

Differences in oral health behaviour between children from high and children from low SES schools in the Netherlands.

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Objective To identify the determinants of dental caries in relation to socio-economic status (SES) within oral health, children's eating habits and parental attitudes towards oral health. **Basic research design** Dental screening data were collected from 6- and 10- year old schoolchildren from low and high SES schools in the Netherlands in this cross-sectional study. **Methods** The clinical examination was performed by trained dental hygiene students who collected the data on dental caries, dental plaque and duration of brushing. The paper questionnaire completed by the parents included 18 questions about oral health behaviour, eating habits and parental attitudes towards oral health. **Results** Two of the six parameters of oral health behaviour were statistically associated with the high caries prevalence in the low SES group (brushing frequency ($p = 0.028$) and age at the first visit to the dentist ($p = 0.044$)). High intake of fruit juices and/or soft drinks ($p = 0.043$) and low calcium intake ($p = 0.028$) were identified as risk determinants for caries with low SES. All parameters of parental attitudes towards oral health were associated with caries, but not with SES. **Conclusions** This study confirmed that the high caries prevalence in children from low SES schools was associated with oral health behaviour and eating habits. The role of parents was indirectly associated with the occurrence of dental caries. Therefore, it is important to include parents in all intervention programmes in order to reduce the prevalence of caries.

Keywords: Behaviour, children, dental caries, oral health, socio-economic status.

Introduction

During the 20th century, dental caries has become a major health care problem leading to high levels of dental morbidity across the world (Hobdell *et al.*, 2003). In the Netherlands children's dental health reached an all time low in the late sixties, when DMFS (Decayed, Missed, Filled Surfaces) of 6-year-old children was at 16.8 (Burgersdijk and Truin, 1997).

Low socio-economic status (SES) appeared to be an important risk determinant for dental caries, particularly in children (Hobdell *et al.*, 2003; Gillcrist *et al.*, 2001; Burgersdijk and Truin, 1997). SES explains approximately 50% of the variance in the prevalence of dental caries at 12 years of age (Hobdell *et al.*, 2003). Moreover, caries prevention programmes in most industrialised countries in the seventies were demonstrated to be less effective in children from low SES groups (Burgersdijk and Truin, 1997; Vanobbergen *et al.*, 2001). Subsequently, the decline in caries in 12-year-old children from low SES groups in the Netherlands has halted (e.g. average DMFT- Decayed, Missed, Filled Teeth is 1.1). In contrast, the percentages of caries-free children from middle and high SES groups have continued to rise (Truin *et al.*, 1998). Currently, low SES groups are still distinguished by high numbers of cavities caused by dental caries (van Loveren and Eijkman, 2003).

In the Netherlands risk determinants for dental caries are low fluoride exposure due to starting tooth brushing at a later age, as well as a lower brushing frequency (Burgersdijk and Truin 1997, Hobdell *et al.* 2003). However, these risk determinants are not able to explain the differences between SES groups in caries prevalence in Flemish children (Vanobbergen *et al.*, 2001).

Other factors such as a high level of carbohydrate consumption appear to be risk determinants in low SES children in countries where a major part of the population belongs to a low SES group, such as Mexico and Brazil, but not in Western European countries. In Brazil, 38% of private school children were caries-free compared to 26% of public school children. For Mexico City, these figures were 29% and 10% respectively (Freire *et al.*, 1996, Irigoyen *et al.*, 1999).

Although oral health behaviour is directly related to the presence of dental caries, it is also likely that SES status modifies the relationship between oral health behaviour and the likelihood of dental caries. However, the underlying factors that lead to an increased risk of dental caries in children from low SES groups are still poorly understood (Reisine and Psoter, 2001). In order to develop effective intervention programmes for low SES groups other determinants of dental caries need to be evaluated.

We aimed to identify risk determinants in children's oral health, eating habits and parental attitudes towards oral health, which are modified by SES status.

Methods

A cross-sectional comparative study was conducted with 12 primary schools in the northern region of the Netherlands. Once parents had given informed consent, two age groups of children (6 and 10 years of age) were submitted to dental screening. Parents were asked to fill out a questionnaire which had been developed by seven professionals in dental and nutritional care.

Schools were classified by overall SES level by post-code based on information regarding well-being, parental educational attainment, parental origin, family income and type and costs of housing. A low level SES school was defined by the presence of more than 50% special needs pupils. Special needs pupils are children of parents with low educational level, poorly educated immigrants and the travelling community. [Dutch Ministry of Education] (Mureau and van der Star, 2004). A high level SES school has less than 50% special needs pupils.

