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Factors associated with prevalence and severity of caries experience in preschool children

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Abstract – *Objectives:* The aim of the present study was to examine the prevalence and severity of caries experience in the primary dentition of preschool children and to assess the association of disease distribution with oral hygiene levels, reported oral health behaviours and socio-demographic factors. *Methods:* Study samples comprised 1250 3-year-old and 1283 5-year-old pre-school children from four distinct geographical areas in Flanders. Information on oral hygiene and dietary habits, oral health behaviours and socio-demographic variables was collected using questionnaires completed by the parents. Clinical examinations were performed using standardized criteria. Caries experience was recorded at the level of cavitation (d_3 level). Simple as well as multivariable logistic regression analyses were performed in order to identify factors associated with prevalence and severity of caries experience. *Results:* Visible plaque was present in 31% of 3-year-olds and 37% of 5-year-olds. In 3-year-olds, 7% presented with caries experience while this was the case in 31% of 5-year-olds. Multivariable logistic regression revealed significant associations, in 3-year-olds, of caries experience with presence of dental plaque (OR = 7.93; 95% CI: 2.56–24.55) and reported consumption of sugared drinks at night (OR = 7.96; 95% CI: 1.57–40.51). In 5-year-olds, significant associations were seen with age (OR = 7.79; 95% CI: 2.38–25.43), gender (OR = 0.37 with 95% CI: 0.19–0.71 for girls), presence of visible dental plaque (OR = 3.36; 95% CI: 1.64–6.89) and reported habit of having sugar-containing drinks in between meals (OR = 2.60 with 95% CI: 1.16–5.84 and OR = 3.18 with 95% CI: 1.39–7.28, respectively for 1×/day and > 1×/day versus not every day). In 5-year-olds with caries experience (30.8% of total sample), the severity of disease was further analysed ($d_3$mft between 1 and 4 versus $d_3$mft 5 or higher). Multivariable analyses showed a significant association with gender [girls more likely to have higher disease levels; OR = 4.67 (95% CI: 1.65–13.21)] and with presence of plaque (OR = 3.91 with 95% CI: 1.23–12.42). *Conclusions:* Presence of visible plaque accumulation and reported consumption of sugared drinks were associated with prevalence of caries experience in Flemish preschool children. Severity of disease was associated with gender and with presence of plaque. Results underline the importance of plaque control and diet management from very young age on.

Key words: caries experience; preschool children; primary dentition

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Despite the fact that the oral health of preschool children improved considerably in most industrialized countries over the past decades (1), dental caries remains an important childhood disease affecting a considerable proportion of young children. Moreover, the distribution of disease levels shows increasing polarization (2–4) and in some areas a rise in dmft scores has been noticed (5–7). The strong polarization of disease distribution, even at very young ages, indicates that a

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considerable proportion of the target group does not benefit from traditional preventive approaches (8).

As caries experience in the primary dentition is a strong predictor for cariogenic breakdown of the permanent dentition (9–13), further research should chart oral health and its determinants in very young children. The start of oral health promotion needs to be situated in early life.

In Flanders, only a few surveys on the oral health of preschool children have been carried out so far. Decreasing caries experience levels have been reported in 5-year-olds in the period between 1981 and 1994. The number of children without visible caries experience increased from 32% to 56% (14, 15). More recent data are not available.

The aim of the present study was to examine the prevalence and severity of caries experience in Flemish preschool children and to assess the association of disease distribution with oral hygiene levels, reported oral health behaviors and socio-demographic factors. The information was collected with the purpose of developing oral health promoting initiatives in preschool children.

