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# Factors associated with regular non-diet soft drink intake among adults in Pelotas, Southern Brazil

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## ABSTRACT

**OBJECTIVE:** To assess factors associated with regular intake of non-diet soft drinks among adults.

**METHODS:** Population-based cross-sectional study including 972 adults (aged 20 to 69) in the city of Pelotas, Southern Brazil, conducted in 2006. The frequency of non-diet soft drink intake in the 12 months prior to the study was evaluated by the question: "In general since last <month>, how many times did you have a non-diet soft drink?". The answers were dichotomized for the analysis. Intake of non-diet soft drinks five times or more per week was considered regular intake. The association between the outcome and sociodemographic, behavioral and nutritional variables was tested using the chi-square test for heterogeneity and linear trend and a multivariate analysis was performed through Poisson regression with a robust variance.

**RESULTS:** Approximately one in every five adults (20.4%) reported regular intake of non-diet soft drinks. Males (PR 1.50; 95%CI 1.20;2.00), smokers (RP 1.60; 95%CI 1.20;2.10) and those reporting weekly intake of snacks (PR 2.10; 95%CI 1.60;2.70) had higher prevalence of non-diet soft drink intake in the adjusted analysis. The analysis stratified by gender showed that in women regular intake of fruits and vegetables was protective against soft drinks consumption (PR 0.50; 95%CI 0.30;0.90).

**CONCLUSIONS:** Regular intake of non-diet soft drinks among adults was high, particularly among men, young adults and smokers.

**DESCRIPTORS:** Adult. Soft Drinks. Food Consumption. Diet Surveys. Cross-Sectional Studies.

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## INTRODUCTION

Soft drink consumption has become increasingly prevalent in recent decades. Many authors<sup>13,18,21</sup> have associated soft drink overconsumption with increased prevalence of obesity and its consequences. Review<sup>13</sup> and meta-analysis studies<sup>18</sup> have showed that the growth in the consumption of sugar-sweetened beverages is associated with increased energy intake, weight gain, obesity and diabetes. In a systematic review in 2008, Wolff and Dansinger<sup>22</sup> argued that although observational studies support the hypothesis that consumption of soft drinks cause obesity, there are few clinical trials to confirm this hypothesis. While more research studies are needed, the World Health Organization (WHO)<sup>21</sup> emphasizes that there is sufficient evidence to discourage consumption of soft drinks in a healthy diet.

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The WHO recommendation has been a priority of public health policies in many countries. The recommended maximum calorie intake is 10% of total dietary energy intake.<sup>21</sup> Soft drinks have been banned from schools in England and France and their sale has been restricted or prohibited in the United States (Los Angeles, Philadelphia and Miami).<sup>18</sup> The Dietary Guide for the Brazilian Population<sup>a</sup> recommends a reduction of at least one-third the current consumption of these foods as a strategy for healthy eating.

The identification of factors associated with soft drink consumption is a first step to approach high-risk groups. Previous studies<sup>8,17</sup> have pointed out gender, low education and age as major determinants of soft drink consumption. Recent studies<sup>7,18,23</sup> have also showed that dietary quality may be associated with the consumption of soft drinks. Compared to other countries such as the United States,<sup>7,17</sup> and European countries,<sup>19</sup> there are few data in Brazil about soft drink consumption and factors associated. The most recent Family Budget Survey conducted in Brazil<sup>b</sup> showed a significant increase in the consumption of soft drinks (400%) compared to the 1970s. The consumption of soft drinks may be even higher since the Family Budget Survey data included only consumption at home. The Telephone-Based Surveillance of Risk and Protective Factors for Chronic Diseases (Vigitel) 2007<sup>c</sup> showed that the rate of adults reporting regular consumption of soft drinks diet ranged from 21.0% in Aracaju, Northeastern Brazil, to 31.7% in Porto Alegre, Southern Brazil, and 38.4% in Macapá, Northern Brazil. The consumption rate was higher among men and decreased with age and education.

