



ORIGINAL ARTICLE

## Oral health and hygiene status in Galician schoolchildren<sup>☆</sup>



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### KEYWORDS

Oral health;  
Dental caries;  
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Amount of  
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### Abstract

**Objective:** The aim of this study is to determine the oral health and hygiene status in 12-year-old Galician schoolchildren.

**Method:** A cross-sectional study was conducted on a sample of 1267 schoolchildren. The field-work was carried out in the 2010–2011 academic year. Information regarding socio-demographic status, dietary habits, and oral hygiene practices was obtained through a structured self-report questionnaire given to the children at school. Dental examination to evaluate plaque and caries was carried out according to World Health Organization criteria. The prevalence and mean with 95% confidence intervals were calculated and logistic regression models were adjusted.

**Results:** Out of a total of 1045 pupils who participated in the study, 35% showed incorrect removal of dental plaque, and the prevalence of caries was 39.3%. Those who belonged to a lower socioeconomic group showed a higher prevalence of caries. Those who brushed their teeth daily had better oral hygiene.

**Conclusions:** Educational programmes need to be designed and implemented in order to improve dental health and hygiene.

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**PALABRAS CLAVE**

Salud oral;  
Caries dental;  
Escolares;  
Cantidad de  
dentífrico;  
Cepillado dental

**Salud e higiene oral en los adolescentes gallegos****Resumen**

**Objetivo:** Conocer el estado de salud e higiene oral entre los escolares gallegos de 12 años.

**Método:** Estudio transversal realizado en el curso 2010-2011 en una muestra de 1.267 escolares. La información sociodemográfica, sobre dieta y hábitos de higiene oral de los participantes se recogió con cuestionarios autocumplimentados. A los participantes se les realizó una exploración de la cavidad oral, de acuerdo con los criterios de la Organización Mundial de la Salud, para valorar la presencia de placa y de caries. Se estimaron medias y prevalencias acompañadas de intervalos de confianza del 95% y se ajustaron modelos de regresión logística.

**Resultados:** Participaron en el estudio 1.045 escolares; en el 35% la eliminación de la placa era incorrecta y el 39,3% tenían caries. La presencia de caries fue mayor entre los escolares de clases sociales más desfavorecidas y la frecuencia diaria de cepillado se asoció con una mejor salud oral.

**Conclusiones:** Es necesario diseñar e implantar programas educativos orientados a los escolares con el objetivo de mejorar su higiene y salud oral.

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**Introduction**

Teeth brushing is the correct hygiene practice to eliminate bacterial plaque and achieve good oral health. There are several factors that influence teeth brushing and its results, such as oral hygiene education, how often the teeth are brushed and how long for, and the amount of toothpaste used.<sup>1</sup>

The dentist, as a health care practitioner, has an essential role as health educator. This is particularly important for children and adolescents, since proper oral hygiene instructions help establish good hygiene practices. Repeating these instructions at every visit to the dentist will ensure they become lifelong habits. As part of this education, the dentist must emphasise the importance of brushing teeth after meals, devoting the right amount of time to allow for proper plaque removal.

The ideal brushing technique is that which enables complete removal of the plaque in the least amount of time and without harming the tissues, though willingness and thoroughness is more important than any specific cleaning technique.<sup>1,2</sup>

At the population level, a pea-sized dose of toothpaste is recommended for brushing (<1 g). For children under the age of 3 years, the recommended amount is lower due to the risk of accidental ingestion, since swallowing reflexes are not completely developed. Excessive use of toothpaste, aside from being wasteful, increases the risk of fluorosis at an early age and reduces mechanical removal of bacterial plaque.<sup>3,4</sup>

To establish good habits, oral hygiene should start as soon as the child's first tooth emerges, since the age at which caries start to appear depends on the time children start brushing their teeth; the older they start, the higher the risk of caries.<sup>2,5</sup>

The practice of oral hygiene must be reinforced during adolescence, a period in which there is a significant change

in habits, which leads to an increase in the prevalence of caries associated with less frequent brushing.<sup>6,7</sup>

Behavioural surveys are regularly performed on the oral health and hygiene habits of a particular population, their awareness of oral hygiene issues and how habits develop over time.<sup>8-11</sup> This information enables health care authorities to design and assess oral health programmes, particularly those aimed at key population groups such as adolescents.

The purpose of this study is to ascertain the status of oral health and hygiene and their potential correlation, among 12-year-old Galician schoolchildren.

**Materials and methods****Study design**

During the 2010-2011 academic year, a cross-sectional study among 12-year-old schoolchildren was performed in Galicia. A two-stage sampling design was used: during the first stage, obligatory secondary education (OSE) centres were randomly selected. They were stratified by province and town size (rural: <20,000 inhabitants and urban: ≥20,000). Following this, a first-year OSE classroom was selected at each centre and every student born in 1998 was included.