Materials and methods

Study sample

The present study is part of the analysis of the baseline data collected at the start of the 'Smile for Life' (Tandje de Voorste) project, a prospective oral health promotion project in preschool children in Flanders (Belgium). The study samples comprise 1250 3-year-olds (born in 2000) and 1283 5-year-olds (born in 1998), from four distinct geographical areas. As selecting individual children would not have been feasible for ethical, practical and economical reasons, the sampling was performed based on listings of kindergartens in the areas considered. In Flanders, more than 99% of 3-year-old and more than 98% of 5-year-old children attended kindergarten in the school year 2002–2003 (source: Ministry of the Flemish Community, Education Department). The kindergartens were selected using stratified cluster sampling without replacement. The target population was divided in three strata, representing the three different types of educational system (state, municipal and private institutions), taking care of an equal spread on rural and urban regions. Whenever a kindergarten was selected, all children in the first (3-year-olds) and third (5-year-olds) grade were included. The kindergartens were selected with a probability proportional to their size. In this way each child of the region had the same probability of being selected. The samples represent about 30% of the population of interest in each of the four regions. Only five out of 80 contacted schools refused to participate in the study. Table 1 provides more detailed characteristics of both samples.

Table 1. Sample characteristics

	3-year-olds	5-year-olds
Number of children	1250	1283
Girls (%)	47.4	49.2
Mean age (SD) (years)	3.3 (0.3)	5.3 (0.3)
Caries experience deciduous dentition (d3 level) (%)		
$d_3mft = 0$	93.1	69.2
d_3mft 1–4	6.1	23.6
$d_3mft \geq 5$	0.8	7.2
Restorative index = 0 (%)	89.2	54.8

Restorative index = f/(d + f).

Questionnaires

Parents of the children were asked to complete a pre-tested and validated questionnaire consisting of structured open-ended questions covering oral hygiene and dietary habits, oral health behaviors and socio-demographic variables (16). For the content of the questions we refer to Table 2. The socioeconomic status of the child was evaluated on the basis of the highest educational level attained by the mother and father (17).

The questionnaires were distributed to the parents through the teacher and were accompanied by a letter explaining the purpose of the survey. Parents were asked to complete the questionnaire and return it to the teacher. At the same time, permission was asked to have the child examined by a dentist. The study protocol was approved by the ethics committee of the Katholieke Universiteit Leuven.

Completed questionnaires were returned for 89% of the sampled children in both age groups.

Clinical examination

The children were examined in kindergarten, in a classroom. Parents did not know the exact date of the clinical examination in advance in order to minimize potential bias (e.g. by extra brushing). Participation levels of 3- and 5-year-olds to the clinical examination were 93.8% and 96.3%, respectively. The examinations were performed by one of eight dentist-examiners. The dentists were trained in the use of the examination methodology. Calibration sessions, consisting of the examination of

Table 2. Socio-demographic variables and (reported) oral health behaviours in 3 and 5-year-old children

	3-year-olds		5-year-olds	
	Numbers	%	Numbers	%
Socio-demographic variables				
Home situation				
Both parents	997	92.1	970	88.7
Other	85	7.9	124	11.3
Educational level mother				
Primary & secondary school	402	43.7	286	42.1
College or higher education	425	46.3	319	47.0
University	92	10.0	74	10.9
Educational level father				
Primary & secondary school	482	52.7	344	50.6
College or higher education	307	33.5	240	35.3
University	126	13.8	96	14.1
Presence of dental plaque[a]				
No	736	69.3	753	62.7
Yes	326	30.7	447	37.3
Oral hygiene habits				
Age at start brushing				
1 year or younger	360	35.7	271	61.5
more than 1 year	455	45.1	134	30.5
more than 2 years	194	19.2	35	8.0
Help with brushing				
Daily	524	50.1	367	33.3
More than once a week	370	35.4	394	35.7
Less than one a week	151	14.5	342	31.0
Brushing frequency				
More than once a day	184	17.6	252	23.0
Daily	556	53.2	620	55.7
Less than once a day	306	29.2	222	20.3
Dietary habits				
Use of nursing bottle				
No	581	59.5	931	88.0
Yes	396	40.5	127	12.0
Application of sweet on pacifier				
Never	912	87.3	937	87.4
Sometimes or always	133	12.7	135	12.6
Cleaning of pacifier in own mouth				
Never	504	50.7	541	54.4
Sometimes or always	471	48.3	453	45.6
In between meals eating				
Less than once a day	200	19.1	190	17.2
Daily	479	45.7	474	42.8
More than once a day	370	35.2	442	40.0
In between meals drinking (sugared)				
Less than once a day	326	31.0	394	35.5
Daily	306	29.1	316	28.5
More than once a day	419	39.9	399	36.0
Drinks at night (sugared)				
None	934	88.9	980	89.4
Daily or more	116	11.1	116	10.6
Snacks at night				
Less than once a week	794	76.0	849	77.6
Once a week	137	13.1	118	10.8
Daily	114	10.9	127	11.6

