Prevalence and severity of dental caries in schoolchildren of Porto, Portugal

T. Mello[1,2], J. Antunes[3], E. Waldman[2], E. Ramos[1], M. Relvas[1] and H. Barros[1]

[1]*Porto Medical School, University of Porto, Porto, Portugal;* [2]*School of Public Health, University of São Paulo, São Paulo, SP, Brazil;* [3]*School of Dentistry, University of São Paulo, São Paulo, SP, Brazil..*

Objectives*:* To measure the prevalence and severity of dental caries in adolescents of the city of Porto, Portugal, and to assess socioeconomic and behavioural covariates of dental caries experience. ***Methods****:* A sample of 700 thirteen-year-old schoolchildren was examined. Results from the dental examination were linked to anthropometric information and to data supplied by two structured questionnaires assessing nutritional factors, socio-demographic characteristics and behaviour related to health promotion. Dental caries was measured using the DMFT index, and two dichotomous outcomes, one assessing the prevalence of dental caries (DMFT>0); the other assessing the prevalence of a high level of dental caries (DMFT≥4). ***Results:*** Consuming soft drinks derived from cola (irrespective of sugared or diet) two or more times per week, attending a public school, being female and having parents with low educational attainment were identified as risk factors both for having dental caries and for having a high level of dental caries. ***Conclusion:*** Caries levels were positively associated with frequency of intake of sweetened foods and drinks.

Key words: Dental caries; education; nutrition, risk factors

Introduction

Dental caries is a multifactorial disease associated with a complex causal chain, which involves the physical-chemical and microbiological composition of the dental bio film, the protective effect of saliva, behavioural factors related to patterns of food intake and oral hygiene, and the socioeconomic context in which children and teenagers live. Despite an overall decline during recent decades, dental caries is still the most prevalent oral health disease affecting children and teenagers (Petersen, 2003). Dental caries is a public health problem that impacts on overall health status and quality of life.

Three national epidemiologic surveys on oral health were performed in Portugal in the last twenty years. The first in 1984, a mean DMFT of 3.7 for 12-year-old schoolchildren was reported. This subsequently decreased to 3.2 in 1990, and to 1.5 in 1999 (Almeida *et al.,* 2003). The survey performed in 1999 also assessed covariates for dental caries prevalence, and identified gender, ethnic group, use of dental services, daily frequency of tooth brushing and the location (urban or rural) of schools as independently associated with caries.

The aim of the present study was to measure the prevalence and severity of dental caries in adolescents of the city of Porto, Portugal, and to assess socioeconomic and behavioural covariates of dental caries experience.

Methods

Located at the North region of Portugal, the city of Porto is one of the most important centres of the coun-try, and represents the second major contribution to the gross national product and the national employment rate. The general census of population, performed in 2001, found that immigrants accounted for 4.2% of the city's inhabitants. In 2003, the Department of Hygiene and Epidemiology of the University of Porto began a cohort study, comprising adolescents born in 1990 and enrolled in public and private schools of the city. This study was named Epiteen (Epidemiological Health Investigation of Teenagers in Porto), and its main purpose was to prospectively analyze risk factors for cardiovascular diseases. All public schools and 19 out of 24 private schools agreed to participate.

We identified 2,788 thirteen-year-old schoolchildren, 2,126 enrolled in public and 662 in private schools. Forty-four (1.6%) did not attend classes during the study period and were excluded. Refusals totalled 583 (20.9%), referring to those that, for some reason, failed to return the signed consent form from their parents; and 2,161 (1,651 attending public and 510 attending private schools) students agreed to participate and were enrolled in the study, representing an overall participation rate of 77.5%, with similar proportions from public (77.7%) and private schools (77.0%). The Ethics Committee of the University Hospital of São João, Porto, approved the study. Written informed consent was obtained both from parents and adolescents.

Collection of data comprised two structured questionnaires; one (on dietary habits) was answered by parents and adolescents at home, the other (on socioeconomic status and oral health behaviour) was completed by the adolescents at school. Current food intake was assessed

Correspondence to: Correspondence to: Dr. Henrique Barros, Porto Medical School, University of Porto, Al. Prof. Hernâni Monteiro 4200 - 319 Porto PORTUGAL E-mail: hbarros@med.up.pt

Table 1. Unadjusted assessment of association between risk factors and the prevalence of dental caries in 13-year-old schoolchildren of Porto, Portugal, 2003.

