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**ORIGINAL ARTICLE**

# The prevalence of and variables associated with smoking in children and adolescents

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## Abstract

**Objective:** To identify the prevalence of smoking and the presence of variables associated with the habit in children and adolescents of both sexes, aged 7 to 17 years, resident in the city of Maceió.

**Methods:** A cross-sectional epidemiological study of the student population of the both private and public education systems at elementary and high school level. Sample size was calculated based on the minimum predicted prevalence of a large number of variables, including smoking itself. Cluster sampling was employed. A questionnaire on smoking habits was completed during individual interviews with each student. Children who admitted having smoked on 1 or more day during the previous 30 were defined as current smokers. The variables analyzed were related to: the students (age, sex, previous experimentation with cigarettes and paid employment), their educational status (public/private school, daytime/evening lessons, grade and repeated years) and their families (economic status, smoking parents and separated parents).

**Results:** A total of 1,253 students were analyzed (547 were male, mean age was 12.4±2.9 years). Observed smoking prevalence was 2.4%. Multivariate statistical analysis demonstrated significant associations between smoking and: increased age (odds ratio: 1.31); previous experimentation with cigarettes (odds ratio: 33.96); studying during the evening (odds ratio: 5.43). It was observed that 286 students (22.8%) admitted having experimented with cigarettes (9% from 7 to 9 years; 21% from 10 to 14 years; 36% from 15 to 17 years).

**Conclusions:** The prevalence of smoking among children and adolescents in the Maceió educational system is 2.4%, being most common among students aged 15 to 17 years, studying in the evening. Students who had experimented with cigarettes exhibited a 34 times greater chance of becoming smokers.

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## Introduction

Smoking is considered the most important public health problem and the principal cause of avoidable deaths in our times,<sup>1,2</sup> while actions to prevent and control

it are priorities for both the World Health Organization (WHO)<sup>3</sup> and the Health Ministry in Brazil.<sup>4</sup>

The majority of smokers acquire the smoking habit and become dependent on nicotine in adolescence,<sup>1-7</sup> beginning with experimentation with cigarettes,<sup>1,5-7</sup> which is one of the strongest predictive factors of addiction to tobacco in adulthood.<sup>1,5-7</sup> In countless studies of young people, smoking prevalence has been shown to increase with age.<sup>8-21</sup> The following variables have also been mentioned as favoring smoking early among children and adolescents: parents, siblings, teachers or close schoolmates with a smoking habit,<sup>8-20</sup> male sex,<sup>11-17</sup> studying out of phase (repeated years, studying in the evenings),<sup>11,13,14,16,18,19,21</sup> separated parents<sup>14,19</sup> and paid employment.<sup>11,19</sup>

As a result of the increase in the price of cigarettes, of the implementation of educational programs in schools

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and of the increased exposure of adolescents to government prevention campaigns, there is evidence that the consumption of cigarettes is in decline among young people in the USA.<sup>5,22-24</sup>

There are not, however, any population data on the evolution of consumption among young people in Brazil. In order that such analyses be possible, prevalence studies carried out over time are essential, which is the objective of the Survey on Smoking Among Schoolchildren (VIGESCOLA),<sup>25</sup> which aims to monitor the magnitude of the smoking problem among Brazilian adolescents aged 13 to 15 years, by means of periodic epidemiological surveys undertaken in public and private schools.

The objective of this study was to identify the prevalence of smoking and the variables associated with the habit among children and adolescents aged 7 to 17 years, of both sexes, enrolled at both private and public schools in Maceió.

## Methods

During the 2001 academic year, a descriptive cross-sectional epidemiological study was undertaken in Maceió with the intention of identifying the prevalence of cardiovascular risk factors (risk of overweight, overweight, obesity, smoking, systemic arterial hypertension and inactivity) in a representative sample of children (7 to 9 years) and adolescents (10 to 17 years) of both sexes enrolled at elementary and high schools in the public (municipal, state and federal) and private education systems in the city of Maceió.

The sample size was calculated using the formula recommended by Thompson,<sup>26</sup> which takes into account the estimated prevalence of the event to be studied, the size of the population and the confidence level and degree of precision required from the estimated prevalence. In this case the total population was 185,702 registered students,<sup>27</sup> the lowest predicted prevalence of any of the variables under investigation (7% for arterial hypertension), a 95% confidence level and 2% precision. The final sample estimate was for 624 students, but we opted to double the number to increase precision.