Totals less than 1250 in 3-year-olds and 1 283 in 5-year-olds are because of missing observations.
[a]Obtained by clinical examination.

children of the same age but not participating in the survey, were organized. The dentist-examiners were assisted by a nurse, who was responsible for on-site input of the clinical data into an electronic database using Dental Survey Plus version 4.50B (Providence software; Providence Software

Solutions Inc., Cary, NC, USA). Data were transferred into SAS®-files (version 8.2) for further analyses.

The oral cavity of the children was examined with the child seated on an ordinary chair, using a mouth mirror with built-in light source (Mirrorlite™ by Defend® from Medident, Belgium) and a WHO/CPITN type E probe (Prima Instruments, Gloucester, United Kingdom). The level of oral hygiene was assessed using the method described by Alaluusua et al. (18). This index records the absence/presence of plaque by visual examination. Buccal surfaces of teeth 52, 55, 72 and 75 were scored [in accordance with Carvalho et al. (14)]. A global plaque score (PI) was obtained by summation of individual scores and division by the number of surfaces evaluated.

Caries experience was recorded using the criteria proposed by the British Association for the Study of Community Dentistry (BASCD) (19). When necessary, teeth were cleaned and/or dried using cotton rolls. No radiographs were taken. Caries experience was recorded at the level of initial disease (d1 level) with tooth surface as the unit of observation. In the current report data are presented and analysed at the level of cavitation (d3 level) observed at tooth level.

Data analysis

Questionnaire data were entered twice (by two different persons) using Excel (Microsoft); Excel Compare™ Version 2.0.3 (http://www.formulasoft.com/) was used to check correspondence between the two databases. All inconsistencies between both files were checked with the original questionnaires until two identical files were obtained. Clinical and questionnaire data were first converted and then merged into SAS-datafiles.

Simple as well as multivariable logistic regression analyses were performed for all covariates under investigation with caries experience (expressed as a binary outcome, i.e. $d_3mft = 0$ versus $d_3mft > 0$) as outcome variable. The analyses were corrected for examiner misclassification, based on the results of the calibration exercises. The sensitivity and specificity in the scoring of caries experience was estimated for each dental examiner versus the benchmark scorer (first author). Sensitivity scores ranged between 0.57 and 0.71, specificity scores ranged between 0.87 and 1.00. The estimates were then used to adjust the logistic regression estimates for misclassification as performed by Magder and Hughes (20) and Lesaffre et al. (21).

In addition, in 5-year-olds with caries experience, the severity of caries experience (d_3mft 1–4 versus $d_3mft \geq 5$) was further investigated by means of univariable as well as multivariable logistic regression analyses. These analyses were not performed in 3-year-olds as the low prevalence of severe caries experience in this age group (only 0.8% with $d_3mft \geq 5$) would not render enough power.

For all statistical analyses, the statistical significance level was set at 0.05.

Results

Table 2 shows that a considerable number of 3- and 5-year-old Flemish children (8% and 11%, respectively) do not grow up in a family environment where both parents are present. The largest proportion of mothers received education at the level of college or non-university higher education (46% and 47% of mothers of 3- and 5-year-olds, respectively), a slightly smaller group of mothers did not continue educational training after primary and/or secondary school (44% and 42%, respectively) and about 10% received education at university level (10 and 11%, respectively). About half of the fathers received education at primary or secondary school level (53% and 51% of fathers of 3- and 5-year-olds, respectively); approximately 14% of fathers received training at university level.

