Oral Health Habits in Primary and Secondary School Children

López-Valverde A[1], Montero J[2], Camañas G[3], Peralta B[4], Gómez de Diego R[1]

[1]Associate Professor, School of Dentistry, Faculty of Medicine, Department of Surgery, University of Salamanca, Spain.[2]Tenured Lecturer, Department of Surgery, University of Salamanca. Spain.[3]Medical Manager, Vitaldent Clinics. Spain.[4]Associate Professor, School of Dentistry, University Alfonso X El Sabio, Madrid. Spain.

Abstract

Purpose: To assess oral hygiene habits in a population of schoolchildren in Primary Education year 6 and Secondary Education year 3 in Madrid city, (Spain) by correlating demographic variables (gender and age) with tooth brushing frequency, gingival bleeding, visits to the dentist, and type and frequency of consumption of cariogenic foods.

Materials and Methods: Descriptive observational clinical study with cross-sectional measures of the sample analyzed. The statistical analysis included the chi-square test and correlation analysis. In all cases, $p<0.05$ was considered statistically significant. All the students attending PSch year 6 and SSch year 3 at three centers in Madrid City (Spain), were invited to participate. The final population analyzed (n=271) included students in primary or secondary education in state-funded (n=45) or private (n=226) schools, who attended class on the previously agreed date of the survey. By school year, the sample consisted of 35.8% of SSch year 3 students (n=97) and 67.2% of PSch year 6 students (n=174).

Results and Conclusions: Analysis of a sample (n=271) with an age range of 11-16 years. Some 80% of the schoolchildren reported brushing their teeth at least twice a day. The usual or esporadic gingival bleeding was reported by 61.5% of the sample. Half of the sample attended the dental office at least once a year. The most commonly consumed cariogenic foods were sweetened soft drinks (59.3%), on a daily basis; and confectionery (72.0%), on a weekly basis. The cariogenic risk was higher among males and older individuals. Moreover the frequency of tooth brushing was significantly higher in girls. The frequency of intake of confectionary was significantly correlated with the intake of other sweetened products such as soft drinks (rs: 0.14; $p=0.02$) and pastries (rs: 0.22; $p<0.01$).

Key Words:Oral Hygiene, Caries, Gingivitis, Schoolchildren, Cariogenic food

Introduction

The most common oral diseases in children and adolescents within the Spanish school population are dental caries and Periodontal Disease (PD) [1].

The World Health Organization (WHO) describes dental caries as a localized pathology of external origin, occurring after the onset of tooth eruption, affecting the hard tissue of teeth and evolving until a cavity is produced [2] (World Oral Health Report, 2003). However, this description is considered incomplete because it recognizes the interaction of three factors-the bacterial agent, the host and diet, associated in time- as the decisive factors favoring the development of disease [3].

In fact, the pathogenesis of caries depends on four factors: bacteria, dental anatomy, diet and the length of time dental plaque sticking to the teeth has been present [4-7]. The Gram-positive bacteria genera Lactobacillus and Streptococcus mutans, use carbohydrates in the diet as a substrate. As a waste product, they emit acid into the oral cavity, causing fluctuations in the pH level. Lower pH leads to the demineralization of dental tissue and a higher pH level produces remineralization. If the pH balance is altered, dental tissue is destroyed and dental cavities will appear [8,9]. Fermentable carbohydrates in the diet play an important role in the etiology of caries. Through the action of the enzyme amylase, starch is degraded to maltose. This, in turn, can be further degraded into glucoses, which lower salivary pH levels. An uncontrolled intake of carbohydrates disturbs the demineralization/remineralization balance in favor of demineralization [10].

The term PD is used to describe damage affecting the tissue supporting the teeth. Essentially, it presents in two clinical entities: gingivitis and periodontitis [11] (Orozco et al, 2006). Inflammatory disease of the marginal, papillary or attached gingivae, associated with the presence of dental plaque, levels of stable insertion in the periodontum, disease reversibility on eliminating etiologic factors without harming the supporting structures, is termed gingival disease [12]. The clinical process can progressively destroy tissues supporting the teeth. This is termed chronic periodontitis and its presence is indicated by gingival inflammation, bleeding and/or reduced resistance of the tissues to probing, the loss of levels of insertion and alveolar bone, which can lead to tooth mobility and loss [13,14]. Chronic periodontitis progresses slowly with episodes of exacerbation and remission. It is the most prevalent type of periodontitis and its local etiology can be considered infectious in nature, due to the presence of specific bacteria or bacteria groups associated with the accumulation of dental plaque [15].