The date of birth, gender and the first name of the children included were collected. Trained and calibrated dental hygiene students from the Hanze University of Groningen performed all dental screenings using a penlight, wooden spatula and a disposable speculum to identify caries and plaque.

The criteria for caries were as follows: The presence of a restoration or an enamel interruption clearly visible to the unaided eye was scored as true or false. The presence of plaque amongst 10 year-old children was recorded on the inside and outside of each single element. For the 6-year-old children the presence of plaque was quantified by dividing the mouth into sextants. Tablets to colour the plaque were only used among the 10-year old children.

After the dental screening all children were asked to brush their teeth as usual. The duration of brushing was timed, however the children were not made aware of this in order to avoid measurement bias.

The questionnaire addressed issues about oral care, children's eating habits and parental attitudes towards oral health. Parents were asked about daily brushing frequency, the timing and duration of brushing, visits to the dentist, as well as about food intake, which addressed the quality, quantity and composition of foods. Parents' experience with caries prevention, teaching their children to brush their teeth and control of sweet consumption were included in the attitude questions.

The statistical analysis focused on identifying risk determinants for caries (in oral care, eating habits and parental attitudes towards oral health) and association between caries and the school SES. The data were analysed using univariate analyses and evaluated at a p-value < 0.05. Data analysis were performed using SPSS 11.00 (SPSS Inc., Chicago, USA).

Results

A total of 496 children were asked to participate in the study. Parents from 40 children refused to provide in-

formed consent, whilst parents of 155 children did not reply to the request. A total of 301 children participated in this study with 184 children from low and 117 from high SES schools. Questionnaires were collected from all 301 subjects, whilst 271 children were available for caries screening. Caries were observed in 51% (82/161) of the 6-year old children and in 56% (62/110) of the 10-year old children.

The overall caries prevalence for children in the low SES schools was 10% higher than in the high SES schools ($p = 0.145$).

Table 1 shows the univariate associations between oral health behaviour and caries. Eighty-four percent (213/253) of the children observed brushed for less time than the recommended two minutes. Four of the six variables were significantly associated with caries i.e., brushing frequency, the age at first visit to the dentist, plaque percentage and check-up visits. Participants who brushed less than twice daily were more likely to have caries. Children over two years of age at the time of their first visit to the dentist were more likely to have caries. Differences in the use of an adult or child's concentration of dentifrice for 10-year old children and duration of brushing were not associated with caries

Intake of fruit juices and/or soft drinks, as well as calcium intake were significantly associated with caries (Table 2) The amount of calcium intake (based on the intake of milk and milk products) was inversely related to caries prevalence. Children who did not take the recommended amount of calcium had a higher risk of caries. The number of snack events and high carbohydrate consumption through sweet snacks were not significantly related to dental caries.

All six evaluated parameters in the parental attitudes to oral health were significantly associated with the caries prevalence (Table 3).

Table 1 shows univariate associations between oral health behaviour and SES. Two variables were significantly associated with the SES of the school: brushing frequency and age at the first visit to the dentist. Participants who brushed less than twice a day and children over 2 years of age at the time of their first visit to the dentist were more likely to be of low SES ($p = 0.028$, and $p = 0.044$, respectively). Percentage plaque, check-up visits, concentrations of dentifrice and duration of brushing were not associated with SES.

Intake of fruit juices and/or soft drinks and calcium intake were significantly associated with SES ($p = 0.043$, and $p = 0.028$ respectively). Seventy-two percent of children in low SES schools were drinking more than five glasses of juice and/or soft drinks a day compared to 22% of the children in high SES schools. The number of snack events and the high carbohydrate consumption through sweet snacks were not significantly related to SES (Table 2). None of the parameters relating to parental attitude towards oral health evaluated were significantly associated with the school SES (Table 3). In respect of the association with SES, more children from low SES schools would avoid brushing their teeth (30% vs. 20%). Similarly, more parents from low SES schools found it difficult to prevent caries (50% vs. 38%), to control the number of snack events (27% vs. 19%) and to keep their child's teeth healthy (51% vs. 41%) (Table 3).