Five work groups comprising a dentist and a dental hygienist, previously trained, visited the centres to perform an oral examination and an interview. To avoid observer bias, observations were calibrated by comparing the level of agreement between each dentist and an external observer in respect of findings in 64 children. The information required to evaluate health and oral hygiene was included in an examination report. The dental examination was performed following the recommendations of the World Health Organization.<sup>12</sup> Dental occlusion, plaque (Silness-Löe index: visible plaque and probe assessment), periodontal status,

status of each tooth and the need for treatment were evaluated. Socio-demographic data and hygiene habits were collected using self-administered questionnaires to be filled out by the schoolchildren themselves in their classroom on the day they underwent their dental examination. The families were informed about the study and were asked to sign an informed consent form.

### Study variables

The oral health indicators “prevalence of plaque” and “prevalence of caries” were treated as dependent variables in the statistical analysis.

The existence of plaque, assessed with the Silness-Löe index, was defined as: 0=no plaque, 1=supragingival plaque, 2=plaque on one third of the gingival border, and 3=plaque on more than one third of the gingival border. For the purpose of analysis, these were transformed into dichotomous variables: schoolchildren who eliminated plaque correctly (categories 0 and 1) and incorrectly (categories 2 and 3). The existence of caries was treated as a dichotomous variable (yes/no). Within the “yes” category, schoolchildren with caries or with a history of caries were included.

In addition, the DMF (decayed, missing, filled) index was estimated, which is the average of permanent teeth with caries (D), absent due to caries (M) and filled (F), for the total study population. The DMF-df index was also analysed, which includes primary dentition. In addition to the DMF index, decayed (d) and filled (f) primary teeth were added to the numerator. The Significant Caries Index (SiC index) was also calculated, which determines the average number of decayed, missing or filled teeth in the third of the sample with higher DMF-df values.

Oral hygiene habits were assessed based on different variables: age at which the child began brushing (prior to the age of 4 years, between the ages of 4–6 years, after the age of 6 years); brushing frequency (sufficient brushing, that is, one or more times a day, and insufficient brushing, less than once a day) having received instructions on teeth brushing by a dentist (yes/no), and amount of toothpaste used during brushing (1/3 of the brush, 2/3 of the brush, the whole brush).

The sociodemographic variables analysed were: gender, place of residence (urban vs rural) and social class (upper, middle or lower).<sup>13</sup>

### Analysis

Mean and percentage values were calculated according to the design of the sample; these are accompanied by the 95% confidence interval (95% CI).

Logistic regression models were used to determine which factors are associated with the presence of plaque and caries (dichotomous variables). The model was adjusted for potential confounding factors, which were identified among the variables shown by the bivariate analysis to be related with the outcome indicator and distributed differently in each study group. Odds ratio with CI is shown. The statistical analysis was performed using SPSS V.20 and the CI was calculated with Epidat 4.0 software.

## Results

One thousand and forty-five 12-year-old schoolchildren participated in the study, of whom 47.9% were boys, 54.4% lived in an urban setting and 44.7% were classified as belonging to the lower social class. The participation rate in the study was 82.5%. Inter-observer agreement showed high reproducibility and an intraclass correlation coefficient of 0.839 (95% CI 0.749–0.899).

In total, 65.3% (95% IC 61.1–69.5) of students eliminated plaque correctly and caries prevalence was 39.3% (35.5–43.1).

Less than half [47.6% (41.5–53.7)] of all students began their oral hygiene before the age of 4 years; 88.0% (85.1–91.0) stated they brushed their teeth once or more times a day; 62.7% (58.6–66.9) had received instructions on brushing from their dentist, and 51.7% (47.1–56.3) stated they used toothpaste along the entire head of the brush (Table 1).

The DMF index score was 0.7 (0.6–0.8), the DMF-df index score was 0.9 (0.7–1.0) and the SiC score was 2.5 (2.2–2.6).