The objective of our study was to assess the oral hygiene habits of a population of 11–16 year-old children and adolescents studying compulsory primary (PSch) and secondary (SSCh) education in Madrid city (Spain). We aimed to associate demographic variables, sex, age, school year and type of school, with a set of predictive variables: tooth brushing frequency, gingival bleeding, dental check-ups, and frequency of consuming cariogenic foods.

Materials and Methods

This study was approved by the ethics and research committee of the Alfonso X el Sabio University (Madrid, Spain).

All the students attending PSch year 6 and SSch year 3 at three centers in Madrid city (Spain), were invited to participate. The final population analyzed (n=271) included students in primary or secondary education in state-funded

Corresponding author: Dr. Antonio López-Valverde, Clínica Odontológica. C/Alfonso X el Sabio S/N. Campus Miguel de Unamuno. Salamanca. 37007. Spain; Tel: 0034 923294500 - ext 1991; Fax +34923294868; e-mail: anlopezvalverde@gmail.com

(n=45) or private (n=226) schools, who attended class on the previously agreed date of the survey. By school year, the sample consisted of 35.8% of SSch year 3 students (n=97) and 67.2% of PSch year 6 students (n=174).

An informed consent agreement was designed and sent to students' parents or tutors by the school boards. Its purpose was to obtain permission for students to participate in the study. It was accompanied by a self-reporting questionnaire with 6 closed items on students' oral hygiene habits. The questions focused on the following predictive variables: demographic data, oral hygiene habits, presence of gingival bleeding, dental check-ups, types of cariogenic foods consumed and frequency of intake.

Table 1 shows data on age, sex and type of school attended. The 11–12 year age range corresponds to children in PSch year 6 and the 14–15 year range to those in SSch year 3. Students aged 13 or 16 are repeating their studies in year 3 or 6, respectively. The sample consisted of 130 girls and 139 boys; 2 students left this item blank. None of the SSch year 3 students was attending a state-funded school.

The research design was a descriptive observational clinical study, with cross-sectional measures of the sample. We excluded questionnaires left blank or with unclear responses, classifying these as "lost".

The statistical analysis included an association of qualitative variables measured by studying frequency and applying the chi-square test. The Spearman Rho coefficients (rs) were used to assess the linear correlation between several ordinal variables. In all cases, $p<0.05$ was considered statistically significant. Statistical analysis was with SPSS 19.0 for Windows.

Results

Table 1 shows data on age, sex and type of school attended. The 11–12 year age range corresponds to children in PSch year 6 and the 14–15 year range to those in SSch year 3. Students aged 13 or 16 are repeating their studies in year 3 or 6, respectively. The sample consisted of 130 girls and 139 boys; 2 students left this item blank. None of the SSch year 3 students was attending a state-funded school.

Table 1. *Distribution of students by age, gender and school type.*

Age in years	**n**	**%**
11	15	42.4%
12	56	20.7%
13	3	1.1%
14	60	22.1%
15	34	12.5%
16	3	1.1%
Total	**271**	**100%**
Gender	**n**	**%**
Boys	139	51.3%
Girls	130	48.0%
N/A (No answers)	2	0.7%
Total	**271**	**100%**
School type		
	State-funded	**Private**
	n	**n**
11 years	25	90
12 years	18	38
13 years	2	1
14 years	0	60
15 years	0	34
16 years	0	3
Total	**45**	**226**

Some 80% of students reported brushing their teeth at least twice a day, whereas 1.5% reported hardly ever brushing their teeth (*Table 2*). A significantly higher rate of brushing was observed within girls than boys (Chi: 6.831; df=2, p=0.033). Moreover a clear trend towards a better tooth-brushing habits was showed in the younger cohort (11-13 yrs) than counterparts (Chi: 5.04, df: 2; p=0.081).