The sample was compiled by treating each school as a separate cluster. The decision was taken to choose, by lots, 40 of the 396 schools registered with the Alagoas State Education Department, with the aim of obtaining greater precision in the prevalence estimates that would be produced. Since the number of students at each school differed, 2.7% of the students at each school were chosen by lots, in order to obtain a final sample that was representative of the size of each school.

The schools were chosen as follows: all of the school (396 in all) were listed sequentially, with their respective numbers of students. Next to the column containing

student numbers, a second column was added containing the cumulative total number of students. The total number of students was then divided by 40 (in order to arrive at 40 schools), producing a sampling interval of 4,642.55. A random-number table was then used to choose a number between 1 and the sampling interval. The chosen number, 531, was within the roll of the school 1, which had 767 students, and so that school was selected. The sampling interval was then repeatedly added and the corresponding school chosen until 40 schools had been chosen. The final sample contained one federal school, 20 state schools, eight municipal ones and 11 private schools from the total of 1 federal, 124 state, 69 municipal and 202 private schools on the register.

Within each school, students were chosen by calculating the cluster sampling interval (the total number of students divided by the number of students to be chosen), then choosing a number between 1 and the sampling interval (thus selecting the first student). The sampling interval was then repeatedly added, identifying the chosen students who would represent that school. The students were chosen from a list of students broken down by class, which had been put in order and numbered from the first (first student of the first class) to the last (last of the last class), thus identifying each student.

The principals of the chosen schools were invited to a meeting with the research team where a presentation was made on the importance, objectives and methodology of the project.

The chosen students and their parents were informed about the project and invited to participate after signing consent (given by parents of students up to 16 years, or by the adolescents themselves when over 16). When participation was refused or when students over 17 years old were chosen, another student from the same school was selected.

Some of the results from this study have already been published.<sup>28,29</sup>

Part of the study protocol was a structured questionnaire including questions on smoking by the students and their parents. The questionnaire was applied during an individual interview in isolation with each student, who was informed that the research team had promised to maintain secret the answers given.

Students who admitted having smoked on 1 day or more during the previous 30 days were defined as current smokers, according to criteria adopted by the Centers for Disease Prevention and Control (CDC), the WHO and the National Cancer Institute/Health Ministry in Brazil.<sup>25</sup> Consumption of cigarettes (even one or two puffs) that did not fulfill the criteria for current smokers was defined as previous experimentation.<sup>25</sup>

Data were tabulated on a Microsoft Excel spreadsheet. Statistical analysis was performed using the statistical

package SPSS (version 11.0) for Windows. Associations between variables were measured using the chi-square test and, when Cochran's restrictions were met, Fisher's exact test was applied. Logistic regression analysis<sup>30</sup> was employed to estimate odds ratios (OR). The level for rejection of the null hypothesis was set at 0.05 or 5%, and significant values are marked with asterisks.

The dependent variable being tested was smoking. Independent variables were related to: the students (age, sex, previous experimentation with cigarettes and paid employment), their educational status (public/private school, daytime/evening lessons, grade and repeated years) and their families (economic status according to the Brazilian Economic Classification Questionnaire,<sup>31</sup> smoking parents and separated parents).

The research project was approved by the Ethics Committee at the Hospital Universitário, Universidade Federal de Alagoas.

## Results

Of the total number of 1,253 students in the sample (five more than predicted, due to the larger numbers of students enrolled at some schools), 706 (56.3%) were female and 547 (43.7%) were male, and the mean age was 12.4±2.9 years.

There were 267 (21.3%) students from private schools and 986 (78.7%) from public schools, with these last distributed across state schools (741), municipal schools (193) and federal schools (52). The economic classification put 70 students in class A (5.6%), 155 in B (12.3%), 341 in C (27.1%), 567 in D (45.2%) and 120 in class E (9.8%).

Just 30 students admitted to the habit of smoking cigarettes, determining a smoking prevalence rate of 2.4% among individuals in the age group from 7 to 17 years in the city of Maceió.