The variables associated with a risk of eliminating plaque incorrectly are shown in Table 2. Girls had 50% less risk of eliminating plaque incorrectly than boys. Insufficient

**Table 1** Description of the population of 12-year-old students.

	<i>n</i>	%	95% CI
<i>Setting</i>			
Urban	605	54.4	46.6–62.2
Rural	440	45.6	37.8–53.4
<i>Social class</i>			
Upper	144	14.2	11.7–16.7
Middle	431	41.1	37.7–44.5
Lower	467	44.7	40.2–49.2
<i>Age at which the child began tooth brushing</i>			
Prior to the age of 4 years	484	47.6	41.5–53.7
Between the ages of 4 and 6 years	501	48.1	42.3–53.9
After the age of 6 years	43	4.3	2.5–6
<i>Brushing frequency</i>			
Sufficient	924	88.0	85.1–91
Insufficient	117	12.0	9–15
<i>Instructions on oral hygiene</i>			
No	385	37.3	33.2–41.4
Yes	648	62.7	58.6–66.9
<i>Amount of toothpaste</i>			
One third of the brush	134	12.6	9.9–15.3
Two thirds of the brush	363	35.7	31.7–39.6
The whole brush	546	51.7	47.1–56.3
<i>Incorrect elimination of plaque</i>			
No	697	65.3	61.1–69.5
Yes	347	34.7	30.5–38.9
<i>Caries</i>			
No	636	60.7	57–64.5
Yes	409	39.3	35.5–43.1

**Table 2** Factors associated with incorrect elimination of plaque.

	<i>n</i>	%	OR	95% CI
<b>Bivariate models</b>				
<i>Gender</i>				
Male	500	42.0	1	
Female	544	27.0	0.51	0.4–0.64
<i>Setting</i>				
Urban	605	35.9	1	
Rural	439	33.3	0.89	0.6–1.32
<i>Social class</i>				
Upper	144	33.7	1	
Middle	430	29.6	0.83	0.53–1.29
Lower	467	40.1	1.32	0.84–2.07
<i>Age at which the child began tooth brushing</i>				
Prior to the age of 4 years	483	32.2	1	
Between the ages of 4 and 6 years	501	35.1	1.14	0.86–1.52
After the age of 6 years	43	48.0	1.95	0.9–4.2
<i>Brushing frequency</i>				
Sufficient	923	32.5	1	
Insufficient	117	50.2	2.10	1.35–3.26
<i>Instructions on oral hygiene</i>				
No	384	32.5	1	
Yes	648	35.9	1.17	0.87–1.57
<i>Amount of toothpaste</i>				
One third of the brush	134	32.6	1	
Two thirds of the brush	362	35.4	1.14	0.75–1.73
The whole brush	546	34.9	1.11	0.8–1.53
<b>Multivariate model</b>				
<i>Gender</i>				
Male	500	42.0	1	
Female	544	27.0	0.53	0.42–0.67
<i>Brushing frequency</i>				
Sufficient	923	32.5	1.00	
Insufficient	117	50.2	1.91	1.22–3

95% CI: 95% confidence interval; *n*, %: frequency and percentage of incorrect elimination of plaque in each group; OR: odds ratio.

brushing frequency doubled the risk of eliminating plaque incorrectly.

Table 3 shows the variables associated with an increase in risk for caries. The risk was higher in students from the lower social class, students with insufficient brushing frequency and among those who used toothpaste on the entire head of the brush.

### Discussion

Insufficient brushing frequency, that is, less than once a day, is associated with both an increased risk for caries and

**Table 3** Factors associated with caries prevalence.

	<i>n</i>	%	OR	95% CI
<b>Bivariate models</b>				
<i>Gender</i>				
Male	501	41.2	1	
Female	544	37.2	0.85	0.68–1.04
<i>Setting</i>				
Urban	605	36.52	1	
Rural	440	42.53	1.29	0.94–1.75
<i>Social class</i>				
Upper	144	33.79	1	
Middle	431	37.59	1.18	0.83–1.68
Lower	467	42.66	1.46	1.04–2.06
<i>Age at which the child began tooth brushing</i>				
Prior to the age of 4 years	484	37.56	1	
Between the ages of 4 and 6 years	501	39.25	1.08	0.78–1.48
After the age of 6 years	43	53.81	1.94	0.92–4.07
<i>Brushing frequency</i>				
Sufficient	924	37.51	1	
Insufficient	117	54.34	1.98	1.31–3
<i>Instructions on oral hygiene</i>				
No	385	36.21	1	
Yes	648	41.75	1.26	0.94–1.69
<i>Amount of toothpaste</i>				
One third of the brush	134	32.42	1	
Two thirds of the brush	363	39.23	1.35	0.92–1.98
The whole brush	546	40.88	1.44	1.01–2.05
<b>Multivariate model</b>				
<i>Social class</i>				
Upper	144	33.79	1	
Middle	431	37.59	1.18	0.82–1.69
Lower	467	42.66	1.43	1–2.04
<i>Brushing frequency</i>				
Sufficient	924	37.51	1.00	
Insufficient	117	54.34	1.90	1.22–2.96
<i>Amount of toothpaste</i>				
A third of the brush	134	32.42	1.00	
Two thirds of the brush	363	39.23	1.45	0.96–2.19
The whole brush	546	40.88	1.44	1.01–2.05

95% CI: 95% confidence interval; *n*, %: frequency and percentage of caries in each group; OR: odds ratio.

incorrect elimination of plaque, and the use of an excessive amount of toothpaste (>1 g) is associated with an increased risk for caries among Galician 12-year-old schoolchildren.

