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# Determinants of ECC in Sardinian preschool children

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***Objective*** The aim of the study was to assess the influence of determinants on the presence of caries in pre-school children. ***Basic research design*** A matched case-control study (1:2) was designed: 55 children (32 males, 23 females) with at least one buccal or lingual caries lesion on one primary maxillary incisors were selected (caries affected=1) and compared to randomly selected controls (no caries=0) from the same sample paired for age and gender. Several variables concerning oral hygiene habits, use of fluoride supplementation, dietary habits, socio-economic status of the family and lifestyle factors were considered as risk predictors for early childhood caries (ECC). A conditional logistic regression model was used to perform matched case-control analysis. ***Results*** Bottle feeding at night (OR=1.90; 95%CI=1.03-3.50) and socio-economic level (OR=1.69; 95%CI=1.01-2.81) were positively associated with case status. ***Conclusions*** We conclude that ECC seemed to be associated with a low socio-economic level and bottle feeding at night.

*Key words: Case-control study, childhood caries, socio-economical levels, epidemiology.*

The term early childhood caries (ECC) was coined more than ten years ago to describe rampant caries in young children. ECC is particularly prevalent amongst toddlers from low income, immigrant and ethnic minority backgrounds (Ismail and Sohn, 1999). The case definition of ECC is not easy and as a result the absence of a generally acceptable definition renders it difficult to make a proper comparison between past and present surveys (Hallett; 2000; Pendrys *et al*., 2004; Quinonez *et al*., 2001; Roeters *et al*., 1995; Tinanoff, 1998). ECC can be defined in terms of the number of teeth affected (DenBesten and Berkowitz, 2003; Duperon, 1995; Hallett, 2000); Ismail (2003) defines ECC as the occurrence of any sign of dental caries on any tooth surface during the first three years of life. In a workshop held in 1999, ECC was defined, "…to indicate the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth. The participants recommended that the term "severe early childhood caries" refer to children with "atypical," "progressive," "acute" or "rampant" patterns of dental caries. The participants also agreed that "early childhood" should include all preschool-aged children between birth and 71 months of age." (Drury *et al*., 1999).

ECC is an infectious disease and *Streptococcus mutans* is the most likely causative agent; diet (feeding practices), oral hygiene and socio-economical level of the family also play a critical role in the acquisition and clinical expression of the disease (Quinonez *et al*., 2001). No national data on caries prevalence in Italy are present, although a comparison of *dmft* levels in pre-school children in three different Italian areas was recently published (Castiglia *et al*., 2002), the highest *dmft* levels were in Sassari, Sardinia (Italy). Several case-control studies about risk predictors for ECC have been reported (Ismail and Sohn, 1999). Yet, scant research and health care resources have been allocated to allow a better understanding of this disease process.

In previous work, we described the caries experience of kindergarten children in an area of Northern Sardinia (Campus *et al*., 2004). Overall, caries experience was 29.8% with a higher *ds* value in males. The present study evaluates the influence of several determinants, besides oral hygiene conditions on the presence of ECC in pre-school children in the town of Sassari. We sought to elucidate the relationship between ECC and oral hygiene habits, dietary habits, socio-economic and life-style factors and use of fluoride supplementation.

## Materials and Methods

### *Study design and survey instrumentation*

From the children enrolled in a previous study (Campus *et al*., 2004) a matched case-control study was designed. Fifty-five subjects (32 males, 23 females; age range: 2.5-4.5 years) with at least one buccal or lingual caries lesion on one primary maxillary incisors (Drury *et al*., 1999) were selected (ECC=1) from 418 subjects and compared to randomly selected controls (ECC=0) paired (1:2) for age and gender, selected from the same sample. All the subjects selected were of Italian ethnicity and lived in the same area, Sassari, from birth. An anonymous questionnaire was filled in by children's parents. The questionnaire was organized in five sections. The first section "Oral Hygiene Habits" included questions on frequency of toothbrushing habits (FTH) and parents or child toothbrushing use (PTU). The second section "Use of Fluoride Supplementation" consisted of questions regarding the use of fluoride tablets (FT) and the

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use of fluoridated toothpastes or mouthrinses (FTM); the third section "Dietary Habits" concerned of breast feeding (BrF), use of pacifier with sugar at night (PSN), bottle feeding (BF), frequency of sweet food (SF) and cariogenic diet (CD). The next section "Socio-Economic status of the family" was based on the SocFam method (Bolin *et al*., 1997) which was developed to codify the socio-economic level of the family based on the parent's occupation status; social class level was based on the higher occupation status of both father or mother; SocFam was then encoded to medium low, medium, medium-high. The final section "Lifestyle factors" related to the frequency of dental check-up.