The present study aimed to assess factors associated with non-diet soft drink consumption in adults.

## METHODS

A cross-sectional population-based study was conducted in the city of Pelotas, Southern Brazil. Pelotas is located in the extreme south of the state of Rio Grande do Sul with about 340,000 inhabitants. According to the Instituto Brasileiro de Geografia e Estatística (IBGE – Brazilian Institute of Geography and Statistics), there are 408 urban household census tracts, which are arranged in a “spiral” from downtown to the districts. Of 404 census tracks including households, 40 were randomly selected for inclusion in the study, covering the city’s entire urban area. We generated a random starting point for each track drawn for the selection of

households to be included in the study. The first household was selected and then the next ones were systematically selected by skipping every seven households, up to 15 households were included in each census track. There were selected 600 households for the study. All residents aged 20 and 69 years were sampled, except those with severe physical or mental disabilities that would prevent them from answering the questionnaire.

We performed two estimates for the sample size. The sample size to assess the prevalence of soft drink consumption was estimated at 35.0% for a margin of error of 4.0%, 95% confidence interval, an addition of 10% for losses and refusals and a design effect of 1.5. It was estimated a sample of 901 respondents. For the assessment of the association between soft drink consumption and independent variables, the following parameters were used for estimating the sample size: 95% confidence level, 80% power, exposure prevalence ranging from 10% to 90%, prevalence ratio of 1.7, addition of 10% for non-respondents and 15% for controlling for confounders and a design effect of 1.5. The estimated sample consisted of 990 respondents.

Information on demographic and socioeconomic characteristics and health and nutritional status were collected using a standard questionnaire with 100 questions. The variable skin color was reported by interviewer observation and socioeconomic status was classified according to the Associação Brasileira de Empresas de Pesquisa (Brazilian Association of Research Companies) criteria.<sup>d</sup> The level of physical activity during leisure time was assessed using the long version of the International Physical Activity Questionnaire (IPAQ).<sup>3</sup> A cutoff of 150 minutes per week was set to classify individuals as physically active or inactive.<sup>3</sup> Nutritional status was evaluated using body mass index (BMI), which was calculated based on self-reported weight and height and classified according to WHO criteria.<sup>20</sup>

The outcome, i.e., regular consumption of non-diet soft drinks, was investigated through the following question: “In general, since the <Month> in the past year, how often did you have a non-diet soft drink?.” The answer options were: (a) once or less than once a month; (b) two to three times a month; (c) once or twice a week; (d) three to four times a week; (e) five or more times a week. For the analysis, the outcome was dichotomized and positive respondents were those who reported consuming non-diet soft drinks five or more

<sup>a</sup> Ministério da Saúde, Secretaria de Atenção à Saúde, Coordenação-Geral da Política de Alimentação e Nutrição. Guia alimentar para a população brasileira. Brasília (DF); 2005

<sup>b</sup> Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2002–2003: análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil. Rio de Janeiro; 2004

<sup>c</sup> Ministério da Saúde. Vigitel Brasil 2007. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Brasília (DF); 2008

<sup>d</sup> Associação Brasileira de Empresas de Pesquisa. Critério de classificação econômica Brasil. São Paulo; 2006[cited 2009 Feb 25]. Available from: <http://www.abep.org/codigosguias/CCEB2008-Base2006e2007.pdf>

times a week (regular use). Consumption was evaluated over a 12-month period prior to the interview.

Both male and female interviewers aged 18 years or more with a minimum requirement of complete high school education attended theory and practical sessions of a 20-hour training program. Interviewers were consistently supervised during the fieldwork. The supervisors, who were physical education and physical therapy undergraduate students, reviewed the questionnaires and carried out quality control checks through re-visits to 25% of the sample. Data obtained from questionnaires were double entered using EpiInfo 6.0 and the analysis was conducted using Stata 9.0.