Table 1 lists the distribution of students, smokers and non-smokers, according to the independent variables under analysis. The statistical analysis demonstrated a significant association between smoking and the adolescent age group, previous experimentation with cigarettes, studying during the evening and having repeated school years.

The inferential results of the analysis of the relationship between the smoking habit and the remaining variables, performed by means of adjustment of the logistic model (Kleinbaum),<sup>30</sup> revealed that the habit was not associated with: sex ( $p = 0.837$ ); type of school ( $p = 0.425$ ); student employment ( $p = 0.684$ ); elemental or high school level ( $p = 0.120$ ); having repeated years ( $p = 0.479$ ); economic status ( $p = 0.175$ ); smoking father ( $p = 0.982$ ); smoking mother ( $p = 0.633$ ) or whether parents live together or are separated ( $p = 0.538$ ).

Table 2 lists variables that had a statistically significant association with smoking.

Interpretation of the results revealed that students who had previously experimented with cigarettes were 33.96 times more likely to be smokers than students who had never experimented. Students studying in the evening were 5.43 times more likely to be smokers. This chance increased by 1.31 for every year of age.

**Table 1** - Distribution of students, smokers and non-smokers, according to study variables

	Smokers n = 30	Non-smokers n = 1,223
Sex		
Male	16	531
Female	14	692
Age group (years)		
7-9	2	247
10-14	5	653
15-17	23*	323
Previous experimentation with cigarettes		
Yes	28*	258
No	2	965
Paid employment		
Yes	3	65
No	27	1,158
School		
Public	23	963
Private	7	260
Level		
Elementary	23	1,018
High school	7	205
Studies during		
Daytime	25	1,212
Evening	5*	11
Repeated years		
Yes	20*	522
No	10	701
Economic classification		
A	1	69
B	8	147
C	8	333
D	10	557
E	3	117
Mother smokes		
Yes	6	252
No	24	971
Father smokes		
Yes	10	339
No	20	884
Parents separated		
Yes	12	456
No	18	767

Chi-square/Fisher's test.

\*  $p < 0.01$ .

**Table 2** - Logistic regression (dependent variable: smoking)

Variables	Coefficient	Standard coefficient error	Exp (coefficient)	Descriptive level (p)
Day/evening	0.1692	0.645	5.432	0.009
Age	0.269	0.100	1.308	0.007
Previous experimentation	3.525	0.743	33.957	< 0.001
Constant	-9.747	1.575	-	< 0.001

## Discussion

In Brazil smoking is directly related with 30% of myocardial infarctions, 25% of cerebral vascular accidents, 85% of deaths from chronic obstructive lung disease and 90 to 95% of deaths from lung cancer, and is the causative factor responsible for 30% of total mortality.<sup>1,4,32</sup>

In children and adolescents, immediate damage caused by tobacco is linked to increased number s of crises of asthma, bronchitis and allergic rhinitis, sinusitis, otitis and bacterial pneumonia.<sup>1,4</sup> Furthermore, since 90% of smokers have acquired the habit by 19 years of age, and the mean age at which they start is 15 years, smoking is considered a pediatric disease, requiring diagnosis, treatment and prevention.<sup>1-4</sup>

This study has made it possible to establish that the prevalence of smoking in the school population of children and adolescents in Maceió is 2.4% and that this prevalence increases with age, with studying in the evening and with a history of repeated academic years, as well as with previous experimentation with cigarettes.

The results of smoking prevalence studies of young people that have been undertaken during recent decades have demonstrated major variations, primarily resulting from the age groups being studied and the definition of smokers adopted, which makes comparison of their results problematic.<sup>5,7,10-22,25,32,33</sup>

In 2003, Malcon et al.<sup>19</sup> performed a systematic review of the literature available on smoking among adolescents in South America, concluding that in Brazil (1966-2002) prevalence varied from 3 to 15.8% and in the rest of South America (1982-2002) the variation was from 10.6 to 58.3%.

Barbosa et al.<sup>11</sup> studied adolescents in 10 Brazilian state capitals during 1980, finding a prevalence of 20%. When the studies undertaken during the 1990s in Brazilian cities were analyzed, prevalence varied from 3.2 to 12.1%.<sup>12-15,18,21</sup>

In 2001, Carlini et al.<sup>7</sup> found a prevalence of 2.2% among young people aged 12 to 17 years in the 107 largest cities in Brazil.