Table 3 shows the prevalence of sporadic gingival bleeding during daily tooth brushing: 100 students reported no bleeding or hardly ever, versus 138 who reported sporadic

Table 2. *Toothbrushing frequency in the whole sample and regarding age and gender.*

	Two or more times a day		**Once a day**		**Hardly ever**	
	N	**%**	**N**	**%**	**N**	**%**
Within the whole sample [a]	215	80.5	48	18.0	4	1.5
According to gender [b] *						
Boys (n=138)	103	74.6	33	23.9	2	1.4
Girls (n=129)	112	86.8	15	11.6	2	1.6
According to age interval [a]						
11-13 years (n=172)	145	84.3	24	14.0	3	1.7
14-16years (n=97)	72	74.2	24	24.7	1	1.0

[a] This information was properly recorded in 269 subjects (99.3% of the whole sample)
[b] This cross-tabulation was feasible for 267 subjects (98.5% of the whole sample)
* Chi-Square Test found significant differences in the sub-groups distributions ($p<0.05$)

Table 3. *Prevalence of gingival bleeding during tooth brushing in the whole sample and regarding age and gender.*

	Always		**Sometimes**		**Hardly ever**	
	N	**%**	**N**	**%**	**N**	**%**
Within the whole sample [a]	22	8.5	138	53.1	100	38.5
According to gender [b]						
Boys (n=132)	11	8.3	65	49.2	56	42.4
Girls (n=126)	10	7.9	73	57.9	43	34.1
According to age interval [a]						
11-13 years (n=168)	14	8.3	92	54.8	62	36.9
14-16 years (n=92)	8	8.7	46	50.0	38	41.3

[a] This information was properly recorded in 260 subjects (95.9% of the whole sample)
[b] This cross-tabulation was feasible for 258 subjects (95.2% of the whole sample)

Table 4. *Frequency of visits to the dentist in the whole sample and regarding age and gender.*

	At least once a year		**When I go to the orthodontist**		**Don't know/don't remember**	
	N	**%**	**N**	**%**	**N**	**%**
Within the whole sample [a]	125	46.8	45	16.9	97	36.3
According to gender [b]						
Boys (n=137)	62	45.3	20	14.6	55	40.1
Girls (n=128)	63	49.2	23	18.0	42	32.8
According to age interval [a] **						
11-13 years (n=172)	90	52.3	15	8.7	67	39.0
14-16 years (n=95)	35	36.8	30	31.6	30	31.6

[a] This information was properly recorded in 267 subjects (98.5% of the whole sample)
[b] This cross-tabulation was feasible for 265 subjects (97.8% of the whole sample)
** Chi-Square Test found very significant differences in the sub-groups distributions ($p<0.01$)

bleeding, and 8.5% who referred usual bleeding. There were not significant differences in the distribution of the bleeding on tooth-brushing regarding gender nor age (*Table 3*).

Table 4 shows the frequency of dental check-ups with 97 students (36.3%) reporting they did not know/remember when they had attended. Half of the sample attended the dental office at least once a year. Given the high number of students undergoing orthodontic treatment, the questionnaire included an item correlating visits to the orthodontist, finding that 16.9% reported these visits. There were no significant difference regarding gender in the frequency of dental attendance, however it was significantly observed a higher prevalence of visits to the orthodontist within those subjects aged 14-16 years (*Table 4*).

In *Table 5* we show the relation between cariogenic food type and frequency of consumption over a period of 1–7 days. Sweetened soft drinks were the food type most commonly consumed both daily (59.3%) and weekly (34.3%); confectionery was commonly consumed in a weekly basis (72.0%).

The frequency of intake of sweetened soft drinks was significantly modulated by gender, being the males at higher cariogenic risk (Chi: 15.41, df:2; p<0.001). The age interval significantly impinged the frequency of intake commercially-produced pastries. The older subjects consumed more frequently this sweetened products than the younger subjects (Chi: 8.97, df:2; p=0.01).

