

# Patterns of Maté Drinking in a Brazilian City<sup>1</sup>

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## ABSTRACT

Maté drinking, a hot infusion of *Ilex paraguayensis* commonly drunk in parts of South America, has been associated with increased risks of upper digestive cancers. In a population-based survey, we have studied the patterns of maté drinking in a sample of 1400 adults living in a southern Brazilian city. Approximately one third of the population drank maté less than once a month or not at all; another third drank maté at least once a month, but less than once a day; while the remaining third drank maté daily. Daily drinking was most common among individuals aged under 60, those who migrated from rural areas, and among cigarette smokers. Drinkers ingested on average about 1800 ml/day at a mean temperature of 69.5°C. Individuals who had never attended school tended to ingest larger quantities. The temperature of the drink was higher for males and for drinkers of alcoholic beverages. This information may contribute to the design of preventive interventions, since a large proportion of upper digestive cancer cases in those regions might be due to maté drinking.

## INTRODUCTION

The drinking of maté (a hot infusion of *Ilex paraguayensis*) is a common habit in parts of southeastern South America where the "gaucho" culture is widespread, including Argentina, Uruguay, southern Brazil, and Paraguay. The gauchos are the cowboys of the pampas, the South American prairies; of mixed Indian and Spanish or Portuguese ancestry, they traditionally work on the cattle ranches.

To prepare the maté infusion, the dried leaves of the *Ilex* tree are minced and placed inside a gourd (the hard shell of a local fruit); hot water is added, and the tea is sucked through a metal cylinder which has a sieve at its lower end to prevent the minced leaves from being ingested.

The areas where maté drinking is prevalent, particularly Uruguay and southern Brazil, present high incidences of esophageal cancer. In Pôrto Alegre, southern Brazil, the age-standardized annual incidence rates for males and females were equal to 26.3 and 7.8/100,000/yr in the period 1979-1982 (1). In Uruguay, mortality rates for males range from 10/100,000 in the capital, Montevideo, to 40/100,000 in the northeast region which borders Brazil (2). Of the 137 populations included in *Cancer Incidence in Five Continents* (1), the rates for Pôrto Alegre males are exceeded only by those of Calvados (France) and for Israeli Jews born in Africa or Asia.

Seven studies have reported on the association between maté drinking and cancer or precancerous lesions of the upper digestive tract (2-8). Two case-control studies from Uruguay found significant higher risks of esophageal cancer among maté drinkers (2, 3); in the more recent study (3) the odds ratios were 6.1 for those ingesting 1.5 to 2.49 liters/day and 12.2 for those drinking 2.5 liters/day or more, after adjustment for confounding variables including alcohol and tobacco consumption. An-

other case-control study from Brazil found a significant association in the crude analysis but, after adjustment for confounding variables, the increased odds ratio for daily maté drinkers (equal to 1.5) was no longer statistically significant (4). In the same Brazilian population, however, daily maté drinkers were more likely to present histologically confirmed esophagitis, a precancerous lesion, than nondrinkers (5). Another Brazilian study found an excess of oral cancer among maté drinkers (6), but this was no longer significant after adjustment for smoking and alcohol consumption. Two other case-control studies from Uruguay reported significant associations between maté drinking and cancer of the oropharynx and of the larynx, even after adjustment for alcohol and tobacco (7, 8). A recent review by a Working Group of the International Agency for Research on Cancer has concluded that "hot maté drinking is probably carcinogenic to humans" (9).

A mechanism for explaining the possible carcinogenic role of maté would be thermal injury, since large amounts are apparently drunk at rather high temperatures. The possible adverse effects of consuming burning-hot tea have been raised by earlier studies (10).

Despite the possible public health impact of this habit, no population-based studies have been carried out to investigate the frequency of maté drinking, nor of other possibly relevant characteristics such as the volume or the temperature of maté usually drunk. We have conducted a population-based survey in the city of Pelotas, in southern Brazil, with the following objectives: (a) to describe the frequency of maté drinking in a population at high risk of esophageal cancer; (b) to describe the characteristics of the habit, including the volume and temperature at which maté is drunk; and (c) to study some demographic, socioeconomic, and life-style factors associated with the presence of the habit and with the volume and drinking temperature.