The VIGESCOLA study<sup>25</sup> was carried out during the second six months of 2002 and 2003 in 12 Brazilian state capitals (not including Maceió) and involved a population of 19,448 students from 13 to 15 years from private and public education systems, identifying a prevalence of 16% (varying from 9 to 27%).

The prevalence found in this study, lower than that observed in the majority of Brazilian towns that have been studied in isolation, may be in part explained by the fact that we included children aged 7 to 9 years, an age group that is absent in the studies mentioned and in which smoking prevalence is lower than the others. Nevertheless, it is close to the result reported by Carlini et al.<sup>7</sup> and does appear to represent the local situation.

Our results demonstrated a predominance of smokers aged 15 to 17 years (77%), which is similar to what was observed by other studies.<sup>8-21</sup> This fact is probably also the reason for the significant association with smoking and studying in the evening<sup>11,13</sup> and having repeated academic years,<sup>16,19</sup> both characteristics observed in older students.

With relation to previous experimentation with cigarettes, our study identified a prevalence of 22.8% of young people in Maceió who had tried smoking. Older Brazilian studies reported prevalence rates of 14.6 to 31.6%.<sup>12,15,16,18,21</sup>

In the study carried out by Carlini et al.<sup>7</sup> this factor was present in 15.7% of those interviewed, corresponding to an estimated number for the whole of Brazil of 1,177,000 young people. The VIGESCOLA project<sup>25</sup> identified a prevalence of experimentation between 13 and 15 years of 44%.

In the knowledge that 90% of adult smokers become dependent on nicotine by the age of 19<sup>34</sup> and that 50% of those who experiment when young will be smokers during

adulthood,<sup>35</sup> it is clear that any experimentation is undesirable. In our study, this group accounts for around 42,340 young people, 21,170 (50%) of whom could become dependent on nicotine.

Taken together these data demonstrate that, despite the implementation in Brazil of countless educational legislative and economic initiatives, on a national scale and by State and City Health Departments,<sup>4</sup> our youth remains very vulnerable to experimentation with cigarettes and to the damage caused by a smoking habit.

In this study multivariate analysis did not identify an association between smoking and some of the variables that have been identified by previous research, such as male sex,<sup>11-17</sup> paid employment,<sup>11,19</sup> higher economic status,<sup>13,21</sup> smoking parents<sup>13,21</sup> or separated parents.<sup>14,19</sup> The divergent results probably demonstrate that different communities of young people respond to different stimuli with relation to cigarettes.

According to previous investigations, starting to smoke among the young is influenced by tobacco industry advertising and publicity,<sup>2-4,25</sup> by peer-group pressure<sup>2,8,25</sup> and by the attitudes encouraged by their role models (in the family and at school).<sup>2,8,9,25</sup> Furthermore, depressive adolescents or those with low self-esteem exhibit an increased tendency to maintain the habit.<sup>25,36,37</sup> There are even reports that children will be more likely to consider smoking when they are older if one or both parents smoke.<sup>2,38</sup> For adolescents, however, the fact that peers are smokers appears to be the most important factor in starting smoking.<sup>2</sup>

Including in future studies variables that were not investigated in this one study will probably aid improved understanding of the situations and behavior that encourage young people to experiment and, later on, to maintain the smoking. The intention is to ensure that strategies aimed at impeding people from starting to smoke, which is the major objective of studies like ours, achieve their aims entirely.

The data presented here demonstrate that the low smoking prevalence identified among children and adolescents in Maceió, in truth still represents an undesirable number of candidates for cardiovascular or respiratory disease in very young age groups, tending to perpetuate into the future the very disease profile that we are attempting to modify today.<sup>2-4,35</sup> Furthermore, the identification of such a large number of young people who have already tried smoking cigarettes and who could become dependent on the habit reinforces the need for the State and Municipal Health and Education Departments implement the programs that have already been laid out by the Health Ministry of Brazil<sup>4</sup> with even greater investments. This is crucial when one is aware that a smoker who decides seriously to quit the habit has less

than 10% chance of being a non-smoker one year later if they do not receive professional help.<sup>3</sup>

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