***Table 5**. Frequency of intake and cariogenic food type in the whole sample and regarding age and gender.*

TYPE OF FOOD	Daily		Weekly		Hardly Ever	
CONFECTIONERY	**N**	**%**	**N**	**%**	**N**	**%**
Within the whole sample [a]	55	20.5	193	72.0	20	7.5
According to gender [b]						
Boys (n=136)	28	20.6	96	70.6	12	8.8
Girls (n=130)	27	20.8	95	73.1	8	6.2
According to age interval [a]						
11-13 years (n=172)	34	19.8	127	73.8	11	6.4
14-16 years (n=96)	21	21.9	66	68.8	9	9.4
SWEETENED SOFT DRINKS						
Within the whole sample [a]	159	59.3	92	34.3	17	6.3
According to gender** [b]						
Boys (n=136)	96	70.6	34	25.0	6	4.4
Girls (n=130)	61	46.9	58	44.6	11	8.5
According to age interval [a]						
11-13 years (n=172)	93	54.1	66	38.4	13	7.6
14-16 years (n=96)	66	68.8	26	27.1	4	4.2
COMMERCIALLY-PRODUCED PASTRIES						
Within the whole sample [a]	113	42.2	133	49.6	22	8.2
According to gender [b]						
Boys (n=136)	64	47.1	59	43.4	13	9.6
Girls (n=130)	48	36.9	74	56.9	8	6.2
According to age interval* [a]						
11-13 years (n=172)	61	35.5	96	55.8	15	8.7
14-16 years (n=96)	52	54.2	37	38.5	7	7.3

[a] This information was properly recorded in 268 subjects (98.9% of the whole sample)
[b] This cross-tabulation was feasible for 266 subjects (98.2% of the whole sample)
* Chi-Square Test found significant differences in the sub-groups distributions (p<0.05)
** Chi-Square Test found very significant differences in the sub-groups distributions (p<0.01)

The Spearman Rho correlation coefficient did not find any significant nor strong correlation between age, frequency of tooth brushing and gingival bleeding. However age was found to be significantly correlated with the frequency of intake of sweetened soft drinks (rs: 0.19; p<0.01), mainly in boys (rs: 0.21; p<0.01). Moreover the frequency of intake of confectionary was significantly correlated with the intake of other sweetened products such as soft drinks (rs: 0.14; p=0.02) and pastries (rs: 0.22; p<0.01). These coefficients were stronger for girls than for boys.

Discussion

Our data analysis showed that the frequency of tooth brushing at least twice a day was higher (80.5%) than that found in other Spanish studies. In a broad-ranging sample of children aged 6–14 (n=1397), Artácoz reported a 58.4%–68.2% frequency of tooth brushing more than once a day [16].

In a descriptive cross-sectional study conducted for the Spanish National Institute for Statistics, Barriuso Lapresa enrolled children and adolescents (age range: 2–15 years) between June 2006 and 2007 [17,18].

They found that 63.07% of the sample (n=8042) brushed their teeth at least twice a day. In our study, the sociodemographic variables only recorded statistically significant differences (p<0.05) for sex, finding that girls brushed their teeth more frequently (86.8%) than boys did (74.6%). These results coincide with Artácoz, who reported that 73.5% of girls brushed their teeth more than once a day [16].

We found a trend between the independent variables age interval and frequency of tooth brushing (*Table 2*) showing that the older the student the lower the frequency of brushing. In this sense, Jürgensen and Petersen found comparable results of tooth brush use on their study performed on 2nd grade SSch population in the Democratic Republic of Laos exploring children of an age similar to our PSch year 6 students [19]. Our results regarding the frequency of tooth brushing are higher than the figures reported by Masson et al in Scotland. These authors analyzed the impact of tooth brushing in association with sugar intake and treatment of dental caries in a population aged 3–17 years (n=1512), finding a 63%–68% frequency of tooth brushing at least once a day [20]. These rates are also higher than results reported by Varenne et al. in a cross-sectional study conducted in Burkina Faso (Africa) to determine attitudes towards and level of knowledge of dental hygiene in a sample (n=505) of 12-year olds [21]. They found a 36% frequency of use of tooth brushing techniques and an 8.1% frequency for the presence of gingival bleeding associated with tooth brushing. The latter could be related to poor tooth brushing technique or correlate with the presence of sub-gingival bacteria, which induces the production of cytosines and other proinflammatory chemical mediators that cause clinical gingivitis [14]. De Almeida analyzed the prevalence of gingival bleeding associated with oral hygiene among 6–12 year-olds in Portugal (n=1599). Using the Community Periodontal Index (CPI), the authors found a 90% frequency in students aged 12 years (n=600) with CPI level 2 and presence of calcified dental plaque and gingival bleeding. In our study, overall frequency of gingival bleeding during tooth brushing was 59% [22]. This was much

lower than that reported by Jürgensen and Petersen who, in a cross-sectional study, found a 99% prevalence of gingival bleeding in their sample of the Laotian school population [23].

