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Consumption of alcoholic and non-alcoholic beverages: ELSA-Brasil results

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Abstract *The study aims to describe the consumption of alcoholic and non-alcoholic beverages according to sociodemographic, health and location variables. Cross-sectional study with ELSA-Brasil data (2008-2010). A questionnaire was used to collect sociodemographic, food, health data and anthropometry. Descriptive analysis and association with variables of interest were carried out. In the sample, 8% of the total caloric value comes from non-alcoholic beverages (5.6%: sugary drinks), and 4% from alcoholic beverages (2.7%: beer). Consumers of unsweetened and artificially sweetened beverages reported moderate/strong physical activity, former smokers and higher education. The opposite was true for sugary drinks. Eutrophic people reported higher consumption of sugary drinks and those obese, artificially sweetened and beer. Alcohol consumption varied with age (young: beer; elderly: wine/spirits) and education (low education: beer/spirits; higher education: wine). Coffee, natural juice and soda were the most consumed non-alcoholic beverages and beer was the most prevalent alcoholic beverage. Consumption variation was observed according to geographic location. The consumption of sugary and alcoholic beverages is high in Brazil and public health strategies are required.*
Key words *Soft Drinks, Fruit Juices, Artificial Sweeteners, Alcoholic Beverages*

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Introduction

Changes in dietary patterns, such as increased consumption of unhealthy and highly processed industrialized foods[1], represent an important contribution to adverse health outcomes[2]. In addition, increased consumption of beverages with high energy density such as sugary drinks, in several countries, have also contributed to the high prevalence of chronic non-communicable diseases (NCD)[2,3]. Excessive alcohol consumption unquestionably leads to increased morbidity and mortality due to NCD, but the effects of moderate consumption of different alcoholic beverages on the cardiovascular system are still controversial[4]. If, on the one hand, there is consolidated evidence that the high consumption of sugary and alcoholic beverages increases the risk of cardiovascular diseases, on the other hand, there are still gaps in knowledge in relation to artificially sweetened ones[5].

Four population surveys carried out between 1987-1988 and 2008-09 showed greater acquisition of processed foods and beverages at the expense of fresh and minimally processed foods[1]. The household availability of soft drinks in Brazilian metropolitan areas increased by 500% between 1974-1975 and 2002-2003, corresponding to an increase of 0.4% to 2.1% of the total calories consumed daily, with this consumption remaining stable in the most recent survey 2008-09[6,7]. The consumption of these beverages has been widely studied as a potential risk factor for several health problems.

Recent systematic reviews and meta-analyses indicate that the consumption of sugar-sweetened drinks is associated with weight gain[8], the risk of type 2 diabetes[9] and coronary heart disease[10]. Still, studies involving the consumption of artificially sweetened drinks are controversial and inconsistent. Although a positive association has already been identified between these beverages and cardiometabolic disorders, the current evidence is still limited, and their consumption does not seem to be a healthy alternative to sugar-sweetened drinks[5,9].

With regard to alcoholic beverages, Brazil exceeds the average annual consumption of pure alcohol per inhabitant of the American continent[11] and the household availability of these beverages, especially beer, has doubled since the 1980s[6,7]. The main active ingredient of any alcoholic beverage is ethanol, and most evidence indicates that this compound is the main factor that can confer health benefits and cause toxicity, depending on the pattern of consumption and dosage[12,13]. The relationship between its excessive consumption and cardiovascular diseases[14] is widely established, although the beneficial effects of moderate consumption remain debated, since results of meta-analyses[15,16] and analysis of ten cohorts of the English population[17] showed no significant effects or no protective effect on cardiovascular outcomes. A recent meta-analysis showed that, in men, any amount of alcohol is associated with an elevated risk of hypertension[18], but there are still questions about the differential effect related to a certain type of alcoholic drink[14]. Although there is no consensus, a literature review has shown that low and moderate wine consumption has a cardioprotective effect, since it is inversely correlated with ischemic heart disease[19].

In view of the above, additional caloric consumption and alcohol content from these beverages can play an important role in increasing the incidence of cardiometabolic disorders[8,14]. The literature on the consumption of industrialized beverages in Brazil is not extensive and the surveys carried out use different methodologies. In Brazil, Household Budget Surveys (POF - *Pesquisa de Orçamentos Familiares*) are being carried out in metropolitan areas and through them the secular trend of household availability of food/beverages has been assessed. POF 2002-2003 is based on household expenses that probably underestimate general individual consumption, since it excludes food outside the home, an important source of industrialized beverages[20]. The Telephone-based Surveillance of Risk and Protective Factors for Chronic Diseases (VIGITEL), carried out on probabilistic samples of the adult population with fixed telephony in Brazilian capitals and the Federal District, presents a questionnaire with questions about food consumption, however it is not is validated in all Brazilian regions[21,22].