Only the children of parents who signed consent were enrolled.

### *Clinical examination*

Children were examined visually by one dentist. The examiner was calibrated to assess caries and enamel defects (Kappa value=0.97). Decay was recorded at the dentinal level $d_3$ (Fyffe *et al*., 2000). Subjects were examined using a plain mirror, the WHO CPITN ballpoint probe under optimal lighting. Bitewing radiography or fiber-optic trans-illumination were not used.

### *Data management and statistical analyses*

Data were coded and imputed into a database (Microsoft® Access 97) and checked to verify data accuracy. Statistical analysis was performed using Stata 7.0 for Windows and Episheet© 2003 (Rothman, 2003). The association between ECC and dichotomous explanatory variables was tested via matched case-control data procedure in Episheet© 2003. The criterion for statistical significance was set at $\alpha$=0.05. A conditional logistic regression model was applied to the analysis of matched case-control studies (Breslow, 1982) for polytomic explanatory variables. The analysis included case status (ECC=1) as the dependent variable and the variables concerning Oral Hygiene Habits, Use of Fluoride Supplementation, Dietary Habits, Socio-Economic status of the family and Lifestyle factors as risk predictors for ECC.

**Table 1.** Distribution of cases and controls, odds ratios and 95% Confidence Intervals (CI), by dichotomous explanatory variables.

| *Background* | *no. of exposed controls* | | | | *OR* | *95% CI* | | *P-Value* |
|---|---|---|---|---|---|---|---|---|
| | *2* | *1* | *0* | | | *Inf* | *Sup* | |
| *No fluoride supplementation (FT)* | | | | | | | | |
| exposed cases | 24 | 15 | 3 | 42 | 1.24 | 0.56 | 2.71 | 0.606 |
| unexposed cases | 5 | 7 | 1 | 13 | | | | |
| Total | 29 | 22 | 4 | 55 | | | | |
| *Breast feeding (BRF)* | | | | | | | | |
| exposed cases | 9 | 12 | 4 | 25 | 0.61 | 0.31 | 1.19 | 0.151 |
| unexposed cases | 8 | 17 | 5 | 30 | | | | |
| Total | 17 | 29 | 9 | 55 | | | | |
| *Bottle feeding (BF)* | | | | | | | | |
| exposed cases | 0 | 5 | 13 | 18 | 2.82 | 1.29 | 6.17 | 0.009 |
| unexposed cases | 0 | 11 | 26 | 37 | | | | |
| Total | 0 | 16 | 39 | 55 | | | | |
| *Use of pacifier with sugar at night )PSN)* | | | | | | | | |
| exposed cases | 2 | 10 | 10 | 22 | 1.43 | 0.73 | 2.80 | 0.308 |
| unexposed cases | 2 | 17 | 14 | 33 | | | | |
| Total | 4 | 27 | 24 | 55 | | | | |
| *Cariogenic diet (CD)* | | | | | | | | |
| exposed cases | 37 | 7 | 1 | 45 | 0.60 | 0.22 | 1.60 | 0.289 |
| unexposed cases | 7 | 1 | 1 | 9 | | | | |
| Total | 44 | 8 | 2 | 54 | | | | |
| *Use of fluoridated toothpaste or mouthrinses (FTM)* | | | | | | | | |
| exposed cases | 12 | 11 | 3 | 26 | 0.53 | 0.26 | 1.08 | 0.073 |
| unexposed cases | 11 | 10 | 5 | 26 | | | | |
| Total | 23 | 21 | 8 | 52 | | | | |

**Table 2.** Conditional logistic procedure for polytomic explanatory variables.

a) SocFam: high level as referent
Log likelihood =-57.60 n° obs=165 LR$\chi^2_2$=5.63 p=0.059

| *outcome* | *OR (95% CI)* | *p- value* |
|---|---|---|
| medium | 2.18 (0.77 – 6.17) | 0.14 |
| low | 3.42 (1.15 – 10.14) | 0.03 |