Only 12.6% of the students used the correct amount of toothpaste (1/3 of the head of the brush). This, however, is twice as high as the 6.7% reported in an earlier, 2005,

study in Galicia.<sup>11</sup> Even though it could be thought that using more toothpaste for tooth brushing would lead to better cleansing quality and protection, the opposite is true. If more toothpaste is used, the mouth fills up with foam quickly, accelerating rinsing and therefore shortening the brushing time, which leads to less mechanical removal of bacterial plaque.<sup>6</sup> This is consistent with earlier studies,<sup>6</sup> and could explain, at least in part, why risk for caries is higher among students using more than the recommended amount of toothpaste.

Most (88%) of the students brushed their teeth at least once a day. This was an improvement over the 83% reported in Galicia and Spain in 2005, although it falls short of the figures reported in other regions in Spain, such as Aragon, with a prevalence of 97% in 2004.<sup>9,11,14</sup> Even though the percentage of students who brush their teeth at least once a day is high, this does not mean that the brushing is done correctly; this factor was not evaluated in the foregoing study.

In total, 62.7% of 12-year-old children in Galicia were instructed on correct teeth brushing techniques by their dentist. This was far higher than the percentage reported in Asturias in 2008 (32.4%) and Aragon in 2004.<sup>14,15</sup>

The estimated prevalence of caries was 39.3%; this is lower than the Spanish average (45% and 47% in 2010 and 2005)<sup>8,9</sup> in 2005, in Galicia<sup>11</sup> (52.7%), or in Valencia in 2004<sup>16</sup> (48.3%), and somewhat higher than the percentage found in Aragón<sup>14</sup> in 2004 (32.2%) and Navarra<sup>17</sup> in 2007 (36.9%). The prevalence of caries, as well as the DMF and DMF-df indexes, has been decreasing since 1995, both in Galicia<sup>10,11</sup> and nationwide.<sup>8,9,16</sup>

Beginning brushing before the age of 4 years and teeth brushing instructions from a dentist have been associated with good oral health in children in different studies,<sup>2,5</sup> even though this association was not observed in this study. There is, however, a potential bias in these variables: children might have incorrectly declared both these variables, or dentists might not find it necessary to give instructions to children with fewer risk factors.

As in other studies,<sup>18,19</sup> we found a higher risk for poor hygiene in boys than girls. This could be associated with an earlier onset of puberty in girls, and a higher level of maturity and awareness of the benefits that good hygiene provides.

Risk for poor hygiene or caries was similar in both urban and rural settings. This differs from previous data from Smyth and Caamaño and Llodra Calvo, who described a higher prevalence of caries in rural compared to urban settings.<sup>6,10</sup> The proliferation of dental clinics in the Galician rural setting could explain this factor.

As in previous studies,<sup>10,17,20</sup> social class was associated with the presence of caries. Thus, students belonging to the lower classes had a higher prevalence of caries than those from the middle and upper class. A potential explanation could be that these children received less health care education and had less access to prevention or treatment programmes.

Brushing teeth at least once a day was associated with good oral health, a finding consistent with other studies.<sup>6,9-11,21</sup> Therefore, among students with a sufficient brushing frequency, the prevalence of both caries and plaque were lower. This study has limitations, including its cross-sectional design, which prevents us from showing a

causal relationship between observed associations. The participation rate, in spite of being high, does not guarantee the absence of a participation bias. This is because participation was dependent on parental consent, and the parents of children with poor oral health might have prevented them from taking part in the study.<sup>20</sup>

The strengths of the study include the high participation rate and the highly representative sample. This was due as much to the study design as to the setting: schooling is mandatory for the 12-year age group, and therefore gave us access to the entire population. Furthermore, the study data refer exclusively to the 12-year-old population which, in most cases, have permanent dentition.

Although there have been improvements in oral health (for example, the prevalence of caries among 12-year-old students has decreased by more than 10% since 2005), action must be taken to improve oral hygiene indicators. Thus, brushing teeth at least once a day and using the correct amount of toothpaste can have a significant impact on risk factors associated with incorrect elimination of plaque and presence of caries, and therefore, policies to promote oral health should emphasise these factors. The government should regulate advertising by laboratories that manufacture toothpaste and make it mandatory to include information about the amount that should be used each time, thus preventing the use of advertisements that show the whole brush covered with this product. In addition, dentists have a key role as health care educators; they should instruct their patients on the benefits of preventive measures.

## Conflicts of interest

The authors declare that there are no conflicts of interest.

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