Thus, new data on the consumption of beverages in large samples of the Brazilian population are needed to assist public food policies. Therefore, this study aims to assess the consumption of alcoholic and non-alcoholic beverages in participants of the baseline of the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil) according to sociodemographic, health and study location variables.

Methods

Study design and participants

This is a cross-sectional study conducted from the baseline of ELSA-Brasil (2008-2010), composed of 15,105 active or retired employees of both sexes, aged between 35 and 74 years, from six public institutions of higher education and national research (USP, UFMG, UFBA, UFRGS, UFES and Fiocruz). Participants with missing data and those with non-plausible dietary data (<500 Kcal/day and ≥6000 Kcal/day) were excluded from this analysis.

The main objective of ELSA-Brasil is to investigate the incidence and determinants of NCD in the Brazilian population, and the general characteristics of the baseline of this cohort have been previously published[23]. ELSA-Brasil was approved by the National Research Ethics Commission (CONEP) and by the research ethics committee of each institution. All participants signed the Informed Consent Form.

Data collection

Participants were contacted for exams and questionnaires at each Research Center (RC). General information on the measurement of clinical examinations, as well as on the questionnaire applied in person to collect sociodemographic, health and lifestyle data is available in a previous publication[24]. All RCs received centralized training to maintain quality control in data collection. Interviewers and gaugers were also certified and recertified every six months.

Sociodemographic data, health status and lifestyle, including the consumption of alcoholic and non-alcoholic beverages, were collected during an interview. The race/color variable was self-reported and categorized as white and non-white (black, brown, Asian-descendant and indigenous); age was categorized into four groups (35-44; 45-54; 55-64; 65-74); the level of education was categorized as elementary (≤8 years of study), medium (9-11 years of study) and higher/graduate (≥12 years of study); smoking was categorized as never, former smoker and current smoker; family income per capita was calculated and analyzed in Brazilian reais. Physical activity was estimated using the International Physical Activity Questionnaire (IPAQ) long version, in the domains of leisure time physical activity (AFTL) and displacement physical activity (AFDL). The instrument was validated in Brazil and consists of questions related to the frequency, duration and intensity (AFTL: walking, moderate and vigorous; AFDL: walking, cycling) of physical activities[25]. The pattern of physical activity, in its different domains, was reported in minutes/week, consisting of multiplying the weekly frequency by the duration of each of the activities performed. Physical activity was considered to be that done with a minimum duration of 10 minutes/week. The variable was later categorized as low, moderate and strong.

Anthropometric measurements

Body measurements (weight and height) were measured according to standardized procedures. An electronic scale was used, with a capacity of 200 kg and precision of 50 g. Height was measured using a wall stadiometer with a precision of 1mm, with the individual in a vertical position, barefoot, supporting the head, buttocks and heels on the wall, keeping the gaze horizontally. Height was checked during the inspiratory period of the respiratory cycle. The Body Mass Index (BMI) was calculated with the weight divided by the height raised to the second power. The individuals were classified as eutrophic (≤24.9 kg/m²), overweight (25 to 29.9 kg/m²) and obese (>30 kg/m²)[26].

Assessment of consumption of alcoholic and non-alcoholic beverages

To assess the consumption of alcoholic beverages (beer, wine, spirits - cachaça, whiskey and vodka) and non-alcoholic beverages (soda, coffee, natural juice, industrialized juice, artificial juice, mate tea, chimarrão and coconut water), participants used a semi-quantitative Food Frequency Questionnaire (FFQ), with 114 food items, validated by Molina et al.[27], with the objective of estimating the usual dietary consumption in the last twelve months.

The FFQ is structured in: 1. Food/preparations; 2. Measures of consumption portions; 3. Frequencies of consumption, with eight response options, ranging from "More than 3x/day" to "Never/Almost Never"; 4. Seasonal consumption for individuals who reported spontaneously consuming the food item only at a certain time of the year or in the season. The list of food and beverages was read by ELSA-Brasil interviewers to the participants, who were asked to respond about their usual consumption in the last twelve months, in daily, weekly and monthly consumption frequencies. A kit of utensils was used during the administration of the FFQ, to help estimate the amount of food, preparations and beverages consumed.