Table 2 also presents more detailed information on oral health behavior, in 3- and 5-year-olds as reported by the parents. Interestingly, parents of 3-year-olds reported to have started brushing the teeth of their child at a later age (the largest group (45%) between the ages of 1 and 2 years) than parents of 5-year-olds (largest group (62%) reported the start of tooth brushing before the age of 1 year). Providing help with tooth brushing was much more common in the youngest than in the older age group (50% and 33% of parents, respectively, reported helping their child on a daily basis). Most 3- and 5-year-olds brushed once a day (53% and 56%, respectively). A considerable proportion of children in both age groups, did not brush on a daily basis (29% and 20%, respectively).

With regard to dietary habits, eating between main meals is common among both 3- and 5-year-olds, with 35% and 40% of them having several eating moments per day on a regular basis. The same is observed for the consumption of sugar-containing drinks (other than water or plain milk) in between main meals with 40% of 3-year-old and

36% of 5-year-old Flemish children receiving sugar-containing drinks between meals at more than one occasion per day. Parents were also asked whether their child was allowed to have sugared drinks at night (at bedtime or during the night). This seems to be a regular habit for 11% of both 3- and 5-year-old Flemish children. Snacking at night on a daily basis was reported for 11% and 12% in the youngest and oldest age groups, respectively.

A large group of Flemish 3-year-olds (41%) used a nursing bottle, while this habit was reported in 12% of 5-year-olds. By 13% of parents from both 3- and 5-year-olds the application of sugared substances on their child's pacifier was reported. The habit of 'cleaning' the child's pacifier in the parent's mouth (e.g. when accidentally fallen on the floor) was reported by 48% and 46% of parents in the respective age groups.

The clinical examination revealed that visible plaque accumulation was present in 31% of 3-year-olds and 37% of 5-year-olds.

In 3-year-olds, 93.1% presented without visible signs of caries experience. A $d_3$mft-score between 1 and 4 was seen in 6.1% of the children; 0.8% presented with a $d_3$mft score of 5 or higher. Because of the strongly skewed distribution of caries experience scores, mean values are not very informative and are therefore not reported. In 5-year-olds, 69.2% of the children did not show any sign of caries experience when examined clinically. A $d_3$mft-score between 1 and 4 was seen in 23.6%, a score of 5 and higher was recorded in 7.2% of 5-year-olds. The restorative index [expressed as the ratio of the number of filled teeth (f) to the number of decayed teeth (d) and filled teeth (f), i.e. f/(d + f)] was equal to 0 for 89.2% of 3-year-olds and 54.8% of 5-year-olds (Table 1).

Results of univariable logistic regression analyses (with caries experience as the outcome variable) are shown in Tables 3 (for 3-year-olds) and 4 (for 5-year-olds). In 3-year-olds, significant associations were observed between visible caries experience and increasing age, lower educational level of the mother, presence of dental plaque accumulation, lack of help provided with brushing, reported habit of applying sugared substances on pacifier, the consumption of sugar-containing drinks in between meals and having sugared drinks at night. In 5-year-olds, significant associations were found with increasing age, gender (boys at higher risk), lower educational level of both mother and father, presence of dental plaque accumulation, reported habit of having sugar-containing drinks in between meals and having snacks at night.

In 3-year-olds, multivariable logistic regression revealed significant associations with presence of dental plaque (OR = 7.93 with 95% CI: 2.56–24.55) and sugared drinks at night (OR = 7.96 with 95% CI: 1.57–40.51) (Table 3). In 5-year-olds, multivariable analyses showed significant associations with age (OR = 7.79 with 95% CI: 2.38–25.43), gender (OR = 0.37 with 95% CI: 0.19–0.71 for girls), presence of visible dental plaque (OR = 3.36 with 95% CI: 1.64–6.89) and sugar-containing drinks between meals at least daily (OR = 2.60 with 95% CI: 1.16–5.84 and OR = 3.18 with 95% CI: 1.39–7.28, respectively for 1×/day and >1×/day versus not every day) (Table 4).