## MATERIALS AND METHODS

The study was carried out in the urban area of Pelotas (population, 250,000) in southern Brazil, within the high-mortality area for esophageal cancer (annual rate of about 20 deaths per 100,000 inhabitants).

The urban area of Pelotas is made up of 222 census tracts, each including approximately 300 households; 23 of these were randomly selected for inclusion in the study. In each tract, a starting point was randomly chosen, and every fifth house moving in a counterclockwise direction was selected until 35 houses were chosen. In all, interviews were attempted in 805 (23 tracts × 35 houses) houses and were carried out in 719 (89.3%) of these. In 46 (5.7%) households there were refusals and, in the remaining 40 (5.0%), it was impossible to contact the occupants after three attempts on different dates.

In the 719 houses studied, 1388 (98.8%) of 1405 residents aged 20 or more answered a questionnaire including information on age, sex, place of origin (urban or rural), years of schooling, frequency of maté drinking, and smoking in the previous month. The study was carried out during the winter months.

From each of the 247 households with one or more daily maté drinkers, one daily drinker was randomly chosen to answer the detailed questionnaire. This included information on frequency and timing of maté drinking, volume ingested, whether maté was drunk alone or

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shared, herbal teas added to the maté, use of thermos bottles, type of gourd or cup, and use of alcoholic beverages and tobacco.

After answering these questions, the interviewee was asked to prepare the maté and to drink three gourdsful (subjects fill the gourds completely each time they drink). The gourd was filled for a fourth time, and the temperature of the water inside the gourd was assessed. The environmental temperature was also measured on that occasion.

The volume of the empty gourds was measured by filling them with water from a graded beaker. The measurement was repeated after the maté tea was placed in the gourd to estimate the actual volume drunk at each time. This was multiplied by the reported number of gourdsful drunk per day to estimate the daily volume ingested. Many subjects reported the daily intake in terms of kettles or thermos bottles. In these cases, these containers were also measured in order to calculate the total intake.

Statistical analysis was carried out with SPSS/PC+ (11). Differences between means were tested using analysis of variance, and differences between proportions by using the  $\chi^2$  test. For skewed variables such as the monthly frequency of maté drinking, medians were compared using the Mann-Whitney *U* test (for dichotomous explanatory variables) or the Kruskal-Wallis analysis of variance (for explanatory variables with three or more categories).

**RESULTS**

**Frequency of Maté Drinking in the Population.** A total of 1405 persons were interviewed. Seventeen subjects (1.2%) who did not provide information on the frequency of maté drinking were excluded from the data set, leaving 1388 individuals for analysis. Approximately one third of them did not drink maté at all, a further third drank maté less than daily, and the remaining third were daily drinkers (Table 1).

The mean frequency of maté drinking in the whole sample was equal to 19.3 times/month (standard deviation, 25.3), ranging from 0 (nondrinkers) to 150 (a person who drank maté 5 times a day). The distribution of monthly frequencies was very skewed, with the median frequency being equal to 9.0 times (*i.e.*, twice a wk). If nondrinkers are excluded, the mean frequency was equal to 29.5 (standard deviation, 25.9) and the median was 22.5.

Table 2 shows the mean and median monthly frequencies of maté drinking and the proportions of daily drinkers according to sex, age, place of origin, schooling, and smoking status. The frequencies of drinking were similar for both sexes. There was little variation in the proportions of daily drinkers up to 59 years of age, but individuals over 60 years were less likely to drink maté.

Important differences were found according to the place of origin. Individuals who spent most of their lives in rural areas drank maté more often than those raised in urban areas (Table 2). Smokers, particularly those smoking 20 or more cigarettes per day, drank maté more frequently than nonsmokers. Education, on the other hand, was not associated with the frequency of maté drinking.