Table 1. SES and oral health behaviour determinants in relation to caries and school SES

<i>Risk determinant</i>	<i>Caries (n=271)**</i>		<i>SES of the school (n=301)**</i>	
	<i>Yes</i> <i>n=144</i>	<i>No</i> <i>n=127</i>	<i>Low</i> <i>n=184</i>	<i>High</i> <i>n=117</i>
SES of the school (%)				
Low ¹	65	56		
High ²	35	44		
p-value	0.145*			
Brushing frequency (%)				
< 2 a days ¹	44	20	36	23
≥ 2 a days ²	56	80	64	77
p-value	<0.001		0.028	
Plaque percentage (%)				
≥ 30 ¹	77	50	67	69
< 30 ²	23	50	33	31
p-value	<0.001		0.739*	
Age on first visit to the dentist (%)				
3-5 years or over ¹	64	47	60	48
0-2 years ²	36	53	40	52
p-value	0.007		0.044	
Dentifrice (only 10-year-old children) (%)				
Children dentifrice ¹	16	15	52	59
Adult dentifrice ²	84	85	48	41
p-value	0.875*		0.026	
Check-up visits (%)				
< 2 x years ¹	36	24	30	26
≥ 2 x years ²	64	76	70	74
p-value	0.027		0.448*	
Duration of brushing (%)				
< 2 minutes ¹	87	81	86	81
≥2 minutes ²	13	19	14	19

¹ Positive and ² negative exposure

* Not significant

** Data of some participants were missing and therefore numbers do not always add up to the presented totals

Table 2. Eating habit determinants in relation to caries and school SES.

Risk determinant	Caries (n=271)**		SES of the school (n=301)**	
	Yes n=144	No n=127	Low n=184	High n=117
Number of glasses of fruit juices/soft drinks	(%)			
≥ 5 glasses ¹	42	16	33	22
≤ 4 glasses ²	58	84	67	78
p-value	<0.001		0.043	
Number of snack events (%)				
≥ 5 a day ¹	39	28	38	30
≤ 4 a day ²	61	72	62	70
p-value	0.073*		0.236*	
Number of sweet snacks (%)				
≥ 5 a day ¹	7	8	9	6
≤ 4 a day ²	93	92	91	94
p-value	0.617*		0.439*	
Calcium units (%)				
< recommended units ¹	40	26	39	26
≥ recommended units ²	60	74	61	74
p-value	0.024		0.028	

¹ Positive and ² negative exposure

* Not significant

** Data of some participants were missing and therefore numbers do not always add up to the presented totals

Discussion

In this cross-sectional study, we found associations between the determinants in oral health behaviour, eating habits and parents' attitude towards oral health and caries prevalence. We also found differences in the oral health, eating habits and parents' attitude towards oral health between children from low and high SES-schools.

Four of six variables concerning oral health behaviour were associated with caries prevalence. In this study, it was found that the children with caries often brush less than twice a day, have a high amount of dental plaque, visit the dentist later in life and visit the dentist for a check-up less than twice a year. Amongst eating habits, we found that high consumption of fruit juices and/or soft drinks, as well as low consumption of milk and milk products and the number of snack events were associated with caries prevalence. All variables in the parental attitudes towards oral health were also significantly associated with caries prevalence.

High prevalence of caries in the low SES schools in this study (58%) was associated with two primary components: oral health behaviour and eating habits. Brushing frequency, the age at first visit to the dentist, intake of fruit juices and/or soft drinks and calcium intake were associated with low school SES. None of the variables in the parental attitudes towards oral health was significantly associated with SES.

Children from low SES schools brushed less often than other children and there was a significant difference in child's age at the first visit to the dentist and SES. Low fluoride exposure due to a low brushing frequency is a risk determinant for low SES children, and was also found in previous studies by Burgerdijk and Truin (1997) and Hobdell *et al.* (2003). The children's age at the time of their first visit to the dentist was a significant predictor of caries prevalence in both SES groups, but particularly in the low SES group (Cosic *et al.*, 2005). Children who visit the dentist early in life and those who visit the dentist regularly for a check-up have a better chance of caries-free teeth. A possible reason for this difference is that these children are able to profit more from an individual prevention programme. Gillcrisp *et al.* (2001) found that there was a significant difference in the number of protective dental sealants between high and low SES children (Gillcrisp *et al.*, 2001). Low SES children have an increased risk of developing caries more frequently, since these children's teeth surfaces are often not protected by a sealant. Parents in this study also lacked information about oral health, due to the low number of visits to the dentist, although there was no significant difference in number of visits between the SES groups.

In our study a high number of (sweet) snack events, consisting of several types of carbohydrates was not found to be a significant risk factor for caries. Furthermore,

Table 3. Determinants of parents' attitudes towards oral health in relation to dental caries and school SES.