In 5-year-olds with caries experience (30.8% of total sample), the severity of disease was further analysed ($d_3$mft between 1 and 4 versus $d_3$mft equal to 5 or higher). Results of univariable and multivariable logistic regression analyses are presented in Table 5. Univariate analyses revealed significant associations with gender (increased risk for girls), educational level of the father, presence of visible dental plaque, higher age at start of brushing and the consumption of sugar-containing drinks at night. Multivariable analyses showed a significant association with gender (girls are more likely to have higher disease levels; OR = 4.49 with 95% CI: 1.61–12.51) and with presence of plaque (OR = 3.91 with 95% CI: 1.22–12.45).

Discussion

The aim of the present study was to chart young children's oral health in Flanders. Data presented in this report originate from four distinct geographical areas in Flanders and cannot be regarded as representative for children of that age for the whole of Flanders. Within each region, however, care was taken to collect data from a representative sample. Based on earlier work, we also know that the selected regions reflect the situation in the whole of Flanders quite well (22, 23).

Participation levels obtained in this survey, both for questionnaire data and for clinical observations, are high and can be regarded as sufficient to allow valid conclusions.

Results show that in 3-year-olds, one out of 14 children presented with visible signs of caries experience, mostly untreated disease. Most of the disease was found in primary molars. At the age of

Table 3. Univariable and multivariable logistic regression models for caries experience ($d_3mft = 0$ or not) in 3-year-olds

	Univariable		Multivariable	
Variable	OR	95% CI	OR	95% CI
Age (year)	**3.32**	**1.11–9.88**	3.64	0.53–25.21
Gender				
Boys (ref)				
Girls	1.67	0.87–3.21	1.45	0.49–4.28
Home situation				
Both parents (ref)				
Other	1.94	0.68–5.54	1.30	0.22–7.47
Educational level mother				
Primary & secondary school (ref)				
College or higher education	**0.45**	**0.21–0.98**	1.12	0.36–3.42
University	0.27	0.04–1.75	1.01	0.12–8.46
Educational level father[a]				
Primary & secondary school (ref)				
College or higher education			0.46	0.13–1.59
University			0.18	0.02–1.55
Presence of dental plaque				
No (ref)				
Yes	**4.29**	**2.27–8.12**	**7.93**	**2.56–24.55**
Age at start brushing				
1 year or younger (ref)				
More than 1 year	2.02	0.83–4.89	3.08	0.93–10.16
More than 2 year	1.94	0.66–5.69	1.31	0.26–6.64
Help with brushing				
Daily (ref)				
More than once a week	1.96	0.84–4.56	1.68	0.48–5.82
Less than one a week	**3.45**	**1.32–8.99**	4.09	0.87–19.25
Brushing frequency				
More than once a day (ref)				
Daily	2.50	0.63–9.87	4.62	0.49–43.91
Less than once a day	3.04	0.74–12.56	2.21	0.20–24.61
Use of nursing bottle				
No (ref)				
Yes	0.72	0.33–1.57	0.56	0.20–1.55
Application of sweet on pacifier				
Never (ref)				
Sometimes or always	**0.34**	**0.15–0.77**	0.31	0.09–1.10
Cleaning of pacifier in own mouth				
Never (ref)				
Sometimes or always	0.72	0.35–1.49	0.42	0.15–1.14
In between meals eating				
Less than once a day (ref)				
Daily	0.87	0.34–2.20	0.96	0.23–4.06
More than once a day	0.79	0.30–2.10	0.78	0.16–3.76
In between meals drinking (sugared)				
Less than once a day (ref)				
Daily	1.51	0.48–4.72	1.47	0.36–6.04
More than once a day	**2.77**	**1.06–7.24**	1.98	0.56–7.07
Drinks at night (sugared)				
None (ref)				
Daily or more	**6.65**	**2.21–19.98**	**7.96**	**1.57–40.51**
Snacks at night				
Less than once a week (ref)				
Once a week	0.88	0.31–2.50	0.90	0.23–3.54
Daily	0.49	0.10–2.50	0.41	0.07–2.52

OR, odds ratio; ref, reference; results significant at 5% level marked in bold.
[a]Not possible to fit the model for this variable.