Prevalence of dental caries	DMFT>0			OR (IC 95%)	p
	Yes	*No*	*Total*		
Dietary Factors					
Ice tea					
< 2 x per week	188	120	308	1.00	
≥ 2 x per week	124	68	192	1.16 (0.80-1.69)	0.426
Soft drinks derived from cola					
< 2 x per week	200	141	341	1.00	
≥ 2 x per week	112	47	159	1.68 (1.12-2.51)	0.011
Other soft drinks					
< 2 x per week	189	117	306	1.00	
≥ 2 x per week	123	71	194	1.07 (0.74-1.56)	0.713
Any soft drink					
< 2 x per week	54	30	84	1.00	
≥ 2 x per week	258	158	416	0.91 (0.56-1.48)	0.696
Chocolate					
< 2 x per week	195	123	318	1.00	
≥ 2 x per week	117	65	182	1.14 (0.78-1.66)	0.510
Sugared foods and beverages					
< 2 x per week	143	111	254	1.00	
≥ 2 x per week	169	77	246	1.70 (1.18-2.46)	0.004
Weight					
Non-overweight	347	203	550	1.00	
Overweight	99	51	150	1.14 (0.78-1.66)	0.511
Social and Demographic Characteristics					
Type of school					
Private School	80	95	175	1.00	
Public School	366	159	525	2.73 (1.93-3.88)	<0.001
Gender					
Boy	193	130	323	1.00	
Girl	253	124	377	1.37 (1.01-1.87)	0.044
Mother's Academic Education					
> 9 years	178	152	330	1.00	
≤ 9 years	195	67	262	2.49 (1.75-3.53)	<0.001
Father's Academic Education					
> 9 years	197	162	359	1.00	
≤ 9 years	176	57	233	2.54 (1.77-3.65)	<0.001
Oral Health Promotion					
Brushes teeth					
≥ 2 x per day	348	215	563	1.00	
< 2 x per day	83	37	120	1.39 (0.91-2.12)	0.129
Fluoride mouthwash					
Yes	161	94	255	1.00	
No	262	156	418	0.98 (0.71-1.35)	0.905
Visits the dentist					
At least once a year	249	139	388	1.00	
Only when there is a problem or has never gone	179	112	291	0.89 (0.65-1.22)	0.477

using a semi-quantitative food frequency questionnaire. The response rate for the questionnaire and for individual questions varied hence the totals in Tables 1 & 2 vary. Adolescents were weighed and measured, which allowed their classification according to categories of the Body Mass Index (BMI) percentile distribution for gender and age, provided by charts of the Centers for Disease Control and Prevention (Kuczmarski *et al.*, 2000).

Dental examinations were performed at school, concurrently with the enrolment of adolescents for the cohort. The current study refers to a snapshot evaluation of a sample (n=700) gathered during the baseline assessment of the cohort, corresponding to the former one third of the whole cohort to be enrolled in the study. Dental caries was diagnosed by visual/tactile criteria. One dentist, assisted by one recording clerk, performed all examinations. The dentist was specifically trained and calibrated for applying WHO's guidelines (WHO, 1997); her intra-observer kappa statistic was 0.876, which is considered good agreement.

As covariates, the study evaluated nutritional factors (intake of soft drinks and sugared products, and overweight), socio-demographic characteristics (type of school, gender, educational attainment of parents) and behaviour related to oral health (habits of oral hygiene and visits to the dentist). All covariates were dichotomized for comparative analysis of outcomes on caries prevalence (DMFT>0), prevalence of a high level of caries (DMFT≥4) and the DMFT score.

The intake of soft drinks was assessed in terms of the weekly frequency that the student drank any of these beverages, irrespective of sugared or diet, in addition to the specific assessment of ice tea, cola-related and other soft drinks. Sugared products were represented by the weekly intake of chocolate, sweets and candies, and the addition of sugar on foods and beverages. Participants were considered overweight when presenting a BMI higher than the 85 percentile (Kuczmarski *et al.*, 2000). Type of school refers to the differentiation between public and private schools. The educational attainment of parents was measured in terms of the number of years

of formal schooling. This variable was dichotomized considering that, in Portugal, the compulsory education corresponds to 9 academic years. The assessment of oral health promotion comprised toothbrushing frequency, use of fluoride mouthwash and visits to the dentist (water supplies in Portugal are not fluoridated).