**Description of the Maté Drinking Habit.** The analyses reported below were restricted to 247 daily maté drinkers (not

Table 2 Mean number of days per month in which maté is drunk and proportion of daily maté drinkers according to age, sex, origin, schooling, and smoking status, Pelotas, Brazil, 1988

	Monthly frequency of maté drinking		Daily maté drinkers (%)	No. of subjects
	Mean	Median		
<b>Sex</b>				
Male	20.5	9.0	29.9	653
Female	18.2	9.0	28.8	735
		<i>P</i> = 0.08 <sup>a</sup>	<i>P</i> = 0.7 <sup>b</sup>	
<b>Age (yr)</b>				
20-29	20.2	13.5	30.5	394
30-39	22.1	13.5	34.3	315
40-49	20.7	11.3	31.1	254
50-59	19.8	9.0	31.7	189
60+	13.1	0.0	18.2	220
		<i>P</i> < 0.001 <sup>c</sup>	<i>P</i> = 0.001 <sup>b</sup>	
<b>Place of origin</b>				
Urban	17.8	9.0	27.5	1105
Rural	26.0	22.5	37.5	275
		<i>P</i> < 0.001 <sup>a</sup>	<i>P</i> = 0.002 <sup>b</sup>	
<b>Schooling (yr)</b>				
None	20.7	13.5	28.9	135
1-4	21.8	13.5	30.9	282
5-8	19.6	9.0	30.8	415
9-11	16.1	9.0	25.8	264
12-18	20.3	9.0	31.8	255
		<i>P</i> = 0.15 <sup>c</sup>	<i>P</i> = 0.56 <sup>b</sup>	
<b>Smoking status (cigarettes/day)</b>				
Nonsmokers	17.6	9.0	26.8	932
1-19	20.9	13.5	29.3	242
20+	25.2	18.0	40.2	214
		<i>P</i> < 0.001 <sup>c</sup>	<i>P</i> = 0.006 <sup>b</sup>	
<b>Total</b>	19.3	9.0	29.3	1388 <sup>d</sup>

<sup>a</sup> Based on the Mann-Whitney *U* test.

<sup>b</sup> Based on the  $\chi^2$  test.

<sup>c</sup> Based on the Kruskal-Wallis analysis of variance.

<sup>d</sup> Information is missing for up to 54 individuals for some variables.

more than one per household) who answered the detailed questionnaire.

Maté drinking is a social habit; two thirds of drinkers usually shared the beverage with other people. It was usually drunk during the morning (44% of drinkers) and just before dinner (43%). It was almost always drunk from a gourd. The mixture in the gourd was continually replenished by hot water, which nine out of ten drinkers kept in a thermos bottle. Herbal teas were usually added to the hot water in the kettle or thermos bottle; over 30 different herbs were cited. The mean volume of water poured into the gourd on each occasion was 57 ml (standard deviation (SD) = 31 ml).

The mean daily consumption among daily maté drinkers was on average 1799 ml (SD = 1244 ml; interquartile range, 850-2418 ml; median, 1608 ml). The mean temperature of the maté consumed was 69.5°C (SD = 6.5°C; interquartile range, 66-75°C; median, 70°C); the temperature in the gourd increased on average 0.34°C for an increase of 1°C in the ambient temperature (*r* = 0.20; *P* < 0.001).

**Characteristics of Maté Drinkers.** Table 3 shows the mean daily volume of maté intake according to a number of characteristics. There was little variation in the volume drunk according to sex, age, smoking status, frequency of alcohol drinking, place of origin, or the use of a thermos bottle. Schooling, however, was significantly associated with the volume ingested, which was highest for the uneducated.

Table 3 also shows the differences in mean drinking temperatures of the maté prepared by the interviewee, according to the

Table 1 Distribution of the study sample according to the frequency of maté drinking, Pelotas, Brazil, 1988

Frequency of maté drinking	No.	%
Nondrinkers (less than monthly)	466	33.6
1-3 times/mo	21	1.5
1-6 times/wk	494	35.6
Daily drinkers	407	29.3
<b>Total</b>	1388	100.0

Table 3 Mean daily volume of maté drunk and mean drinking temperature according to some characteristics (analysis restricted to daily maté drinkers), Pelotas, Brazil, 1988