Regarding non-alcoholic beverages natural juice (fruit or pulp), industrialized juice (box or bottle), artificial juice (powder), coffee and mate tea, the participant had three response options: with sugar, without sugar or with artificial sweetener. Regarding soda, the participant had two answer options: with sugar or with sweetener. Finally, coconut water and chimarrão were considered in their natural versions, that is, without added sugar. Regarding alcoholic beverages, it was asked about the consumption of spirits (cachaça, whiskey or vodka), beer and wine (white or red).

The beverages were divided into two groups: alcoholic and non-alcoholic. Alcoholic beverages were presented separately (beer, wine and spirits) and as the sum of all drinks. Non-alcoholic beverages were presented separately (each beverage considering the versions with sugar, without sugar and with artificial sweetener) and also in three groups: sweetened with sugar, unsweetened and artificially sweetened. All beverages were analyzed in ml/day and kcal/day.

The Nutrition Data System for Research (NDSR) software was used to analyze the consumption referred to in the FFQ. The extreme consumption values (above the 99th percentile) were replaced by the exact 99th percentile. In addition, when the participant voluntarily mentioned the seasonal consumption of some food or beverage, the total daily consumption value of that food was multiplied by 0.25 (considered as present in ¼ of the year).

Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) 18.0 software. Descriptive analysis was conducted to identify the consumption profile of alcoholic and non-alcoholic beverages of the participants, and then consumption was analyzed according to socioeconomic, health and location variables (RC). From the total caloric value obtained by reporting the food items of the FFQ, the caloric contribution of each type of beverage was evaluated. The variables were presented as proportions, means (SD) or medians. For continuous variables, the Student's t-test and ANOVA were used. For categorical variables, the chi-square test was used. The level of significance was set at $p<0.05$.

Results

The final sample consisted of 14,224 individuals with an average age of 52.1±9.1 years. Significant differences were found between genders according to sociodemographic, health and total calorie variables (Table 1). Most of the sample was represented by women (55%), with higher education (53.5%), overweight (40.4%), who practice weak physical activity (76.9%) and who never smoked (57.2%). The average caloric intake was 2,291±778 Kcal/day.

The consumption of non-alcoholic beverages differed in relation to sociodemographic and health variables (Table 2). Higher average consumption of non-sweetened and artificially sweetened beverages was observed in women, older age, white, with higher education/postgraduate education and who reported engaging in moderate/strong physical activity and being former smokers ($p<0.001$). The opposite was found for sugar-sweetened drinks ($p<0.001$). In addition, eutrophic individuals reported higher consumption of sugar-sweetened drinks ($p<0.001$) and obese individuals, higher consumption of artificially sweetened drinks ($p<0.001$).

Regarding alcoholic beverages, consumption was higher among men ($p<0.001$) (Table 2). The consumption of these beverages varied with age (young people consumed more beer and older people more wine and spirits), education level (those with elementary education used more beer and spirits, while wine was more consumed by individuals with higher education), race/color (beer was mostly consumed by non-whites and wine by whites) ($p<0.001$). Overweight participants consumed more beer ($p<0.001$). The nutritional status did not differ according to the consumption of wine and spirits beverages. Higher averages of beer consumption were observed in individuals who practiced low physical activity ($p<0.001$) and greater consumption of wine was observed in individuals who engaged in moderate/strong physical activities ($p<0.001$). Smokers reported higher consumption of beer ($p<0.001$) and spirits ($p<0.001$), while former smokers reported higher consumption of wine ($p<0.001$).

Table 3 shows the consumption of alcoholic and non-alcoholic beverages according to geographic location (RC). The three most consumed non-alcoholic beverages were coffee (148±125 ml/day), natural juice (138±194 ml/day) and soda (99±183 ml/day), and in both the consumption was higher in the sugar-sweetened version. The consumption of some drinks is higher

Table 1. Distribution of sociodemographic, health and total calorie variables according to sex. ELSA-Brasil, 2008-2010.