The crude analysis tested the relationship between the outcome and gender, age, skin color/ethnicity, socioeconomic status, smoking, leisure-time physical activity, nutritional status, regular consumption of fruits and vegetables (five or more times a week) and weekly consumption of snack foods (burgers and hot dogs) (once or more a week). The chi-square test was used for testing heterogeneity and linear trend. Multivariate analysis was performed through Poisson regression with robust variance. The sampling effect was taken into consideration in the analysis using Stata svy commands. The level of significance was set at 5%.

The study was approved by the Research Ethics Committee of the Escola Superior de Educação Física da Universidade Federal de Pelotas on 01/17/2008 (protocol No. 005/2008). Data were collected after respondents signed an informed consent form.

## RESULTS

Of 514 households selected, 1,062 adult residents were eligible to participate in the study. Of them, 972 answered the questionnaire (nonresponse rate of 9.3%). The independent variable with most missing values was BMI as 87 respondents did not know their weight and/or height.

The study sample was characterized by: 57% were female; 26.1% aged between 20 and 29 years; 41.5% were categorized in class C; 82% were white; 49.4% have never smoked; 69.8% were sedentary; 51.3% were overweight or obese; 20.9% reported regular consumption of fruits and vegetables; and 36.6% reported snack food consumption on a weekly basis (Table 1).

Regular consumption of non-diet soft drink was 20.4% (95% CI 17.9;22.9). The design effect, considering the census tract as the sampling unit, was 1.6. Additional analyses showed that the design effect using the household as the sampling unit was 1.4 for regular consumption of non-diet soft drinks.

**Table 1.** Description of the sample according to sociodemographic, behavioral, nutritional and health-related variables. Pelotas, Southern Brazil, 2006. (n=972)

Variables	n	%
Gender		
Male	418	43.0
Female	554	57.0
Age (years)		
20 to 29	254	26.1
30 to 39	195	20.1
40 to 49	247	25.4
50 to 59	173	17.8
60 to 69	103	10.6
Socioeconomic status		
Classes A and B	382	40.1
Class C	395	41.5
Classes D and E	175	18.4
Skin color/ethnicity		
White	797	82.0
Non-white	175	18.0
Smoking		
Former smoker	216	22.2
Current smoker	276	28.4
Never smoked	480	49.4
Leisure-time physical inactivity		
Yes	676	69.8
No	292	30.2
Nutritional status		
Obesity	133	15.0
Overweight	321	36.3
Normal weight	431	48.7
Regular consumption of non-diet soft drinks		
Yes	196	20.4
No	765	79.6
Regular consumption of fruits and vegetables		
Yes	200	20.9
No	756	79.1
Weekly consumption of snack foods		
Yes	348	36.3
No	611	63.7

Table 2 shows the frequency of consumption of regular non-diet soft drinks and the prevalence ratios for the independent variables. There were no statistically significant differences in age, socioeconomic status, skin color/ethnicity, leisure-time physical inactivity, nutritional status and regular consumption of fruits and vegetables. In the adjusted analysis, males, current smokers, and those who reported snack food consumption had the highest prevalence of regular consumption of non-diet soft drinks.

**Table 2.** Factors associated with regular consumption of non-diet soft drinks. Pelotas, Southern Brazil, 2006. (n=972)