Associations between dental outcomes and covariates were assessed by unadjusted and adjusted odds ratio (OR), as estimated by unconditional logistic regression analysis (tables 1 and 2). Covariates presenting p≤0.25 at the unadjusted assessment were selected for inclusion in multivariate logistic regression (tables 3 and 4). Multivariate models for each outcome (DMFT≥4 and DMFT>0) excluded covariates whose adjusted association was not significant at the p<0.05 level. The resulting multivariate models comprised nutritional factors and socio-demographic characteristics of examined children, and their goodness-of-fit assessment used Nagelkerke's (or pseudo-) R^2 and the −2loglikelihood test. The comparison of DMFT individual scores among categories of the most relevant covariates used the Mann-Whitney's U test (table 5). Data analyses used the software "Statistical Package for the Social Science (SPSS – PC Version 10)".

Results

The mean DMFT was 2.74, with 69.3% comprising decayed teeth (D), 3.8% missing teeth (M) and 26.9% filled teeth (F). Dental caries (DMFT>0) affected 63.7% of adolescents; high levels of caries (DMFT≥4) affected 33.9% of adolescents. Figure 1 shows the distribution of the DMFT index for the whole sample.

From the unadjusted assessment of associations between dental caries prevalence (DMFT>0) and measures of interest, the consumption of soft drinks derived from cola (OR=1.68) and the intake of sugared foods or beverages two or more times per week (OR=1.70) (nutritional factors); attending a public school (OR=2.73), being female (OR=1.37) and the low educational attainment of parents (OR=2.49) (socio-demographic characteristics) were statistically significant. No significant associations were
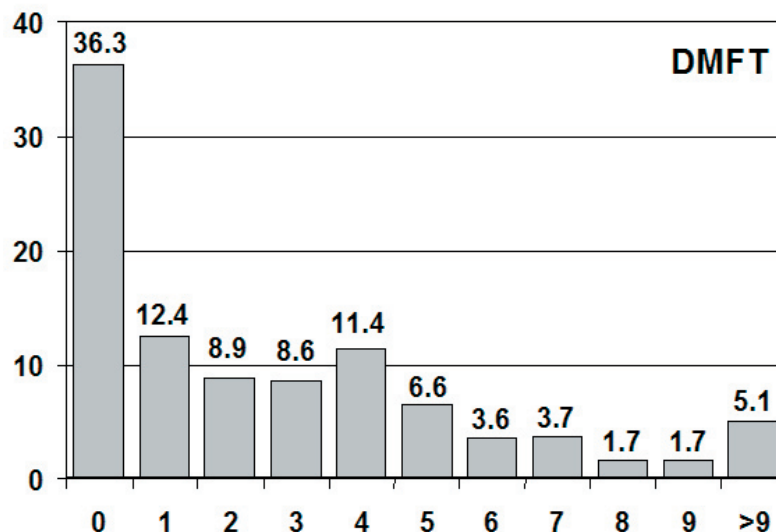

Figure 1. *DMFT distribution (%) of 13-year-old schoolchildren of Porto, Portugal, 2003.*

Table 2. Unadjusted assessment of association between risk factors and the prevalence of a high level of dental caries in 13-year-old schoolchildren of Porto, Portugal, 2003.

Prevalence of dental caries	DMFT≥4			OR (IC 95%)	p
	Yes	No	Total		
Dietary Factors					
Ice tea					
< 2 x per week	90	218	308	1.00	
≥ 2 x per week	69	123	192	1.36 (0.93-1.99)	0.117
Soft drinks derived from cola					
< 2 x per week	89	252	341	1.00	
≥ 2 x per week	70	89	159	2.23 (1.50-3.31)	<0.001
Other soft drinks					
< 2 x per week	86	220	306	1.00	
≥ 2 x per week	73	121	194	1.54 (1.05-2.26)	0.026
Any soft drink					
< 2 x per week	18	66	84	1.00	
≥ 2 x per week	141	275	416	1.88 (1.07-3.29)	0.027
Chocolate					
< 2 x per week	103	215	318	1.00	
≥ 2 x per week	56	126	182	0.93 (0.63-1.37)	0.708
Sugared foods and beverages					
< 2 x per week	68	186	254	1.00	
≥ 2 x per week	91	155	246	1.61 (1.10-2.35)	0.014
Weight					
Non-overweight	187	363	550	1.00	
Overweight	50	100	150	0.97 (0.66-1.42)	0.878
Social and Demographic Characteristics					
Type of school					
Private School	20	155	175	1.00	
Public School	217	308	525	5.46 (3.32-8.98)	<0.001
Gender					
Boy	93	230	323	1.00	
Girl	144	233	377	1.53 (1.11-2.10)	0.009
Mother's Academic Education					
> 9 years	71	259	330	1.00	
≤ 9 years	127	135	262	3.43 (2.40-4.91)	<0.001
Father's Academic Education					
> 9 years	89	270	359	1.00	
≤ 9 years	109	124	233	2.67 (1.88-3.79)	<0.001
Oral Health Promotion					
Brushes teeth					
≥ 2 x per day	180	383	563	1.00	
< 2 x per day	48	72	120	1.42 (0.95-2.13)	0.090
Use of fluoride mouthwash					
Yes	85	170	255	1.00	
No	140	278	418	1.01 (0.72-1.40)	0.966
Visits the dentist					
At least once a year	127	261	388	1.00	
Only when there is a problem or has never gone	99	192	291	1.06 (0.77-1.46)	0.724