Table 4. Univariable and multivariable logistic regression models for caries experience ($d_3mft = 0$ or not) in 5-year-olds

	Univariable		Multivariable	
Variable	OR	95% CI	OR	95% CI
Age (year)	**3.06**	**1.54–6.08**	**7.79**	**2.38–25.43**
Gender				
Boys (ref)				
Girls	**0.61**	**0.41–0.92**	**0.37**	**0.19–0.71**
Home situation				
Both parents (ref)				
Other	1.29	0.64–2.60	0.62	0.21–1.80
Educational level mother				
Primary & secondary school (ref)				
College or higher education	**0.56**	**0.35–0.91**	0.55	0.25–1.22
University	**0.34**	**0.15–0.75**	0.30	0.07–1.20
Educational level father				
Primary & secondary school (ref)				
College or higher education	**0.47**	**0.29–0.78**	0.84	0.39–1.82
University	**0.43**	**0.22–0.87**	0.73	0.22–2.35
Presence of dental plaque				
No (ref)				
Yes	**3.53**	**2.18–5.72**	**3.36**	**1.64–6.89**
Age at start brushing				
1 year or younger (ref)				
More than 1 year	1.59	0.82–3.08	1.50	0.57–3.94
More than 2 year	2.99	0.78–11.42	1.24	0.29–5.34
Help with brushing				
Daily (ref)				
More than once a week	1.57	0.92–2.71	1.24	0.53–2.88
Less than one a week	1.40	0.81–2.40	1.61	0.74–3.50
Brushing frequency				
More than once a day (ref)				
Daily	1.38	0.78–2.43	1.21	0.56–2.62
Less than once a day	1.77	0.90–3.51	0.71	0.23–2.23
Use of nursing bottle				
No (ref)				
Yes	1.54	0.74–3.24	1.15	0.36–3.70
Application of sweet on pacifier				
Never (ref)				
Sometimes or always	0.66	0.33–1.33	1.24	0.49–3.15
Cleaning of pacifier in own mouth				
Never (ref)				
Sometimes or always	1.14	0.71–1.82	1.07	0.57–2.00
In between meals eating				
Less than once a day (ref)				
Daily	0.62	0.33–1.17	0.40	0.16–1.02
More than once a day	0.90	0.48–1.69	0.65	0.25–1.71
In between meals drinking (sugared)				
Less than once a day (ref)				
Daily	**2.27**	**1.30–3.97**	**2.60**	**1.16–5.84**
More than once a day	**2.96**	**1.73–5.05**	**3.18**	**1.39–7.28**
Drinks at night (sugared)				
None (ref)				
Daily or more	12.82	0.26–635.28	1.64	0.18–14.63
Snacks at night				
Less than once a week (ref)				
Once a week	**2.85**	**1.25–6.47**	2.12	0.71–6.39
Daily	**2.18**	**1.02–4.66**	1.59	0.56–4.47

OR,odds ratio; ref, reference; results significant at 5% level marked in bold.