Variables	Sex		Total (n=14,224)	p-value*
	Male (n=6,366)	Female (n=7,858)		
	n (%)	n (%)	n (%)	
Age				
35 to 44	1421 (22.3)	1703 (21.7)	3124 (22)	<0.001
45 to 54	2477 (38.9)	3112 (39.6)	5589 (39.3)	
55 to 64	1717 (27)	2269 (28.9)	3986 (28)	
65 to 74	751 (11.8)	774 (9.8)	1525 (10.7)	
Race/color				
White	3435 (54)	4080 (51.9)	7515 (52.8)	0.016
Non-white	2931 (46)	3778 (48.1)	6709 (47.2)	
Education				
Elementary	1032 (16.2)	725 (9.2)	1757 (12.4)	<0.001
Middle	2037 (32)	2815 (35.8)	4852 (34.1)	
Higher/graduate	3297 (51.8)	4318 (55)	7615 (53.5)	
BMI (Kg/m²)				
Eutrophic	2152 (34)	3069 (39.1)	5221 (36.8)	<0.001
Overweight	2900 (45.5)	2852 (36.3)	5752 (40.4)	
Obese	1307 (20.5)	1944 (24.7)	3251 (22.8)	
Physical activity				
Low	4674 (73.4)	6262 (79.7)	10936 (76.9)	<0.001
Moderate	984 (15.5)	1010 (12.9)	1994 (14)	
Strong	708 (11.1)	586 (7.5)	1294 (9.1)	
Smoking				
Never	3221 (50.6)	4917 (62.6)	8138 (57.2)	<0.001
Former	2272 (35.7)	1998 (25.4)	4270 (30)	
Current	873 (13.7)	943 (12)	1816 (12.8)	
Per capita income (reais)	1695±1366	1825±1503	1767±1445	<0.001
Total calories (Kcal/day)	2548±799	2083±695	2291±778	<0.001

*Chi-square test for categorical variables and Student's t-test for continuous variables.

Source: Elaborated by the authors.

in some RCs, such as: chimarrão in Rio Grande do Sul and mate tea in Rio de Janeiro and Rio Grande do Sul. The consumption of coconut water is more common in coastal regions, such as Espírito Santo, Bahia and Rio de Janeiro.

The percentage of caloric contribution was 5.6% for sugar-sweetened drinks and 4% for alcoholic beverages, with small variations according to the RC (Figure 1). Table 4 shows the means (kcal/day) and percentage of contribution of beverages to total caloric consumption according to sex. The calorie consumption of sugar-sweetened drinks and alcoholic beverages was higher in men (p<0.001) and of artificially sweetened drinks was higher in women (p<0.001). The daily contribution of unsweetened and artificially sweetened beverages to total caloric intake was higher in women (p<0.001). The daily contribution of beer and spirits to total caloric intake was higher in men (p<0.001). Probably, the differences found in the analyses in relation to the averages in calories and percentage of caloric contribution by sex is due to the higher total caloric consumption among males. We can also observe that 8% of the total caloric value consumed comes from non-alcoholic beverages and 4% from alcoholic beverages.

Discussion

In the sample studied, 8% of the total caloric value consumed comes from non-alcoholic drinks (5.6% from sugar-sweetened drinks), and 4%

Table 2. Consumption of non-alcoholic and alcoholic beverages according to sociodemographic and health variables. ELSA-Brasil, 2008-2010.

Variáveis	Non-alcoholic beverages			Alcoholic beverages[a]		
	Unsweetened	With sugar	With sweetener	Beer	Wine	Spirits
	(ml/day)	(ml/day)	(ml/day)	(ml/day)	(ml/day)	(ml/day)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Sex						
Male	171±292	312±367	132±232	214±313	32±52	5.8±13
Female	180±279	243±326	159±242	76±158	25±40	1.2±5
p-value*	0.050	<0.001	<0.001	<0.001	<0.001	<0.001
Age						
35 to 44	161±280	344±371	127±229	148±252	23±38	1.9±7
45 to 54	170±285	291±349	137±228	164±271	25±43	3.2±10
55 to 64	186±280	228±327	167±251	144±269	34±53	4.6±12
65 to 74	205±302	186±300	174±249	100±213	40±56	5.8±13
p-value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Race/color						
White	214±314	223±302	157±240	122±228	35±52	3.7±10
Non-white	134±240	331±382	135±235	182±296	20±37	3.5±11
p-value*	<0.001	<0.001	<0.001	<0.001	<0.001	0.452
Education						
Elementary	154±315	372±403	117±232	232±332	14±33	6.2±15
Middle	140±273	347±376	123±223	189±309	17±34	2.9±10
Higher/graduate	205±282	205±294	169±246	114±211	37±52	3.5±10
p-value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BMI (Kg/m²)						
Eutrophic	176±279	285±334	99±199	118±225	28±45	3.2±10
Overweight	176±285	270±346	156±237	160±274	29±48	3.9±10
Obese	175±290	266±365	207±276	174±287	26±45	3.7±10
p-value*	0.996	0.007	<0.001	<0.001	0.114	0.090
Physical activity						
Low	162±274	297±354	140±235	156±273	25±43	3.6±11
Moderate	219±316	197±297	171±246	128±230	38±55	3.5±10
Strong	230±305	195±321	169±248	123±215	37±55	3.3±9
p-value*	<0.001	<0.001	<0.001	<0.001	<0.001	0.609
Smoking						
Never	174±274	273±350	146±238	107±213	27±43	2.2±8
Former	189±307	249±330	159±244	171±273	34±54	4.7±12
Current	157±276	336±363	121±220	243±346	21±43	6.0±14
p-value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

*Student's t-test and Anova; [a] n=8,956 (consumers of alcoholic beverages).

