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Original Article

Dentistry Section

The Association between Cariogenic Factors and the Occurrence of Early Childhood Caries in Children from Salem District of India

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ABSTRACT

Introduction: Various aetiological factors for Early Childhood Caries (ECC) have been suggested in literature, but the role of each factor has been disputed in various studies.

Aim: To evaluate the association between ECC and its related factors in children between three to six years of age, from rural, semi-urban and urban schools in the district of Salem (India).

Materials and Methods: The study consisted of children between three to six years of age, selected randomly from schools in semi-urban, urban and rural schools at Salem. Questionnaire (comprising of the factors associated with ECC) and parental consent forms were sent to each of the parents of the school children. Filled questionnaires and parental consent forms were obtained from a total of 2771 children, out of which 1771 were boys and 1000 were girls. Clinical examination for ECC was carried out according to the WHO criteria, by a single examiner and an assistant to eliminate inter-examiner variability. Statistical analysis was carried out using the student's independent t-test and ANOVA (one way analysis of variance).

Results: Out of a total of 2771 children examined, only 443 (315 boys and 128 girls) children were found to have ECC (16 %). Significant correlations were found between the occurrence of ECC and various factors like age of parents, number of siblings, on-demand breast feeding and bottle feeding habits and sweetened pacifier use. However, factors such as age and gender of the child, type of birth and duration of pregnancy, had no significant correlation with the occurrence of ECC.

Conclusion: The need for educating parents on the ill effects of improper breast feeding and bottle feeding habits is important.

Keywords: Bottle feeding, Breast feeding, Pacifier, Pregnancy

INTRODUCTION

Dental caries can result in pain, loss of function, early tooth loss and subsequent malocclusion, growth retardation, loss of self-esteem, impairment in quality of life and failure to thrive [1-3]. ECC has been defined as "the presence of one or more decayed, missing due to caries, or filled tooth surfaces in any primary tooth in children under six years of age" [4]. In developing countries like India, changes in lifestyle and diet are resulting in increased incidence of dental caries [5]. In a recent study conducted in Salem (Tamil Nadu, India), the prevalence of ECC was found to be 16% with a mean Decayed and Filled Surfaces (DFS) of 5.23±1. It was found to occur commonly in children from low socioeconomic strata, children belonging to working mothers and in children with less educated parents [6]. Although, the prevalence of ECC was found to be high in Salem, there is no literature on the role of various other factors that may have contributed to it, such as age and gender of the child, parental age, number of siblings, use of sweetened pacifiers, type of birth, breast feeding and bottle feeding habits. Moreover, the risk factors of ECC have been found to differ from one population to the other [7]. Therefore, this study was aimed at evaluating the association between these factors and the occurrence of ECC in children aged between three to six years, from rural, semi-urban and urban schools in the district of Salem.

MATERIALS AND METHODS

This cross-sectional study consisted of children between three to six years of age, selected randomly from upper and lower kindergarten schools located in urban, semi-urban and rural areas of Salem. Urban, semi-urban and rural areas were determined on the basis of the data obtained from the municipality office at Salem. Ethical committee approval and permission to conduct the examination in children were obtained from the dental college and school authorities, respectively. Questionnaire and parental consent forms were sent to each of the parents of the children, for obtaining permission for the childs' participation in the study. Mentally challenged children and those with developmental disorders of teeth were excluded from the study. Filled questionnaires and parental consent forms were obtained from a total of 2771 children, out of which 1771 were boys and 1000 were girls. Clinical examination was performed by a single examiner to eliminate inter-examiner variability. Intra-examiner reliability was assessed from 15% of the children (416) who constituted the total sample (2771). Out of 416 children, a batch of 30 children was examined for ECC per day. The examination was repeated the next day for the same batch, along with examination of another batch of 30 children, and so on. Thus, completion of assessment of intra-examiner reliability was completed over a period of three months. Kappa statistic was calculated in order to obtain the agreement between examinations, and was found to be 0.88 (good agreement).