Table 3. Multivariate model of logistic regression analysis assessing risk factors for the prevalence of dental caries (DMFT > 0) in 13-year-old schoolchildren of Porto, Portugal, 2003.

Covariates	n	Adjusted OR (95% Confidence Interval)	p
Type of school			
Private School	175	1.00	
Public School	525	2.05 (1.35 – 3.11)	0.001
Gender			
Boy	323	1.00	
Girl	377	1.42 (0.97–2.08)	0.070
Mother's Academic Education			
> 9 years	359	1.00	
≤ 9 years	233	1.76 (1.15–2.67)	0.008
Soft drinks derived from cola			
< 2 x per week	341	1.00	
≥ 2 x per week	159	1.53 (1.00–2.32)	0.049
Goodness-of-fit indicators			
-2 Log Likelihood		623.12	
Nagelkerke - R^2		0.10	

Table 4. Multivariate model of logistic regression analysis assessing risk factors for the prevalence of a high level of dental caries (DMFT ≥ 4) in 13-year-old schoolchildren of Porto, Portugal, 2003.

Covariates	n	Adjusted OR (95% Confidence Interval)	p
Type of school			
Private School	175	1.00	
Public School	525	1.74 (1.14–2.65)	0.011
Gender			
Boy	323	1.00	
Girl	377	4.31 (2.42–7.67)	<0.001
Mother's Academic Education			
> 9 years	359	1.00	
≤ 9 years	233	2.27 (1.48–3.47)	<0.001
Soft drinks derived from cola			
< 2 x per week	341	1.00	
≥ 2 x per week	159	2.04 (1.32–3.14)	0.001
Goodness-of-fit indicators			
-2 Log Likelihood		537.86	
Nagelkerke - R^2		0.23	

observed regarding the variables related to oral health promotion (Table 1).

Table 2 presents the unadjusted assessment of association between a high level of dental caries (DMFT≥4) and measures of interest. The findings are very similar to those found for caries prevalence: a more frequent weekly intake of soft drinks derived from cola (OR=2.23), other soft drinks (OR=1.54), any soft drinks (OR=1.88) and intake of sugared foods and beverages (OR=1.61) (nutritional factors), and all socio-demographic characteristics were statistically significant. No significant association was found for variables assessing the promotion of oral health.

The multivariate model, assessed by logistic regression, included the following conditions as independently associated with caries prevalence (DMFT>0): studying in a public school (OR=2.05), being female (OR=1.42), the mother's lower educational attainment (OR=1.76) and drinking soft beverages derived from cola two or more times per week (OR=1.53) (Table 3).

The multivariate model of logistic regression assessing the high experience of caries (DMFT≥4) identified the same covariates: studying in a public school (OR=4.31), being female (OR=1.74), the mother's lower educational attainment (OR=2.27) and drinking soft beverages derived from cola two or more times per week (OR=2.04) (Table 4).

Table 5. Mean DMFT of sub-groups based on socio-demographic and behavioural characteristics of 13-year-old schoolchildren of Porto, Portugal, 2003.

Categories	n	DMFT (Std dev)	Significance
Gender			
Girl	377	3.10 (3.56)	p=0.005
Boy	323	2.32 (2.88)	
Type of school			
Public	525	3,25 (3,49)	p <0.001
Private	175	1,21 (1,86)	
Mother's Academic Education			
≤ 9 years	233	3,73 (3,55)	p <0.001
> 9 years	359	1,80 (2,48)	
Cola Soft Drinks			
≥ 2 x per week	159	3.26 (3.31)	p <0.001
< 2 x per week	341	2.23 (2.92)	

Std dev: Standard deviation

The mean DMFT levels of groups were identified using covariates included in the multivariate analysis. Significantly higher levels were observed for girls, for adolescents attending public schools, for those whose mother had a lower educational attainment, and for those drinking colas twice a week or more often (Table 5).

