5	4·8	0·5	0·2
Vitamin B_{12} (μg)	4·96	13·7	11·7	0·8	1·3	5·20	11·6	9·3	1·4	0·9	4·64	16·6	13·8	2·0	0·7
Vitamin D (μg)	3·45	38·8	38·4	0·2	0·2	3·18	33·7	33·1	0·5	0·2	3·12	42·4	41·7	0·6	0·1
Ca (mg)	538	37·7	30·4	4·1	3·1	511	36·2	25·5	8·2	2·5	507	46·5	34·2	10·4	1·9
P (mg)	991	17·1	13·9	1·8	1·4	988	15·9	10·9	4·0	1·1	899	22·6	15·7	6·1	0·8
Mg (mg)	246	8·3	7·3	0·4	0·7	246	7·0	5·7	0·8	0·5	226	9·6	8·1	1·1	0·4
Zn (mg)	11·2	6·8	5·4	0·9	0·6	11·6	6·1	4·1	1·6	0·4	9·9	9·1	6·4	2·3	0·4
Na (mg)	3224	3·7	2·7	0·9	0·2	3237	4·0	1·9	2·0	0·1	2904	7·2	3·7	3·3	0·1
K (mg)	2369	11·6	10·4	0·2	0·9	2418	9·4	8·2	0·5	0·7	2280	12·6	11·2	0·8	0·5

RAE, retinol activity equivalents.
*Total dairy products include milk (plain and flavoured milk, milk drinks, grains cooked in milk and milk in coffee), cheese and yoghurt.

that sweetened and full-fat dairy products such as flavoured milks are a contributor to intake of added sugars and solid fats, particularly among adolescents[35]. These processed dairy products are among the foods for which limited consumption is recommended in the 2014 Brazilian dietary guidelines. Nutrition education efforts targeted to adolescents could help this population increase dairy consumption while minimizing intake of added sugars, thus improving the overall nutritional quality of their diets.

Apparent differences in the percentage contributions of dairy products to nutrient intakes by household location and age group observed in the current analysis may largely be attributed to differences in dairy product consumption across sub-populations. The proportion of dietary vitamin D intake provided by dairy products for residents in rural areas was considerably lower than the proportion provided for urban residents (18·5 % *v.* 40·9 %, respectively). The lower contribution may be a result of several factors, including a greater proportion of residents in rural areas consuming fresh cow's milk which was not assumed to contain vitamin D in the food composition database used to process nutrient intakes in the Brazilian survey[14]. The potentially increased contributions of dairy products to nutrient intakes among the elderly may be attributed to their greater per capita intake of dairy products and overall lower energy intake and nutrient intakes. The exception to higher contributions of dairy products to nutrient intakes by the elderly was added sugars, presumably because of relatively low intake of flavoured milk and milk drinks in this sub-population.

Bezerra and colleagues recently compared food intakes by Brazilian adults with American adults and found that the percentage of American adults consuming milk was 47 % compared with 23 % among Brazilians, while 62 % of adults in the US consumed dairy products (other than milk) compared with 18 % in Brazil[36]. The percentage of total energy intake accounted for by milk and dairy products combined in the USA was 9·6 % *v.* 4·5 % in Brazil[36]. The higher energy contributions from total dairy products in the current analysis for adults (5·7 %) and elderly adults (8·1 %) in Brazil, and the higher percentage of adults reporting intake of milk, may in part reflect our inclusion of milk consumed as part of coffee drinks in the estimates of total milk intake. Milk in coffee was the only source of dairy product intake for 25 % of the population of adults and elderly adults in Brazil. Given the frequency of coffee with milk consumption by adults in Brazil, this source of milk is an important component of total dairy consumption among Brazilians. In the USA, 8 % of fluid milk reported consumed by adults was plain milk added to another beverage[37].

Strengths of the present analysis include use of a recent and large nationally representative sample to estimate nutrient intakes. Estimates of intake for sub-populations categorized by location of household and age group allow for identification of dietary patterns unique to these individuals. It is also

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important to consider limits of the cross-sectional data analysis. As with all estimates based on dietary records, these estimates are limited by the accuracy of the information provided in the records and the accuracy to which the assigned nutrient composition data reflect the nutrient composition of the foods consumed. IBGE evaluated energy intakes collected in the dietary records and concluded that results were consistent with data collected in similar studies[14]. Nutrient composition data for selected nutrients, including vitamin D, were assigned based on composition data from the USA. Most milk in the USA is voluntarily fortified with vitamin D at a level of 400 IU per quart, which is equivalent to approximately 2·5 μg vitamin D per 240 ml serving. Milk in Brazil may contain added vitamin D, although standard milk is typically not fortified. The estimated intakes of dietary vitamin D in the current analysis therefore may not necessarily reflect current consumption patterns. Additionally, levels of sugars added to beverages were based on standardized calculations rather than recorded amounts.

In the present analysis dairy product intake (grams and portions) and nutrient contributions from dairy products were estimated from reported intakes of milk, cheese and yoghurt. With the exception of milk consumed in coffee, mixtures were not disaggregated to identify dairy product components, therefore our findings may slightly underestimate total dairy product intake. Additionally, all estimates are based on one day of food records and may not be representative of usual intakes, although estimates based on one day are appropriate to estimate mean intakes by a population[16,17].

Conclusions

Results from the present study indicate that dairy product consumption is well below the 2006 recommended levels of intake for most of the population aged ≥10 years in Brazil, regardless of location of residence or age. Dairy products were significant contributors to dietary intake (11·1–37·9 % of daily intake) of several nutrients including Ca, P and vitamin A, all of which are nutrients of concern in Brazil. Dairy products also contributed to intakes of saturated fat (16·9 %), total sugars (11·1 %) and added sugars (4·3 %). Education efforts to raise awareness about current guidelines for dairy intake may serve to improve diet quality of individuals in Brazil.

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