Intraoral examination for dental caries was carried out according to the WHO criteria in schools under visible light, using the Community Periodontal Index (CPI) probe on the occlusal, buccal, lingual, palatal, mesial, distal and incisal surfaces [8]. The mothers and teachers of the children were provided oral health education in their respective schools on a separate day, after the completion of oral examination in children. The questionnaire contained questions comprising of the child's name, age, gender, number of siblings, parental age, use of sweetened pacifiers, process of birth, duration of pregnancy, breast feeding practices (on-demand breast feeding, time difference between breast feeding and sleeping, duration of each breast feed, frequency and duration of breast feeding) and bottle feeding practices (use of normal and sweetened bottle feed, nocturnal bottle feeding, frequency and duration of bottle feeding).

STATISTICAL ANALYSIS

Statistical analysis was performed using the program statistical package for social sciences (SPSS Inc, version 11.5, USA). Confidence interval of 95% and significance level of 5% ($p \leq 0.05$) was adopted. The students' independent t-test was used to compare mean dfs scores of any two groups, and the analysis of variance test (ANOVA) was used to compare mean DFS scores for more than two groups.

RESULTS

Out of a total of 2771 children examined, the number of children from rural, semi-urban and urban schools were 1022 (36.9%), 1300 (46.9%) and 449 (16.2%), respectively. Upon examination, only 443 (315 boys and 128 girls) children were found to have ECC.

Age and gender: Although, the number of caries lesions were found to increase with increasing age of the child (three to six years), the relation between increasing age and mean dfs values were not found to be statistically significant [Table/Fig-1]. Similarly, the relationship between the prevalence of ECC and gender was not found to be significant [Table/Fig-1].

Parental age: The occurrence of ECC was found to be proportional ($p<0.01$) with increasing age of the parents [Table/Fig-1].

Number of siblings: The occurrence of ECC was found to be proportional ($p<0.01$) with the number of siblings [Table/Fig-1].

Pacifier habit: ECC was found to be higher in children who used sweetened ($p<0.01$; [Table/Fig-1]) pacifiers.

Type of birth: ECC was found to occur more frequently in children born normally compared with those born through surgical intervention. However, the difference was found to be insignificant [Table/Fig-1]. ECC was found to occur more frequently in full term born children compared with those born prematurely. However, the difference was found to be insignificant [Table/Fig-1].

Factor	Value	N	%	Mean dfs	SD	t-test/ ANOVA	p
Age (years)	3	44	9.93	8.05	3.94	1.819 (ANOVA)	0.143
	4	50	11.29	10	4.78		
	5	110	24.83	8.88	4.28		
	6	239	53.95	9.05	3.9		
Parental age (years)	25 or less	125	28.22	8.28	4.08	3.993 (ANOVA)	0.003
	26 - 30	99	22.35	8.3	3.98		
	31 - 35	88	19.86	10.05	4.19		
	36 - 40	107	24.15	9.4	4.03		
	Above 40	24	5.42	10.25	4.01		
Number of Siblings	0	255	57.56	8.33	3.94	8.829 (ANOVA)	0.00
	1	122	27.54	8	4.16		
	2	53	11.96	8.98	3.9		
	Above 3	13	2.94	10.57	4.2		
Gender	Boys	315	71.11	8.85	4.17	1.31 (t-test)	0.192
	Girls	128	28.89	9.41	3.99		
Sweetened pacifiers	Given	173	39.05	12.31	2.78	17.58 (t-test)	0.00
	Not given	270	60.95	6.89	3.39		
	Total	443	100	9.01	4.12		
Process of Birth	Normal	295	66.59	9.09	4.27	0.538 (t-test)	0.591
	surgical	148	33.41	8.86	3.82		
	Total	443	100	9.01	4.12		
Duration of pregnancy	Premature	34	7.67	8.68	4.21	0.496 (t-test)	0.62
	Normal	409	92.33	9.04	4.11		
	Total	443	100	9.01	4.12		

[Table/Fig-1]: Association between various factors and the occurrence of ECC. N=Number; SD=Standard deviation; t-test=Student's independent t-test; ANOVA=One way analysis of variance; p=Probability