Some 62.7% of children reported visiting the dentist/orthodontist once or more a year. In Spain, our figures were higher than those reported by Barriuso Lapresa [17], who found a 47.35% frequency in the population analyzed, but lower than those reported by Almerich and Montiel in their survey of infant oral health in the Valencian Community, Spain [24]. These authors reported 78% of respondents visited the dentist once or twice a year. Similarly, in children and adolescents in the Chartered Community of Navarre, Spain. Artácoz recorded frequencies of 87.4% and 91.6%, for students aged 6 and 12, respectively [16]. On comparing our study with others conducted outside of Spain, the figures are higher than those reported by Jürgensen and Petersen [19], who report a 29% frequency in the infant population of south-east Asia, and higher too than those reported by de Almeida [22], with a 58.3% frequency in Portuguese 12 year-olds, or the 46% frequency reported by Peng in a cross-sectional study of 12 year-old schoolchildren (n=698) in the Republic of China [25].

The correlation between type of cariogenic food and frequency of consumption showed that sweetened soft drinks were the food type most commonly consumed daily. These results were similar to those of Jürgensen and Petersen [19] who found sweetened soft drinks were consumed daily during school hours. However, they contrast with data obtained by Barriuso Lapresa who only found 8.63% of the population reported consuming sweetened soft drinks daily [17]. They also differs from data reported by Zaborskis, who conducted an ecological study in a population of children and adolescents (range: 11–13 years) in 27 European countries, Israel, Canada and the USA [26]. They concluded there was a high prevalence of consumption of confectionery and low rates of frequency for the consumption of sweetened soft drinks, although they do not specify frequency of intake. Almerich and Montiel found that 20.7% of the population reported the daily intake of sweetened foods, without specifying whether these were sweetened soft drinks, confectionery or commercially-produced pastries [24]. On a weekly basis, confectionary is the most commonly consumed cariogenic food (72%). This contrasts with data reported by Barriuso Lapresa, who found a 9.13% frequency of consumption in their study population, surveyed at the same time [17].

Conclusion

In our study, we found that the population analyzed showed: a higher frequency of daily tooth brushing than that reported in other studies conducted in Spain and abroad; a lower frequency of gingival bleeding associated with tooth brushing than in other studies; a lower frequency of check-ups with the dentist/orthodontist than in other studies in Spain but one that was similar to some international studies; and that the most commonly consumed cariogenic foods were sweetened soft drinks, on a daily basis, and confectionary, weekly.

References

1. Bravo Pérez M, Llodra Calvo JC, Cortés Martincorena FJ, Casals Peidró E. Encuesta de Salud Oral de Preescolares en España. *Riverside County Office of Education*. 2007; **12**: 143-168.

2. World Oral Health Report. 2003.

3. Keyes PH. The infectious and transmissible nature of experimental dental caries: Findings and implications. *Archives of Oral Biology*. 1960; **1**: 304-320.

4. Aas JA, Grifen AL, SR Dardis AM, Lee I, Dewhirst F. Bacteria of dental caries in primary and permanent teeth in children and young adults. *Journal of Clinical Microbiology*. 2008; **46**: 1407-1417.

5. Nishimura J, Saito T, Yoneyama H, Bai LL, Okumura K, Isogai E. Biofilm formation by Streptococcus mutans and related bacteria. *Advances in Applied Microbiology*. 2012; **2**: 208-215.

6. Koo H, Falsetta ML, Klein MI. The exopolysaccharide matrix: A virulence determinant of cariogenic biofi lm. *Journal of Dental Research*. 2013; **92**:1065-1073.