Variables	Regular consumption of non-diet soft drinks		PR (95%CI)	Adjusted PR (95%CI) <sup>a</sup>	p
	n	%			
Gender					0,001 <sup>b</sup>
Male	113	27.4	1.80 (1.40;2.33)	1.50 (1.20;2.00)	
Female	83	15.2	1	1	
Age (years)					0.10 <sup>c</sup>
20 to 29	69	27.3	2.10 (1.22;3.62)	1.50 (0.80;2.60)	
30 to 39	44	23.2	1.78 (1.01;3.15)	1.50 (0.80;2.60)	
40 to 49	38	15.5	1.19 (0.66;2.14)	1.00 (0.60;1.80)	
50 to 59	32	18.5	1.42 (0.78;2.58)	1.34 (0.70;2.40)	
60 or more	13	13.0	1	1	
Socioeconomic status					0.36 <sup>c</sup>
Classes A and B	78	20.5	1.16 (0.80;1.69)	1.30 (0.90;1.90)	
Class C	82	20.8	1.17 (0.81;1.71)	1.30 (0.90;1.90)	
Classes D and E	31	17.7	1	1	
Skin color/ethnicity					0.55 <sup>b</sup>
White	157	20.0	0.89 (0.65;1.21)	0.90 (0.70;1.30)	
Non-white	39	22.4	1	1	
Smoking					<0.001 <sup>c</sup>
Never smoked	84	17.8	1	1	
Current smoker	79	28.7	1.62 (1.24;2.12)	1.60 (1.20;2.10)	
Former smoker	33	15.5	0.87 (0.60;1.26)	1.00 (0.70;1.05)	
Leisure-time physical inactivity					0.80 <sup>b</sup>
Yes	132	19.7	0.90 (0.69;1.18)	0.97 (0.70;1.30)	
No	63	21.9	1	1	
Nutritional status					0.56 <sup>c</sup>
Obesity	27	20.8	0.94 (0.64;1.37)	1.10 (0.70;1.60)	
Overweight	64	20.0	0.90 (0.68;1.20)	0.90 (0.70;1.20)	
Normal weight	94	22.1	1	1	
Regular consumption of fruits and vegetables					0.09 <sup>b</sup>
Yes	26	13.0	0.59 (0.40;0.86)	0.70 (0.50;1.10)	
No	167	22.1	1	1	
Weekly consumption of snack foods					<0.001 <sup>b</sup>
Yes	113	32.6	2.42 (1.88;3.11)	2.10 (1.60;2.70)	
No	82	13.5	1	1	

<sup>a</sup> All variables were adjusted for

<sup>b</sup> Wald's test for heterogeneity

<sup>c</sup> Wald's test for linear trend

After adjusting for potential confounders, it was found that the variables regular consumption of fruits and vegetables (inverse association) and weekly consumption of snack foods (direct association) among females and smoking and consumption of snack foods (direct association) among males remained associated with regular consumption of non-diet soft drinks (Tables 3 and 4).

## DISCUSSION

The study sample was representative of adults aged 20 to 69 years living in the city of Pelotas in view of the high proportion of respondents and low loss and refusal rate. One of the study limitations is that comparisons with results from other studies should be treated with caution due to different sampling and

**Table 3.** Factors associated with regular consumption of non-diet soft drinks in women. Pelotas, Southern Brazil, 2006. (n=554)