Source: Elaborated by the authors.

from alcoholic drinks (2.7% from beer). Consumers of non-sweetened and artificially sweetened beverages reported engaging in moderate/strong physical activity, being former smokers and having higher schooling. The opposite was found for sugar-sweetened drinks. Regarding nutritional status, eutrophic individuals reported higher consumption of sugar-sweetened drinks and obese individuals, artificially sweetened drinks and beer. The consumption of alcoholic beverages varied with age (young people: beer; elderly people: wine/spirits) and education (low education: beer/spirits; higher education: wine). The most consumed non-alcoholic beverag-

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Table 3. Consumption of alcoholic and non-alcoholic beverages according to Research Center. ELSA-Brasil, 2008-2010.

Variables	Centro de Investigação							p-value*
	Bahia	Espírito Santo	Minas Gerais	Rio de Janeiro	Rio Grande do Sul	São Paulo	ELSA-Brasil	
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Non-alcoholic beverages (ml/day)	(n=1,869)	(n=1,011)	(n=2,979)	(n=1,699)	(n=1,986)	(n=4,686)	(n=14,224)	
Soft drinks with sugar	45±108	50±138	54±137	74±185	68±172	67±174	61±159	<0.001
Soft drinks with sweetener	19±68	29±90	35±106	61±144	54±139	33±108	38±113	<0.001
Coffee unsweetened	13±56	10±42	17±62	14±54	41±93	16±50	18±62	<0.001
Coffee with sugar	114±156	71±103	91±129	57±97	85±140	67±92	80±120	<0.001
Coffee with sweetener	68±133	51±86	55±107	55±93	50±100	34±71	50±100	<0.001
Natural juice unsweetened	44±125	30±102	45±112	52±117	50±111	44±111	45±113	<0.001
Natural juice with sugar	133±233	100±203	57±161	43±135	30±118	51±140	62±164	<0.001
Natural juice with sweetener	50±133	57±133	30±96	37±104	17±72	19±80	30±100	<0.001
Industrialized juice unsweetened	9±47	3±28	15±62	20±70	32±87	16±65	17±65	<0.001
Industrialized juice with sugar	25±82	35±94	38±94	44±112	23±83	45±109	37±100	<0.001
Industrialized juice with sweetener	4±28	23±64	16±51	19±58	6±34	10±43	12±46	<0.001
Artificial juice unsweetened	3±22	0.1±3	2±20	1±16	13±48	6±34	5±30	<0.001
Artificial juice with sugar	8±41	13±66	20±74	9±55	21±85	31±100	21±80	<0.001
Artificial juice with sweetener	1.5±15	4±26	5±29	4±23	8±38	7±34	5±30	<0.001
Mate unsweetened	24±74	11±51	14±61	17±64	45±102	20±31	22±73	<0.001
Mate with sugar	8±32	6±26	13±45	15±48	10±41	13±43	12±42	<0.001
Mate with sweetener	8±41	11±47	13±51	20±63	11±50	11±49	12±50	<0.001
Chimarrão	1.2±16	2.7±38	1.2±22	3.5±49	283.5±414	4.7±65	42.1±188	<0.001
Coconut water	51±74	39±68	21±48	35±62	10±36	22±50	26±56	<0.001
Alcoholic beverages (ml/day)[a]	(n=1,203)	(n=545)	(n=2,003)	(n=1,089)	(n=1,343)	(n=2,773)	(n=8,956)	
Beer	185±299	191±306	175±280	175±300	108±216	113±213	148±261	<0.001
Wine	20±35	25±42	27±43	30±49	44±60	26±45	29±47	<0.001
Spirits	3.3±10	4.2±12	4.9±12	2.8±9	2.9±9	3.4±10	3.6±11	<0.001

* Anova; [a] n=8,956 (consumers of alcoholic beverages).

Source: Elaborated by the authors.

es were coffee, natural juice and soft drinks, all three in the sugar-sweetened version. Regarding alcoholic beverages, beer was the most prevalent. The consumption of some beverages varied according to geographic location.