With a view to assessing the effectiveness of the sampling design, we compared examined adolescents with the remaining subjects included in the cohort for covariates on socioeconomic status included in the study. No discrepancies were observed, except for the significant difference in the proportion of mothers presenting lower educational attainment. While the examined sample presented 48.5% of mothers with less than nine years of schooling, the group of non-examined adolescents had a significantly (p<0.001) higher proportion: 58.1%.

Discussion

The overall mean DMFT, 2.74, can be classified in the border between the "low" and the "moderate" prevalence level, according to the scale used by Petersen (2003). However, this figure is considerably higher than that (1.5) observed by Almeida *et al.* (2003) in a nationwide survey of 12-year-old Portuguese students. This figure is also higher than the DMFT estimated for other European countries, United Kingdom: 0.8 (United Kingdom, 2004), Spain: 1.1, France: 1.9 (WHO, 2006).

The high contribution of untreated decayed teeth (D) to the overall DMFT indicates that the access of Portuguese children to dental treatment is low. Almeida *et al.* (2003) also indicated that decayed teeth was the dominant component, both for the dmft of 5-year olds and the DMFT of 12-year olds, suggesting a restrictive access to dental care in Portugal.

The fact that girls present higher caries levels than boys has been attributed to differences in the chronology of the permanent tooth eruption (Antunes *et al.,* 2003); thus the importance of including gender as a control in the multivariate assessment of covariates for dental caries prevalence and severity.

Frequent consumption of soft drinks may damage oral health, not only due to its sucrose composition, but also because of its low pH level (Erickson *et al.,* 2001). In the current study, the intake of soft drinks derived from cola and the intake of sugared beverages and food two or more times per week, were found to be significantly associated with having caries (DMFT>0) or having four or more teeth affected by caries (DMFT≥4) (Tables 1 and 2). Peres *et al.* (2000) made a similar observation in Brazil. Sohn *et al.* (2006) also associated the high consumption of carbonated soft drinks by children with an increased risk of dental caries.

Inappropriate dietary habits, mainly excessive sugar intake, are well-known risks for dental caries and obesity. In the comparison of caries between overweight and non-overweight adolescents, there were no statistically significant differences of caries (DMFT>0) and high caries (DMFT≥4) prevalence (Tables 1 and 2). Although several studies reported higher indices of dental caries for obese children (Willershausen *et al.*, 2004; Marshall *et al.*, 2007), the absence of association has also been reported (Moreira *et al.*, 2006). Karjalainen (2007) suggested that exposure to fluoride may have weakened the correlation between dental caries and increased sugar intake.

Several studies have reported on the influence of socioeconomic status on dental caries levels (Antunes *et al.,* 2002). The higher prevalence of dental caries for those attending public schools and those whose parents present low schooling degree reflects the importance of socioeconomic factors in the distribution of dental disease. As public schools do not collect tuition fee, the enrolment of children in private schools has been assessed as a proxy indication of improved socioeconomic status. In 1995, Nadanovsky and Sheiham (1995) observed that, in European countries, the educational attainment of mothers was a more effective predictor of child caries prevalence than the access to dental services. In Brazil, students enrolled in public schools were reported to be more likely to have parents with low schooling levels and a lower per capita income than their counterparts attending private schools (Maltz and Silva, 2001). People with a higher formal education tend to brush their teeth more

often and their children adopt appropriate oral hygiene habits at a younger age (Baldani *et al.,* 2002).

Eighteen percent of adolescents reported brushing their teeth less than twice a day, 62% did not use fluoride mouthwash. In addition, an irregular access to the dentist, or no access at all, affected 43% of the examined sample. These observations indicate that there is room for improving hygiene habits and the access of adolescents to dental services. Individual behaviours related to oral hygiene practices, dietary patterns and attendance for dental care – as well as the risk of dental caries – are largely influenced by the family, the community, the society.

Data collected from questionnaires should be interpreted with caution. Self reported information is subject to bias e.g. deficient recall and answers addressing social desirability. In addition, the high proportion of non-responses to questionnaires limited the current study. Although all parents returned the socioeconomic form, only 500 schoolchildren responded to the questionnaire on dietary habits.