Table 5. Univariable and multivariable logistic regression models for severity of caries experience ($d_3$mft 1–4 versus $d_3$mft > or = 5) in 5-year-olds

	Univariable		Multivariable	
Variable	OR	95% CI	OR	95% CI
Age (year)	2.25	0.84–6.03	5.85	0.99–34.59
Gender				
Boys (ref)				
Girls	**2.36**	**1.32–4.21**	**4.49**	**1.61–12.51**
Home situation				
Both parents (ref)				
Other	1.88	0.78–4.48	1.30	0.20–8.46
Educational level mother				
Primary & secondary school (ref)				
College or higher education	0.53	0.26–1.09	0.53	0.15–1.88
University	0.39	0.08–1.86	1.56	0.11–21.35
Educational level father				
Primary & secondary school (ref)				
College or higher education	**0.32**	**0.08–0.62**	0.34	0.07–1.56
University	0.35	0.09–1.24	0.79	0.10–5.96
Presence of dental plaque				
No (ref)				
Yes	**3.84**	**2.02–7.32**	**3.91**	**1.22–12.45**
Age at start brushing[a]				
1 year or younger (ref)				
More than 1 year	1.08	0.44–2.65		
More than 2 year	**3.22**	**1.01–10.24**		
Help with brushing				
Daily (ref)				
More than once a week	2.11	0.92–4.83	3.83	0.87–16.76
Less than one a week	0.97	0.38–2.43	0.75	0.17–3.20
Brushing frequency				
More than once a day (ref)				
Daily	0.99	0.40–2.43	3.07	0.53–17.75
Less than once a day	1.35	0.50–3.64	2.04	0.24–17.18
Use of nursing bottle				
No (ref)				
Yes	1.53	0.62–3.74	2.06	0.48–8.85
Application of sweet on pacifier				
Never (ref)				
Sometimes or always	0.82	0.34–1.97	1.21	0.31–4.67
Cleaning of pacifier in own mouth				
Never (ref)				
Sometimes or always	0.81	0.39–1.66	0.65	0.23–1.83
In between meals eating				
Less than once a day (ref)				
Daily	0.57	0.24–1.38	0.29	0.06–1.23
More than once a day	0.69	0.30–1.60	0.65	0.14–2.91
In between meals drinking (sugared)				
Less than once a day (ref)				
Daily	1.94	0.73–5.13	1.88	0.42–8.33
More than once a day	2.00	0.80–5.02	1.38	0.29–6.60
Drinks at night (sugared)				
None (ref)				
Daily or more	**3.49**	**1.11–10.96**	5.17	0.56–47.31
Snacks at night				
Less than once a week (ref)				
Once a week	0.87	0.35–2.13	0.53	0.12–2.42
Daily	1.21	0.51–2.90	1.39	0.34–5.60

OR, odds ratio; ref, reference; results significant at 5% level marked in bold.
[a]not included in multivariable model.

5, almost one out of three children had experienced caries with more than half of them without any sign of treatment. Only little information is available on the oral health of 3-year-olds in Flanders. Earlier work showed that in 1995, 69% of children from this age group (living in the area of Leuven) presented with caries experience (14). In a recent study in 3-year-old innercity children (city of Ghent), it was found that 18.5% of the children suffered from early childhood caries (24). However, comparison of the results of these studies is difficult as the methodology used (e.g. initial lesions included in one of the studies) and geographical area studied differ considerably. In an earlier study on 5-year-olds in 1990–1991, data were collected at a regional level, but using a comparable methodology (22). At that time, 41% of the children presented with caries experience and the restorative index was 0 in 70%. Although comparison should be performed with caution, it appears that a marked decline in caries prevalence took place in Flanders over the past decade, accompanied by an increase in treatment level.

When looking at determinants for experiencing caries ($d_3$mft different from 0), analyses at the age of 3 years indicate that caries experience is significantly associated with visible dental plaque accumulation and with having drinks at night. At the age of five, significant predictors of caries experience were: age, gender, visible plaque accumulation and the habit of having sugar-containing drinks between main meals. In both age groups, sugar-containing drinks (regularly consumed at night or between meals) are to be considered as an important determinant for caries experience in childhood. This confirms earlier work on caries susceptibility in early childhood (25). When developing oral health promoting activities towards parents and their young children, this topic certainly needs to be addressed. Although limitation in recall and motives of social desirability often distort answers obtained via questionnaires (26), it is remarkable that high numbers of Flemish parents reported habits such as frequent eating and drinking between main meals and even at night. Surprisingly, large numbers of 3- and 5-year-old children still used a nursing bottle (often at night). More research is needed to look for reasons for this habit, possible consequences (e.g. orthodontic problems) and ways to prevent it.