	Mean daily volume (ml)	Mean temperature (°C)	No. of subjects
Sex			
Male	1841	71.1	123
Female	1788	67.6	108
	<i>P</i> = 0.8	<i>P</i> < 0.001	
Age (yr)			
20-29	1785	68.7	59
30-39	1993	70.1	67
40-49	1896	69.4	50
50-59	1660	70.1	33
60+	1418	69.1	22
	<i>P</i> = 0.4	<i>P</i> = 0.8	
Schooling (yr)			
None	2491	70.0	21
1-4	1970	69.5	45
5-8	1782	69.7	78
9-11	1477	68.7	34
12-18	1723	69.2	50
	<i>P</i> = 0.05	<i>P</i> = 0.9	
Smoking status (cigarettes/day)			
Nonsmokers	1806	68.8	125
1-19	1949	70.0	51
20+	1714	70.4	55
	<i>P</i> = 0.6	<i>P</i> = 0.3	
Alcohol drinking (times/mo)			
Nondrinkers	1765	68.7	115
1-8	1909	68.3	49
9-29	1599	71.0	40
30+	1969	71.9	39
	<i>P</i> = 0.5	<i>P</i> = 0.01	
Place of origin			
Urban	1755	69.2	174
Rural	2008	70.4	55
	<i>P</i> = 0.19	<i>P</i> = 0.20	
Use of thermos bottle			
Yes	1755	69.5	211
No	2108	69.2	30
	<i>P</i> = 0.15	<i>P</i> = 0.8	
Total	1799	69.5	247 <sup>a</sup>

<sup>a</sup> Information on volume was missing for 6 (2.4%) and on temperature for 4 (1.6%) subjects. Data on some of the explanatory variables were missing for up to 19 (7.7%) subjects.

above characteristics. Males drank maté at higher temperatures than females. There was also a positive association between temperature and frequency of alcohol drinking. On the other hand, temperature did not vary significantly according to age, schooling, smoking status, place of origin, or the use of a thermos bottle. The lack of an association between temperature and the use of thermos bottles should be interpreted with caution, since temperatures were assessed shortly after the water was heated; otherwise, the use of thermos bottles might have been associated with greater temperatures, since water kept in other containers such as kettles cools more rapidly.

## DISCUSSION

To our knowledge, the present study is the first population-based survey of the frequency and characteristics of maté drinking. It provides information on a representative sample of individuals aged 20 years or more from a Brazilian city in an area of high incidence of esophageal cancer, for which maté is considered as a possible risk factor (2-8). The survey had a satisfactory response rate, reaching approximately 90% of the target sample.

The detailed analysis of the maté habit was restricted to daily drinkers, as studies of digestive cancers have found that the increased risk is limited to this subgroup. It is not possible, therefore, to extrapolate the present results to nondaily drinkers. In addition, the fact that the study was carried out during the winter months may have affected the results; although no data are available, hot maté drinking seems to be more prevalent during the cold months.

Maté drinking was very widespread in the population under study, of whom one third were daily drinkers. Daily drinkers ingested an average of about 1800 ml per day, at a mean temperature of 69.5°C. The high prevalence and the large volumes ingested are striking. Also, the fact that women use maté as often as men but drink it colder may help explain the gender differences in esophageal cancer incidence (2-4).

Such a common habit, even if associated with a small increase in the risk of cancer, may represent a large public health problem. The earlier Brazilian case-control study on esophageal cancer (4) showed that maté drinking might account for 24% (90% confidence interval, 0 to 43%) of the cases arising in that part of the country. The corresponding etiological fraction, calculated from data from the recent Uruguayan study (3), would be 77% (95% confidence interval, 47 to 90%), due to the elevated prevalence of consumption and to the much higher odds ratios found in that study. It is not clear why the results of the Uruguayan and Brazilian studies were so discrepant; it should also be noted that the above etiological fractions, although impressive, have wide confidence intervals. Nevertheless, the probable carcinogenic effect (9) of hot maté drinking may account for a substantial proportion of the cases of esophageal cancer in this high-incidence area of South America.

If educational campaigns on the likely hazards of maté drinking are planned, the information above may be used for targeting educational messages at high-risk groups. These might include smokers and individuals born in rural areas, who tend to consume maté more frequently. Other possible target groups are males and regular alcohol drinkers who tend to ingest maté at higher temperatures and individuals of low socioeconomic status who ingest greater volumes. The possibility of incorporating warnings about the possible dangers of hot maté drinking into antismoking and antialcohol campaigns should be considered.

The health impacts of the widespread use of thermos bottles for keeping the water hot, and of adding herbal teas to the hot water, are unclear at present but may warrant further investigations.

Finally, the finding that both smoking and alcohol drinking are associated with characteristics of maté drinking is of relevance for future research. Since both habits are risk factors for a number of cancers, studies which fail to take them into account as confounding variables may produce biased results.

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