The results found confirm the differentiated profile of consumption of beverages according to the five regions of Brazil, such as chimarrão, mate tea and coconut water, considering the climatic and cultural influences. A study carried out with data from the National Dietary Survey (INA - *Inquérito Nacional de Alimentação*), in a probabilistic sample from the POF (2008-2009), showed that the Brazilian basic diet, in relation to

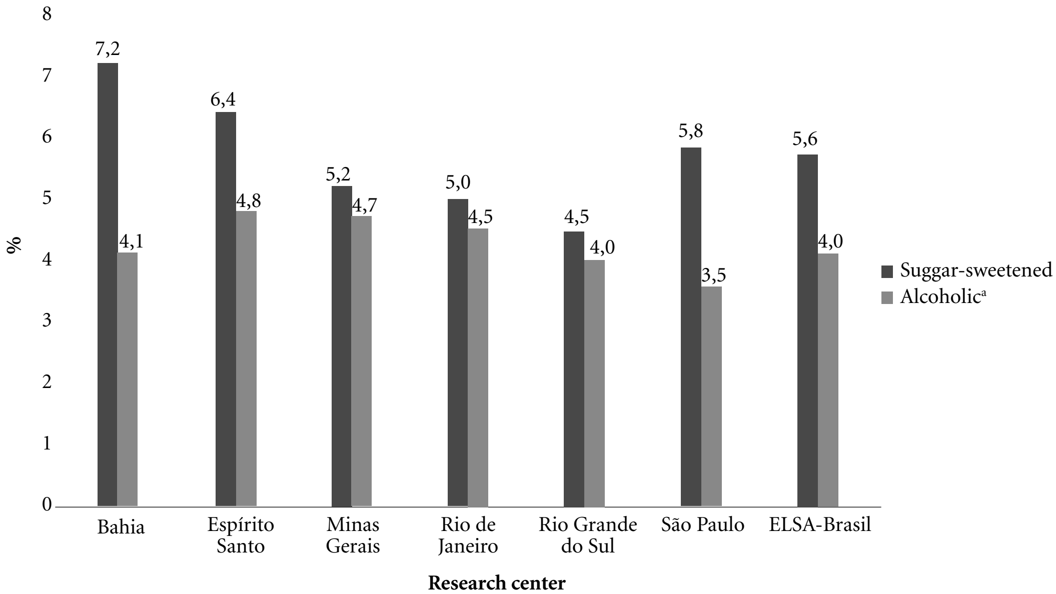

Figure 1. Daily caloric contribution of sugar-sweetened and alcoholic beverages to total energy consumption according to Research Center. ELSA-Brasil, 2008-2010.

[a] n=8,956.

Source: Elaborated by the authors.

beverages, is characterized by the intake of coffee, juices and soft drinks, and two foods are markedly for regional consumption, one being tea in the south of the country[28]. In addition, greater coffee intake was observed in the north and northeast of the country[28], corroborating with the data from the present study that found higher consumption averages in the Bahia RC. The lowest averages of beer consumption were observed in the Rio Grande do Sul RC, while it presents the highest average consumption of wine and chimarrão, known as more convenient options for the regional climate and culture.

According to the POF (2008-2009), the average consumption of soft drinks in Brazilian adults was approximately 100 ml/day[6], a value close to that found in this study. In the United States and United Kingdom, the average consumption of soft drinks is higher, around 284 ml/day and 114 ml/day, respectively[9]. POF (2008-2009) analyses also showed that alcoholic and non-alcoholic beverages contribute about 17% to total energy consumption[3]. In this sample, the contribution of these beverages was slightly lower, around 12%.

It is well documented that men have a higher intake of alcoholic beverages than women and that habitual consumption is higher in individuals with higher education[29]. The INA (2008-2009) showed a higher prevalence of soft drink intake in men and in the highest income quartile[28], as did VIGITEL, which also found a higher consumption of soft drinks among men with higher education during the period evaluated (2007-2016)[30]. In our study, the average consumption of sugary and alcoholic beverages was higher in men and in individuals with less education (except for wine). We observed that in individuals with higher education, the consumption of non-sweetened drinks, those artificially sweetened and wine is higher. Artificial sweeteners are marketed as an alternative for weight loss because they do not add calories, although studies have already indicated changes in the microbiota and glucose homeostasis[31]. The consumption of wine, a drink generally with a higher price, has been associated with a better quality of life and cardioprotective benefits[32].

Meta-analysis showed the effect of consuming sugar-sweetened drinks on weight gain and

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Table 4. Averages and daily caloric contribution of non-alcoholic and alcoholic beverages to total energy consumption. ELSA-Brasil, 2008-2010.