Variables	Regular consumption of non-diet soft drinks		PR (95%CI)	Adjusted PR (95%CI) <sup>a</sup>	P
	n	%			
Age (years)					0,16 <sup>b</sup>
20 to 29	28	20.9	4.04 (1.28;12.77)	3.66 (0.90;14.50)	
30 to 39	22	19.3	3.73 (1.16;11.96)	3.47 (0.90;14.06)	
40 to 49	15	10.3	1.99 (0.60;6.61)	2.21 (0.50;9.10)	
50 to 59	15	15.6	3.02 (0.91;10.00)	4.10 (1.00;16.60)	
60 or more	03	5.2	1	1	
Socioeconomic status					0.40 <sup>b</sup>
Classes A and B	26	12.4	0.79 (0.45;1.41)	1.20 (0.57;2.52)	
Class C	40	17.2	1.10 (0.65;1.87)	1.50 (0.76;3.00)	
Classes D and E	16	15.7	1	1	
Skin color/ethnicity					0.74 <sup>c</sup>
White	63	14.3	0.76 (0.48;1.19)	0.92 (0.55;1.52)	
Non-white	20	18.9	1	1	
Smoking					0.35 <sup>c</sup>
Never smoked	41	13.7	1	1	
Current smoker	28	20.0	1.46 (0.94;2.26)	1.40 (0.89;2.21)	
Former smoker	14	12.8	0.94 (0.53;1.65)	1.09 (0.60;1.97)	
Leisure-time physical inactivity					0.20 <sup>c</sup>
Yes	68	16.4	1.46 (0.86;2.46)	1.40 (0.80;2.60)	
No	15	11.3	1	1	
Nutritional status					0.30 <sup>b</sup>
Obesity	13	17.1	1.25 (0.70;2.25)	1.50 (0.80;2.80)	
Overweight	26	17.0	1.25 (0.78;2.00)	1.29 (0.80;2.00)	
Normal weight	34	13.7	1	1	
Regular consumption of fruits and vegetables					0.03 <sup>c</sup>
Yes	14	9.5	0.56 (0.32;0.96)	0.50 (0.30;0.90)	
No	68	17.1	1	1	
Weekly consumption of snack foods					<0.001 <sup>c</sup>
Yes	43	25.7	2.49 (1.68;3.69)	2.30 (1.05;3.40)	
No	39	10.3	1	1	

<sup>a</sup> All variables were adjusted for

<sup>b</sup> Wald's test for linear trend

<sup>c</sup> Wald's test for heterogeneity

data collection procedures and frequency of use classifications. Reverse causality bias may be present in the association between frequency of non-diet soft drink consumption and nutritional status as obese overweight may modify their consumption because of their nutritional status. In addition, there may be recall error as the period of consumption studied was 12 months prior to the interview.

A fifth (20.4%) of the adults studied in Pelotas regularly consumed non-diet soft drinks. The design effects for both the census track and the household were very close to those obtained in the sample size estimation and controlled for in the statistical analyses.

The rate of non-diet soft drink consumption found in this study is much lower than that reported in the United States. In 2007 Dhingra et al<sup>5</sup> found that 35% of adults in the Framingham Study consumed non-diet soft drinks at least once a day. Our findings are similar to that reported in a Brazilian study on risk factors for noncommunicable diseases (Vigitel).<sup>c</sup>

Corroborating other studies,<sup>10,17</sup> the present study found higher rates of non-diet soft drink consumption among men, and no significant differences were seen regarding age, socioeconomic status and skin color/ethnicity. However, other authors reported differences in age,<sup>10,15</sup> socioeconomic status<sup>4</sup> and color skin/ethnicity.<sup>4</sup>

**Table 4.** Factors associated with regular consumption of non-diet soft drinks in men. Pelotas, Southern Brazil, 2006. (n=418)

Variables	Regular consumption of non-diet soft drinks		PR (95%CI)	Adjusted PR <sup>a</sup> (95%CI)	p-value
	n	%			
Age (years)					0.70 <sup>b</sup>
20 to 29	41	34.5	1.45 (0.80;2.63)	0.90 (0.50;1.80)	
30 to 39	22	29.0	1.22 (0.64;2.32)	1.10 (0.60;2.10)	
40 to 49	23	23.2	0.98 (0.51;1.87)	0.80 (0.40;1.50)	
50 to 59	17	22.1	0.93 (0.47;1.84)	0.80 (0.40;1.70)	
60 or more	10	23.8	1	1	
Socioeconomic status					0.20 <sup>b</sup>
Classes A and B	52	30.4	1.48 (0.89;2.45)	1.60 (0.90;2.80)	
Class C	42	25.9	1.26 (0.75;2.12)	1.40 (0.80;2.40)	
Classes D and E	15	20.6	1	1	
Skin color/ethnicity					0.70 <sup>c</sup>
White	94	27.3	0.98 (0.64;1.48)	1.10 (0.70;1.70)	
Non-white	19	27.9	1	1	
Smoking					<0.001 <sup>c</sup>
Never smoked	43	24.7	1	1	
Current smoker	51	37.8	1.53 (1.09;2.14)	1.90 (1.30;2.70)	
Former smoker	19	18.3	0.74 (0.46;1.20)	1.10 (0.70;1.80)	
Leisure-time physical inactivity					0.14 <sup>c</sup>
Yes	64	25.0	0.81 (0.59;1.11)	0.80 (0.60;1.10)	
No	48	31.0	1	1	
Nutritional status					0.07 <sup>b</sup>
Obesity	14	25.9	0.76 (0.46;1.24)	0.80 (0.50;1.40)	
Overweight	38	22.8	0.67 (0.47;0.94)	0.60 (0.40;0.90)	
Normal weight	60	34.1	1	1	
Regular consumption of fruits and vegetables					0.20 <sup>c</sup>
Yes	12	22.6	0.81 (0.48;1.38)	0.70 (0.40;1.20)	
No	99	27.8	1	1	
Weekly consumption of snack foods					<0.001 <sup>c</sup>
Yes	70	38.9	2.10 (1.51;2.91)	1.80 (1.30;2.60)	
No	43	18.5	1	1	