Factor	Practice	N	%	Mean dfs	SD	t-test/ ANOVA	p
On-demand breast feed	Given	218	49.21	10.18	4.09	6.13 (t-test)	0.00
	Not given	225	50.79	7.88	3.75		
	Total	443	100	9.01	4.12		
Time difference between breastfeeding and sleeping	Soon	159	35.89	10.33	4.06	5.17 (t-test)	0.00
	Late	284	64.11	8.28	3.97		
	Total	443	100	9.01	4.12		
Duration of each breast feed (minutes)	5	27	12.39	8.78	3.99	3.285 (ANOVA)	0.012
	10	86	39.45	9.59	4.33		
	15	61	27.98	10.87	3.64		
	20	28	12.844	10.86	3.95		
	30	16	7.34	12.56	4.15		
Frequency of breast feeding (per day)	2	14	6.42	9.43	4.09	6.247 (ANOVA)	0.00
	3	16	7.34	7.25	3.94		
	4	28	12.84	9.21	4.15		
	5	50	22.936	9.34	4.35		
	6	49	22.48	10	4.2		
	7	37	16.97	12.51	3.02		
	8	24	11.01	12.67	2.28		
Breast feeding duration (months)	6 or less	27	12.39	10	3.76	3.071 (ANOVA)	0.017
	7 - 12	111	50.92	9.69	4.24		
	13 - 18	23	10.55	9.17	3.38		
	19 - 24	35	16.055	11.71	4.21		
	Above 24	22	10.09	11.95	3.72		
	Total	218	100	10.23	4.13		

[Table/Fig-2]: Association between breast feeding and the occurrence of ECC. N=Number; SD=Standard deviation; t-test=Student's independent t-test; ANOVA=One way analysis of variance; p=Probability

Breast feeding habit: ECC was more prevalent ($p<0.01$) in children who were breast fed on-demand [Table/Fig-2]. The occurrence of ECC was found to increase proportionally with the duration ($p<0.05$; [Table/Fig-2]) and frequency ($p<0.01$; [Table/Fig-2]) of breast feeding, and the number of months of breast feeding ($p<0.01$; [Table/Fig-2]). ECC was also found to be higher ($p<0.01$) in children who were put to sleep soon after breast feeding [Table/Fig-2].

Factor	Practice	N	%	Mean dfs	SD	t-test/ ANOVA	p
Bottle feed	Given	140	31.6	9.89	3.83	3.084 (t-test)	0.002
	Not given	303	68.4	8.61	4.19		
	Total	443	100	9.01	4.12		
Bottle feed	Sweetened	92	65.71	10.3	3.79	1.772 (t-test)	0.049
	Non-sweetened	48	34.29	9.1	3.83		
	Total	140	100	9.01	4.12		
Nocturnal bottle feed	Practiced	77	17.38	9.94	3.75	2.17 (t-test)	0.031
	Not Practiced	366	82.62	8.82	4.17		
	Total	443	100	9.01	4.12		
Duration of bottle feed (minutes)	5	23	16.43	8.96	4.11	5.565 (ANOVA)	0.001
	10	62	44.29	8.85	3.81		
	15	32	22.86	11.28	3.38		
	20	23	16.42	11.7	3.08		
Frequency of bottle feed (per day)	2	16	11.43	9	4.05	5.603 (ANOVA)	0.041
	3	42	30	9.6	3.77		
	4	25	17.86	9.76	3.48		
	5	25	17.86	10.16	4.28		
	6	32	22.86	10.63	3.81		
	Total	140	100	9.89	3.83		

[Table/Fig-3]: Association between bottle feeding and the occurrence of ECC. N=Number; SD=Standard deviation; t-test=Student's independent t-test; ANOVA=One way analysis of variance; p=Probability

Bottle feeding habit: ECC was found to be higher in children who were bottle fed (p<0.01; [Table/Fig-3]); bottle fed with sugary fluids (p<0.05; [Table/Fig-3]) and bottle fed nocturnally (p<0.05; [Table/Fig-3]). The occurrence of ECC was also found to increase proportionally with the duration (p<0.01; [Table/Fig-3]) and frequency (p<0.05; [Table/Fig-3]) of bottle feed.