7. Bowen WH, Koo H. Biology of Streptococcus mutans-derived glucosyltransferases: Role in extracellular matrix formation of cariogenic biofilms. *Caries Research*. 2011; **45**: 69-86.

8. Loesche WJ. Role of Streptococcus mutans in human dental decay. *Microbiological Reviews*. 1968; **50**: 353-380.

9. Kidd E, Fejerskov O. Changing conceps in cariology: Forty years on. *Dental Update*. 2013; **40**: 277-278.

10. Kidd E. The implications of the new paradigm of dental caries. *Journal of Dentistry*. 2011; **2**: 3-8.

11. Orozco A, Gemmell E, Bickel M, Seymour GJ. Interleukin-1 β, interleukin-12 and interleukin-18 levels in gingival fluid and serum of patients with gingivitis and periodontitis. *Oral Microbiology and Immunology*. 2006; **21**: 256-260.

12. Mariotti A. Dental plaque-induced gingivla deseases. *Annals of Periodontology*. 1999; **4**: **7**-19.

13. Baelum V, Fejerskow O, Manji F. Periodontal diseases in adult Kenyans. *Journal of Clinical Periodontology*. 1988; **15**: 445-452.

14. Socransky SS, Haffajee AD, Goodson JM, Lindhe J. New concepts of destructive periodontal disease. *Journal of Clinical Periodontology*. 1984; **11**: 21-32.

15. Socransky SS, Haffajee AD. The bacterial etiology of destructive periodontal disease: current concepts. *Journal of Periodontology*. 1992; **63**: 322-331.

16. Artázcoz J, Cortés F J, Rosel E, González Rodríguez P, Bravo M. Percepción y hábitos de salud bucodental en niños y adolescentes de Navarra en 2007. *Anales Del Sistema Sanitario De Navarra*. 2010; **33**: 51-64.

17. Barriuso Lapresa L, Sanz Barbero B, Hernando Arizaleta L. Prevalencia de hábitos bucodentales saludables en la población infanto-juvenil residente en España. *Anales De Pediatría*. 2012; **76**: 140-147.

18. Ministerio de Sanidad, Política Social e Igualdad. Encuesta Nacional de SaluddeEspaña. 2006. http://www.mspsi.es/estadEstudios/estadisticas/encuestaNacional/encuesta2006.htm.

19. Jürgensen N, Petersen PE. Oral health behaviour of urban and semi-urban schoolchildren in the Lao PDR. *Community Dental Health*. 2011; **28**: 280-285.

20. Masson LF, Blackbum A, Sheehy C, Craig LC, Macdiarmid JL, Holmes BA, McNeill G. Sugar intake and dental decay: Results from a national survey of children in Scotland. *British Journal of Nutrition*. 2010; **104**: 1555-1564.

21. Varenne B, Petersen PE, Quattara. Oral health behaviour of children and adults in urban and rural areas of Burkina Faso, Africa. *International Dental Journal*. 2006; **56**: 61-70.

22. de Almeida CM, Petersen PE, André SJ, Toscano A. Changing oral health status of 6- and 12-year-old schoolchildren in Portugal. *Community Dental Health*. 2003; **20**: 211-216.

23. Jürgensen N, Petersen PE. Oral health and the impact of socio-behavioural factors in a cross sectional survey of 12-year old

school children in Laos. *BMC Oral Health*. 2009; **16**: 29.

24. Almerich-Silla JM, Montiel-Company JM. Encuesta sobre hábitos higiénicos orales en la población adolescente de la Comunidad Valenciana en 2004. *Riverside County Office of Education*. 2006; **11**: 195-201.

25. Peng B, Petersen PE, Fan MW, Tai BJ. Oral health status and oral health behavior of 12 year old urban schoolchildren in the Pople´s Republic of China. *Community Dental Health*. 1997; **14**: 44.

26. Zaborskis A, Milciuviene S, Narbutaite J, Bendraitiene E, Kavaliauskiene A. Caries experience and oral health behaviour among 11 -13-year-olds: an ecological study of data from 27 European countries, Israel, Canada and USA. *Community Dental Health*. 2010; **27**: 102-108.