Variables	Sex						Total	
	Male	Female	p-value*	Male	Female	p-value*	Mean±SD (Kcal/day)	Percentage of caloric contribution
	Mean±SD (Kcal/day)			Percentage of caloric contribution				
Non-alcoholic beverages[a]	(n=6,366)	(n=7,858)		(n=6,366)	(n=7,858)		(n=14,224)	(n=14,224)
Unsweetened	35±68	37±67	0.081	1.4	1.8	<0.001	36±67	1.5
Sugar-sweetened	147±188	118±177	<0.001	5.8	5.7	0.206	130±182	5.6
With sweetener	17±51	23±57	<0.001	0.7	1.1	<0.001	20±54	0.8
Total	199±182	179±174	<0.001	7.8	8.6	<0.001	187±77	8
Alcoholic beverages[b.c]	(n=4,675)	(n=4,281)		(n=4,675)	(n=4,281)		(n=8956)	(n=8956)
Beer	92±135	33±69	<0.001	3.6	1.5	<0.001	63±112	2.7
Wine	27±44	21±34	<0.001	1.1	1	0.102	24±39	1
Spirits	14±33	3±12	<0.001	0.5	0.14	<0.001	8±25	0.3
Total	133±148	57±79	<0.001	5.2	2.7	<0.001	96±126	4

*Student's t-test. [a]Average calories=2,548 Kcal male and 2,083 Kcal female; [b]n=8,956 (consumers of alcoholic beverages); [c]Average calories=2,562 Kcal male and 2,094 Kcal female.

Source: Elaborated by the authors.

cardiometabolic risk, particularly type 2 diabetes, in various parts of the world, including low and middle income countries[8]. There is evidence that weight gain occurs due to the positive energy balance, since there is a decrease in satiety and incomplete compensatory reduction in energy consumption in subsequent meals after the intake of calories from liquids[33], in addition to the high glycemic load in the diet being associated with insulin resistance[34]. High energy density beverages (excluding alcoholic and dairy products) provide almost half of the total sugar in the Brazilian diet, reinforcing the need for greater control over the consumption of these beverages[35]. Therefore, the consumption of sugar-sweetened drinks has become an important source for increasing energy intake and its deleterious effects are widely highlighted in the literature.

High alcohol consumption is also associated with cardiometabolic disorders, since it can lead to endothelial dysfunction, an early indicator of vascular damage[14]. According to the National Health Survey (2013)[29], alcohol consumption was higher among younger people, with higher education and white race. In the present study, it was possible to observe that beer consumption was higher among younger people and those with lower education; that of wine among older and more educated individuals; and that the highest consumption of alcoholic beverages was observed among whites. It is important to highlight that the use of alcohol in Brazil is the fourth risk factor for the global burden of disease[36] and the rapid growth of beer sales in the last decade, increases concern about over-consumption[37].

We observed in this study that obese individuals reported a higher consumption of artificially sweetened beverages, probably as a way to add less calories to the diet, and that although the intake of alcoholic beverages by overweight individuals is higher than that of eutrophic individuals, it is below the daily recommendation proposed by WHO[38]. It is important to highlight that alcohol intake is a common practice worldwide and is rooted in the social environment[39], however the WHO defines as moderate consumption the daily intake of one dose (10 to 15 grams of ethanol) for women and two doses for men (from 20 to 30 grams of ethanol), which corresponds to approximately 350 ml of beer[38]. Current evidence indicates that light to moderate alcohol intake is less likely to be a risk factor for adiposity than excessive consumption[40] and that the intake of daily doses above the recommended level represents health risks[38].

Sugar-sweetened drinks are associated with weight gain and cardiometabolic disorders, and there has been a greater choice for other alternatives, such as artificially sweetened beverages and fruit juices[5]. A recent systematic review and meta-analysis shows that the habitual consumption of sugar-sweetened drinks increases the risk of type 2 diabetes regardless of adiposity, and artificially sweetened drinks and fruit juice do not decrease the risk of such injury and, therefore, cannot be considered healthy options[9]. These findings are probably related to the high glycemic index (soft drinks) and moderate one (juices) associated with type 2 diabetes[41]; the high fructose content associated with insulin resistance[42]; in addition to the deleterious effects of caffeine[43], phosphoric acid and dyes[44].