<sup>a</sup> All variables were adjusted for

<sup>b</sup> Wald's test for linear trend

<sup>c</sup> Wald's test for heterogeneity

Among current smokers the rate of non-diet soft drink consumption was significantly higher, which is consistent with other studies.<sup>5,11,15</sup> This finding confirms the trend that a health risk behavior is associated with a range of other health risk behaviors.<sup>5,11</sup>

We did not find any association between excess weight and non-diet soft drink consumption, which contrast with the results from recent reviews and meta-analyses.<sup>13,18</sup> A recent systematic literature review<sup>13</sup> has pointed a positive association between higher consumption of sugar-sweetened beverages and weight

gain and obesity in children and adults. In a meta-analysis including 88 studies, Vartanian et al<sup>18</sup> found a strong association between soft drink consumption and increased energy intake and body weight. Possibly the cross-sectional design of our study was a limiting factor in the analysis of this association.

One possible explanation for weight gain resulting from overconsumption of sugar-sweetened beverages is different physiological effects of energy intake from solid and liquid foods on satiety. Thus, carbohydrates from liquid foods would promote a higher positive

energy balance. Possibly because liquid foods cause less gastric distension and have faster transit time, the body would not properly “identify” the energy contained in these foods with incomplete compensation for energy consumed in liquid form.<sup>1,6</sup>

Contrasting with previous studies,<sup>11,15</sup> no significant association was seen between regular consumption of non-diet soft drinks and physical inactivity in our study. However, this result should be treated with caution as these studies used different instruments and criteria for classification of physical activity levels.

A significant association was found between weekly consumption of snack foods and regular consumption of non-diet soft drinks. Other authors<sup>2,5,12,16</sup> have argued that in general people who regularly consume soft drinks also eat nutritionally poor diets because these beverages would stimulate their appetite for non-nutritious foods. A study<sup>16</sup> showed that individuals who consume more

soft drinks have diets with a higher glycemic index, confirming the assumption that intake of foods with high glycemic index such as soft drinks would stimulate the intake of other similar foods.<sup>12</sup> Another study have showed that consumption of soft drinks is associated with the consumption of burgers and pizza.<sup>2</sup>

Regular consumption of fruits and vegetables was inversely associated with that of non-diet soft drinks, especially in females. A similar association was reported by Marshall et al<sup>14</sup> in U.S. children, by Figueiredo et al<sup>9</sup> in adults in São Paulo and in young adults in Japan.<sup>23</sup>

In conclusion, the consumption of non-diet soft drinks in adults in Pelotas is high, especially among males, current smokers and those who eat snack foods every week and do not regularly consume fruits and vegetables. People should reduce their consumption of non-diet soft drinks as it is associated with increased energy intake of low nutrition foods and other unhealthy eating habits as well.

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