Risk determinant	Caries (n=271)**		SES of the school (n=301)**	
	Yes n=144	No n=127	Low n=184	High n=117
Children who may skip brushing (%)				
Yes ¹	34	20	30	20
No ²	66	80	70	80
p-value	0.012		0.087*	
It is difficult to prevent caries for a parent (%)				
Yes ¹	55	31	50	38
No ²	45	69	50	62
p-value	<0.001		0.057*	
What is the parents' opinion on the number of snack events (%)				
Too high ¹	18		12	11
To low or good ²	82	93	88	89
p-value	0.016		0.938*	
It is difficult to know how many sweets my child eats (%)				
Yes ¹	33	15	27	19
No ²	67	85	73	81
p-value	0.001		0.114*	
It is difficult to teach the child brushing (%)				
Yes ¹	48	27	39	38
No ²	52	73	61	62
p-value	<0.001		0.958*	
It is difficult to keep child's teeth healthy (%)				
Yes ¹	61	33	51	41
No ²	39	67	49	59
p-value	<0.001		0.134*	

¹ Positive and ² negative exposure

* Not significant

** Data of some participants were missing and therefore numbers do not always add up to the presented totals

this was also not related to SES. These findings are not comparable with the results of studies demonstrating that high carbohydrate consumption is a risk factor for low SES children in less developed countries (Freire *et al.*, 1996; Irigoyen *et al.*, 1999). The results of our study suggest that high intake of (sweet) snacks is not responsible for the high number of low SES children with caries in West European countries. This conclusion is supported by the Vanobbergen *et al.* (2001) study. The high consumption of fruit juices and/or soft drinks and low consumption of milk and milk products are, on the other hand, a significant risk factor for caries prevalence amongst these children. The low SES children consume significantly more fruit juices and/or soft drinks than

children from other SES groups (Cosic *et al.*, 2005), which was also observed in this study. Low consumption of milk and milk products in the children with low SES is probably associated in equal measure with high consumption of fruit juices and/or soft drinks. Recommendations to consume more milk and/or milk products instead of fruit juices and/or soft drinks should be made in intervention programmes for oral nutritional health.

Many parents in this study found it difficult to prevent caries, keep children's teeth healthy, teach children to brush their teeth and control the number of occasions their children snacked. The parents of the children from low SES schools did not significantly differ from other parents in their attitudes towards oral health. However,

slight differences in terms of percentages were found between the low and high SES schools for children avoiding brushing, as well as parents who found it difficult to prevent caries and keep their children's teeth healthy and control the number of times the children snacked. In addition, all the above determinants in oral health behaviour and eating habits were dependent on parental attitude.

In summary, parental attitudes towards oral health could be one of the most important determinants for developing caries in low SES children, although no significant relationship was demonstrated in this study.

Free access to dental care for children under the 18 years is provided in The Netherlands and there are a sufficient numbers of dentists and dental hygienists to provide this type of care. Furthermore, there is no difference in levels of accessibility to dental care between children from low and high SES backgrounds.

Since caries is defined only as clearly visible enamel interruption in this research, it is expected that the actual number of children with caries not visible yet is much higher. Caries detection with an analytical eye is less reliable under these circumstances (using only penlight and no possibility to dry the tooth surface); this may also contribute to an underestimation of the true caries prevalence among these children. In our study, we made a distinction between intake of snacks and sweet snacks, which may have caused some confusion for the parents answering these questions. The amount of calcium intake in this study was based on the intake of milk and milk products alone, and additional information about the daily diet is also required. One limitation of the study is that the data on the SES used were based on the percentages of special needs pupils per school, whereas differences at the individual level were not investigated. This may also have been a reason there was no significant association between the school SES and caries prevalence for this study. This contrasts with other studies which have found a relationship at an individual level. SES and social class are complex concepts determined by occupation, household, education and many other factors (Vanobbergen *et al.*, 2001, Thomson and Mackay, 2004), and therefore, additional research is required.

An important benefit of this study was the differences observed in oral health and eating habits between the low and high SES schools. This could be of significant value for developing an effective intervention programme for children from low SES schools. However, intervention programmes such as these should address risk determinants from all three components: oral health behaviour, eating habits and parental attitudes towards oral health, since it is known that the first two are indirectly related to parental attitudes towards (oral) health. These programmes should include both parents and children. A long-term national plan will be required in order to reduce differences in oral health between SES groups.

Conclusion

This study confirmed that the high prevalence of dental caries in children from low SES schools is associated with oral health behaviour and eating habits. The role of parents' attitudes towards oral health and low SES was not statistically significant. However, there was an indirect relationship due to parental influence in upbringing and teaching children oral and eating habits. Therefore, it is important to include parents in all intervention programmes in order to reduce caries prevalence in this group.

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