*b) Frequency of toothbrushing habits (FTH) : > twice a day as referent*
*Log likelihood =-55.79 n° obs=159 LR$\chi^2_3$=4.88 p=0.18*

| *outcome* | *OR (95% CI)* | *p- value* |
|---|---|---|
| <1 a day | 3.66 (0.89 – 14.97) | 0.07 |
| 1 a day | 2.88 (0.91 – 9.17) | 0.07 |
| >1 a day | 5.32 (0.77 – 36.77) | 0.09 |

c) Frequency of sweet food (SF) : once a week as referent
Log likelihood=-59.85 n° obs=165 LR$\chi^2_2$=1.15 p=0.56

| *outcome* | *OR (95% CI)* | *p- value* |
|---|---|---|
| 1 a day | 1.03 (0.44 – 2.43) | 0.95 |
| >1 a day | 1.49 (0.59 – 3.78) | 0.40 |

## Results

The distribution of cases and controls, odds ratios and 95% confidence intervals by dichotomous determinants is displayed in Table 1. A significant role was played by bottle feeding use (OR=2.82, 95%CI: 1.29-6.17; p=0.009). The exposure to FTM was higher among controls (64.4% *vs* 50.0%), but was not statistically significant (OR=0.53, 95%CI: 0.26-1.08; p=0.073). No other relevant differences in exposure among cases and controls was found for the other dichotomous explanatory variables.

Table 2 shows the results of the three conditional regression analyses for the association between cases status and the polytomic explanatory variables: socio-economic levels, frequency of toothbrushing, frequency of sweet food. A low level of SocFam showed a significant association to case status (OR=3.42, 95%CI: 1.15-10.14; p=0.03). No significant association with case status was found across exposure levels for FTH and SF levels (p>0.05). The effect of significant covariates on case status was evaluated by conditional regression procedure (Table 3). Bottle feeding (OR=1.90; 95%CI=1.03-3.50) and socio-economic level (OR=1.69; 95%CI=1.01-2.81) were positively associated to case status.

**Table 3.** Odds ratio (OR) and 95% confidence intervals for ECC by SOCFAM and BF.

Log likelihood =-55.50 n° obs=165
LR $\chi^2_2$=9.85 p=0.007

| *outcome* | *OR (95% CI)* |
|---|---|
| SOCFAM | 1.69 (1.01 – 2.81) |
| Bottle Feeding | 1.90 (1.03 – 3.50) |

## Discussion

Caries experience in Sardinian kindergarten children was higher than that reported in other European surveys (Sundby and Petersen, 2003). Severe anomalies in the balance among bacteria, substrate and host are the factors claimed to result in ECC, but the socio-economical status of the family and behavioral habits also has a substantial impact on the development of ECC.

Horowitz (1998) reported on Duperon‘s suggestion (1995) of an association among lower socio-economic level, bottle feeding habits and ECC. In addition, several studies in Europe, the USA, Middle and Far East (DenBesten and Berkowitz, 2003; Roeters *et al*., 1995; Tinanoff, 1998) described the important effect of these factors on oral health status. Low socio-economic status compromises the ability of individuals to care for their health leading to a reduced resistance to oral and other diseases.

Uncorrected nursing habits (bottle-feeding, use of pacifier at night, etc.) are the most frequently reported causes of ECC (Ismail and Sohn, 1999), but the disease may also occur in children who are breast-fed. In the United States, for example, the majority of babies are fed using a nursing bottle, yet the majority of them do not develop ECC (Horowitz, 1998).

Contrary to almost universally accepted findings, the preventive role of fluoride supplementation was not statistically associated with case status in our study. This could be related both to the rare use of fluoride supplementation in our district and in Italy in general, as was previously reported by Petti *et al*. (2000), and to the increase in the use of fluoridated toothpastes.

A number of limitations should be also considered when interpreting these findings. For example the study

was cross-sectional and, consequently, no information is available regarding to lesion progression; the methods used for caries diagnosis (visual inspection with probe and mirror) may be considered a limitation, but these methods are considered to have excellent reliability (Bolin *et al*., 1997; Campus *et al*. 2004; Castiglia *et al*., 2002).

In conclusion, our results highlight the role played by socio-economic status, dietary habits like bottle feeding, and behavioural habits in the development of ECC. We hope that the results of our study help in the promotion of improved oral health amongst infants and small children in Sassari.

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