The second significant determinant for experiencing caries is the presence of visible plaque accumulation. This underlines the importance of efficient plaque control. The fact that plaque (besides gender) is the only significant variable in the analysis of severity of caries experienced in 5-year-olds, confirms this even more. The results in this study show that a considerable proportion of Flemish preschool children do not brush their teeth on a daily basis. This is in agreement with earlier findings with respect to oral hygiene habits of Flemish children. In a comparison between 32 countries from different continents, parents of Flemish children reported the most unfavorable brushing habits regarding regularity of cleaning (27). In the Flemish regional survey from 1990 to 1991, 38.9% of the parents of 5-year-olds reported that their child did not brush every day (22). The present report shows that not only the regularity of brushing seems to be a problem, but that also providing help with brushing can be improved considerably.

When asked for the age of the child at the start of brushing, very different answers were obtained for 3- and 5-year-old children. Parents of 5-year-olds reported significantly more often that they started brushing their child's teeth before the age of 1 year than parents of the younger children. As this unexpected result is probably because of recall bias the impact of this phenomenon should be considered when interpreting the results.

Although young parents are nowadays informed at child care centers about the cariogenic effect of the application of sweets on the pacifier, the habit is still widespread among Flemish parents. Also, parents seem to have no problem with 'cleaning' the pacifier of their child in their own mouth after it has fallen on the floor. Almost half of the parents admit doing so or having performed so. As this habit facilitates the transmission of oral bacteria, and more specifically *Streptococcus mutans* species (28), it also needs to be considered in preventive projects and its impact on oral health further investigated.

Caries experience is significantly associated with gender. Girls are less likely to experience oral disease by the age of 5 years than boys do. However, when girls do experience caries they will present more severe disease levels. A possible explanation for this finding remains highly speculative. Earlier emergence of primary teeth in girls than in boys (yet to be confirmed), would result in longer exposure times of teeth to the oral environment and this could explain more advanced disease levels when caries is present. However, this hypothesis needs confirmation.

In many reports on the oral health of young children, socio-demographic variables have been shown to be potent discriminators of oral health inequalities (24, 29, 30). This is not remarkable as dental caries is a multi-factorial disease closely related to lifestyle. The exact mechanism however, remains incompletely explained. In the present report, social class seems not to impact profoundly on caries experience of the children after correction of all other possible confounding factors. One reason could be that social class acts as a proxy for a range of other underlying oral health determining variables that had already been adopted in the multivariable model.

Another reason could be that the variable used in the present study (highest educational level attained by the parents) is not a good indicator for social class in this setting. However, earlier work showed that (oral) health outcomes in children are highly correlated with parents (31) and especially mother's education attainment (27, 32). Other possible variables that could be used as a measure for deprivation are occupational status, family income or composite measures combining unemployment rates, overcrowding and access to material resources (e.g. car, television). Information on none of these was available in the present survey.

Finally, it should be kept in mind that information obtained using questionnaires is often distorted because of recall bias and motives of social desirability leading to information bias (26). However, it is important to realize that the effect of the variables considered in the analyses is attenuated rather than reinforced by this phenomenon.

Conclusion

As the present analyses illustrated that the presence of visibly detectable dental plaque and the reported consumption of sugar-containing drinks at night or between meals were associated with a high prevalence of dental caries in preschool children, as well as with the severity of caries experience, oral health promotion initiatives should be directed towards these risk indicators. Further research should establish the determinants of these risk behaviors and investigate the effectiveness of interventions to prevent them.

Any oral health promoting program in young children should include recommendations for obtaining adequate plaque control (and an evaluation of the clinical outcome) and warnings for the potential risk for caries development when sugared substances are consumed at night or between meals on a frequent basis.

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