It is worth pointing out that the potential benefits of consuming non-calorie drinks will not be achieved if the intake is accompanied by a compensatory increase in energy intake from other food sources[5]. Thus, we have shown in the present study that the consumption of non-sweetened and artificially sweetened beverages was associated with the practice of more vigorous physical activity and that eutrophic individuals consumed more sugar-sweetened drinks, while the obese presented greater consumption of artificially sweetened beverages. Thus, we can see that, under these conditions, sugar-sweetened drinks may be being replaced by artificially sweetened ones because they have fewer calories and, therefore, appear to be healthier options. However, even though studies in this area are consolidating in the literature, studies already show that the high consumption of artificial sweeteners can contribute to the increased risk of obesity and negative health effects[45], in addition to increasing the risk of stroke[46]. We also observed that individuals who practice low physical activity and current smokers made greater use of sugar-sweetened drinks, adding another component to the less healthy lifestyle.

Although POF data since the 1980s showed an increase in household soft drink availability until 2002-2003 and stability in 2008-2009[6,7], a study by VIGITEL found a significant reduction in regular consumption (≥5 days/week) of soft drinks and artificial juices from 30.9% to 16.5% during the years analyzed (2007-2016), although one in six adults (16.5%) reported daily consumption[30]. These data, however, need to be interpreted with caution, since, despite the downward trend observed in the period, health risks cannot yet be considered to be overcome, since in 2016 almost 26 million Brazilian adults consumed sugar-sweetened drinks almost daily or even every day[30]. The methodological differences between the POF and VIGITEL make the comparison of data delicate, but they contribute to the discussion of the topic. There are still no published studies that endorse this declining trend as of 2007, considering that the last national population-based survey was carried out in 2008-2009.

At the same time, it is important to highlight that the growth of the food processing industry, the inclusion of transnational companies in parallel with the expansion of supermarkets has been rapidly diversifying the options of drinks with high energy density in Brazil[47]. The consumption of these beverages in the country follows the trends of increasing excess weight, since the percentage of Brazilian adults with excess weight increased from 24% (1974-1975) to 49% (2008-2009)[48]. In the present study, overweight exceeds 60%. In this context, one of the main targets for rapidly improving public health has been the taxation of processed foods and beverages[49].

The search for strategies to reduce or slow the expansion of consumption of industrialized products is essential. It is already proven that the taxation of soft drinks in Brazil would lead to reductions in consumption[50]. In 2017, the Minister of Health in Brazil, in an informal note, reported being in favor of adopting a tax on sugar-sweetened drinks, but no initiative was observed. Thus, in Brazil, there are no advances in the taxation of sugar-sweetened drinks and there is also no progress in the regulation of advertising of food and beverages, despite the fact that the country has made a commitment to reduce obesity and the Pan American Health Organization consumption of sugar-sweetened drinks by 2019[51].

Brazil is one of the signatories to the Global Strategy to Reduce Harmful Use of Alcohol[52], approved by the World Health Assembly, which brings some aspects and recommendations also present in the National Alcohol Plan[53] and in the prohibition on drinking and driving[54]. However, when analyzing the public policies adopted, with regard to the reduction of harmful use of alcohol, it is observed that measures such as the restriction of marketing, sponsorship and promotions and increase in prices and sales limits[55] are not being adopted in Brazil.

ELSA-Brasil is not a representative study of the Brazilian population, but it portrays a portion of the population, which by the results found, does not differ much from the general population. The FFQ is the most suitable instrument for epidemiological studies, but it presents as a limitation the possibility of overestimating food consumption. This issue is frequently reported, but it was possible to minimize it with greater quality control in data collection and exclusion of participants who reported implausible intake values. However, the methodological aspects of this study reinforce its internal validity, such as the standardization of data collection, the consolidated procedures for conducting the interview, measurement of anthropometric measures and periodic training in all RCs. Although the Brazilian surveys that investigated food consumption have strengths (representativeness of the Brazilian population), they also have limitations. ELSA-Brasil is carried out with a large sample of civil servants from three Brazilian regions and used a collection instrument that allows greater detail of food consumption, as it reflects habitual consumption.

Finally, the consumption of sugary-sweetened and alcoholic beverages is high in Brazil and there is already evidence that public health strategies discourage the consumption of these beverages as part of a healthy lifestyle. Food guidelines, inspection policies and taxation of processed foods are necessary to reduce and prevent diseases related to overweight, in addition to improving the population's food consumption.

Collaborations

JH Siqueira performed the analysis and interpretation of the data and produced the writing of the article. NMT Santana, AD Moreira and TSS Pereira assisted in data analysis and critically reviewed the content. IM Benseñor, SM Barreto and G Velasquez-Melendez contributed to the study design and data acquisition. MCB Molina assisted in the study design, data acquisition, critical review of the content and final approval of its version for publication.

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