DISCUSSION

The questionnaire that was prepared was a modification of that used by Winter GB et al (1971), and was printed in English and Tamil languages [9]. The presence of caries on the labial or lingual surfaces of at least two maxillary incisors, with absence of caries in the mandibular incisors, was used as the criteria for assessing ECC [10,11]. The dfs index was used to assess the severity of ECC.

With regard to the increase in severity of ECC with increasing age of the child, our finding was similar to that of various authors [12-20]. Similar to the findings from two previous studies, the relation between the prevalence of ECC and gender was not found to be significant [14,21]. Most authors had found a greater prevalence of ECC among males [22-25], however, few had found the contrary [12,26].

The result from this study are similar to those of two previous studies which found the occurrence of ECC to be proportional with increasing age of the parents [15,27]. Our finding is also similar to those of three other studies which found a positive correlation between the occurrence of ECC and the number of siblings [17,20,28]. Although, Yen CE et al., found that ECC was likely to affect the second born child and those born after, Tusek I et al., [25] found that ECC was likely to affect the third born child and those born after. However, our result differs from that of Jain et al., who found that the number of siblings does not affect the occurrence of ECC [14]. With regard to the use of pacifiers, our finding was similar to those of three previous studies that found a positive correlation between sweetened pacifier use and the occurrence of ECC [12,14,28]. No significant relation was found between the occurrence of ECC and the duration of pregnancy, however, dos Santos Junior VE et al., had found a greater occurrence of ECC in preterm born children [29].

On-demand breast feeding has been known to be an important contributing factor for ECC [12,30,31]. A similar result was found in this study, however, it differs from those of three previous studies that found no relation between on-demand breast feeding and the occurrence of ECC [16,18,32]. The occurrence of ECC was found to increase proportionally with the duration of breast feeding, similar to the findings from two other studies [14,24]. However, the occurrence of ECC due to insufficient duration of breast feeding has also been reported [33]. The occurrence of ECC was found to increase proportionally with the frequency of breast feeding, similar to the findings from two other studies [23,34]. The occurrence of ECC was found to be related proportionally with the number of months of breast feeding beyond one year of age, similar to the findings from two other studies [35,36]. ECC has been reported to occur due to prolonged breast feeding beyond 12 months [37,38], 18 month [39] and 24 months [30,31,34] of age. However, Nunes AM et al., found that prolonged breast feeding had no effect on the occurrence of ECC [18]. ECC was also found to be higher in children who were put to sleep immediately after breast feeding, similar to the findings from three other studies [22,24,40].

Similar to the findings from two other studies, ECC was found to be higher in children who were bottle fed [28,41]. Moreover, it was found to be higher in children WHO bottle fed with sugary fluids, similar to findings from three other studies [13,24,35]. With regard to the occurrence of ECC due to nocturnal bottle feed, our results were similar with those found by various studies [12,13,22,24,32,35,37,38,40]. Perera PJ et al., found that the risk of ECC occurred when children were nocturnally bottle fed beyond two years of age [30]. However, Tanaka K et al., found that nocturnal bottle feeding did not result in ECC [39]. The occurrence of ECC was also found to increase proportionally with the duration and frequency of bottle feeding, similar to the findings by two other studies [14,42].

LIMITATION

This study had certain limitations. Convenience sampling method had been used in the study. With regard to the use of sweetened pacifiers and sweetened bottle feed, the degree of sweetness and the sweetening agents used could not be calibrated. The number of times that on-demand breast feeding was provided could not be assessed, since most mothers could not remember the number of times they had provided it per day. The time difference between breast feeding and sleeping could not be ascertained in minutes, since most mothers were unable to ascertain the same. Knowledge regarding the aetiologic factors causing ECC in children from Salem district, would help in its prevention through the implementation of oral health education programs. Parents who benefit from such programs would successfully improve feeding and dietary practices for their children, which would eventually reduce the occurrence of ECC in the future.

CONCLUSION

In children from Salem district, significant correlations were found between the occurrence of ECC and various factors like age of parents, number of siblings, breast feeding and bottle feeding habits and sweetened pacifier use. However, factors such as age and gender of the child, type of birth and duration of pregnancy, had no significant correlation with the occurrence of ECC. Moreover, the need to educate parents about the ill effects of improper breast feeding and bottle feeding habits is necessary.

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