In spite of 2,162 students having been enrolled in the cohort, only 700 of them were submitted to the dental examination. The methodological option of performing dental examinations in a non-probabilistic sample of the cohort is an additional source of bias for the assessment of caries distribution. Notwithstanding, the number of participants is relatively large, and near one third of the cohort was examined. Hence the findings are likely to be close to the true picture in the population examined Furthermore, we observe that the overall profile of dental caries may be even worse than indicated by the present results, because the proportion of mothers with a higher educational attainment was significantly lower for the entire cohort than for the sample, and this covariate was associated significantly with caries levels. Notwithstanding, as the final multivariate models were controlled by the schooling level of mothers, we suggest that the assessment of associations for caries levels would not have been affected by the sampling design.

The multivariate models presented in the current study (Tables 3 and 4) indicated the same set of covariates on dietary habits and socio-demographic characteristics significantly associated both with the prevalence and the severity of dental caries in adolescents. Therefore, improving the profile of dental caries may demand the implementation of polices to reduce the consumption of soft drinks and sugared foods and beverages. The association of caries distribution with covariates assessing the type of school and parental schooling level reinforce the importance of the care received by children at their own homes and schools in the prevention of caries.

Acknowledgements

References

Almeida, C.M., Petersen, P.E., André, S.J., Toscano, A. (2003): Changing oral health status of 6- and 12-year-old schoolchildren in Portugal. *Community Dental Health* **20,** 211-216.

Antunes, J.L.F., Frazão, P., Narvai, P.C., Bispo, C.M., Pegoretti, T. (2002): Spatial analysis to identify differentials in dental needs by area-based measures. *Community Dent Oral Epidemiology* **30**, 133-142.

Antunes JLF, Junqueira SR, Frazão P, Bispo CM, Pegoretti T, Narvai PC. (2003). City-level gender differentials in the prevalence of dental caries and restorative dental treatment. *Health Place* **9**, 231-239.

Baldani, M.H., Narvai, P.C., Antunes, J.L.F. (2002): Cárie dentária e condições sócio-econômicas no Estado do Paraná, Brasil, 1996. *Cad Saúde Pública* **18**, 755-763.

Erickson, P.R., Alevizos, D.L., Rindelaub, D.J. (2001): Soft Drinks: hard on teeth? *Northwest Dent* **80**, 15-19.

Ismail, A.I., Burt, B.A., Eklund, S.A. (1984): The cariogenicity of soft drinks in the United States. *J Am Dent Assoc* **109**, 241-245.

Karjalainen, S. (2007): Eating patterns, diet and dental caries. *Dent Update* **34**, 295-298, 300.

Kuczmarski, R.J., Ogden, C.L., Grummer-Strawn, L.M., et al. (2000): CDC growth charts: United States. *Adv Data* **8,** 1-27.

Maltz, M., Silva, B.B. (2001): Relação entre cárie, gengivite e fluorose e nível socioeconômico em escolares. *Rev Saúde Pública* **35**, 170-176.

Marshall, T.A., Eichenberger-Gilmore, J.M., Broffitt, B.A., Warren, J.J., Levy, S.M. (2007): Dental caries and childhood obesity: roles of diet and socioeconomic status. *Community Dent Oral Epidemiol* **35**, 449-458.

Moreira, P.V., Rosenblatt, A., Severo, A.M. (2006): Prevalence of dental caries in obese and normal-weight Brazilian adolescents attending state and private schools. *Community Dent Health* **23**, 251-253.

Nadanovsky, P., Sheiham, A. (1995): Relative contribution of dental services to the changes in caries levels of 12-year-old children in industrialized countries in the 1970s and early 1980s. *Community Dent Oral Epidemiol* **23**, 331-339.

Peres, K.G., Bastos, J.R.M., Latorre, M.R.D.O. (2000): Severidade de cárie em crianças e relação com aspectos sociais e comportamentais. *Rev Saúde Pública* **34**, 402-408

Petersen, P.E. (2003): The world oral health report 2003: continuous improvement of oral health in the 21st century - the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol* **31,** 3-24.

Sohn, W., Burt, B.A., Sowers, M.R. (2006): Carbonated soft drinks and dental caries in the primary dentition. J Dent Res **85**, 262-266.

United Kingdom. National Statistics (2004). Decline in obvious decay in children's permanent teeth. Children's dental health survey 2003. Preliminary findings. London: National Statistics.

Willershausen, B., Hass, G., Krummenauer, F., Hohenfellner, K. (2004): Relationship between high weight and caries frequency in German elementary school children. *Eur J Med Res* **9**, 400-404.

World Health Organization (1997): *Oral Health Surveys: Basic Methods*. Geneva: WHO.

World Health Organization (2006): European health for all database. Geneva: WHO Regional Office for Europe.