The prevalence and risk factors of Early Childhood Caries among 3-year-old children in Wenzhou

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Research article

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Abstract

Background: This study aimed to investigate the prevalence and risk factors of Early Childhood Caries (ECC) among 3-year-old children in Wenzhou China. **Methods:** Preschool children aged 3 were recruited using a stratified cluster sampling method. Dental examinations were carried out by one trained dentist, and oral health-related data were collected. Examinations were surface-specific for dental caries, following World Health Organization (WHO) criteria. Bivariate tests and logistic regression models were used to investigate the risk factors of dental caries. **Results:** A total of 693 children were recruited for the study, and 445 completed the dental examination. Among the 445 children, the prevalence of ECC was 59.8%. The mean decayed, missing, and filled primary teeth (dmft) was 2.9, and of the total dmft, only 6.3% were filled. The mean decayed, missing, and filled primary surface (dmfs) was 4.9. Logistic regression analyses identified age and parents' oral health knowledge level were associated with the experience of ECC ($P < 0.05$). **Conclusions:** A higher prevalence of ECC was observed and most of the carious teeth were not restored. The experience of ECC was related to age and parents' oral health knowledge level.

Background

Dental caries (noncavitated or cavitated lesion) of primary teeth in children under the age of six is defined as Early Childhood Caries (ECC) [1]. Dental caries with a negative impact on the oral health-related quality of life (OHQoL) of children is one of the most common childhood disease [2, 3].

Declines in the prevalence of dental caries were observed in the developed countries during last three decades [4]. In contrast, because of the easy availability of refined sugars than earlier, compromised dental care and prevention, very few programs to eradicate the disease and poor public knowledge about the disease, dental caries in China has become a new threat and been on the rise [5, 6, 7, 8]. The Third National Oral Health Epidemiology Survey reported that the prevalence of caries was 66% and the mean decayed, missing, and filled primary teeth (dmft) score was 3.5 among 5-year-old children in China [7]. The high prevalence of early childhood caries exist in China is alarming.

ECC is a chronic and multifactorial infectious disease. The risk factors found to be responsible for ECC included low family socioeconomic status [9, 10], sugary snacks or beverages consumption [10, 11], nutritional problems, improper bottle use [12], poor oral hygiene status [9, 12], and higher levels of *Streptococci mutans* bacteria [10]. A systematic review revealed that longer duration of breastfeeding up to age 12 months would be a protective factor for dental caries [13]. However, children who were breastfed > 12 months were more likely to develop dental caries [13]. Owing to the different study designs and statistical analysis, the reports of risk factors for ECC in different population differ in part [14]. It has been revealed that the prevalence of 3 years old children in Wenzhou was very high [15]. However, the risk factors of dental caries among Wenzhou preschool children remained unknown. This investigation aimed to assess the relationships between the prevalence of ECC and dietary lifestyle, oral health behaviors, demographic risk indicators and socio-economic status in Wenzhou preschool children.

Methods

Selection of participants and sample size

Data from a longitudinal observational study in Wenzhou were used and analyzed. A stratified cluster sampling method was used. 6 kindergartens were sampled from three districts of Wenzhou. Three glasses from Grades 1 (aged 3-4 years) were sampled in the selected 6 kindergartens. It was reported that the prevalence of ECC in the 5-year-old age group in China was 66% [7][Qi, 2008 #45]. The sample size estimation was found to be 92. Because the participants were younger than 5 years old, it was speculated that the corresponding prevalence of dental caries would be less than 66%. Therefore, larger sample size was required. Eventually, 693 children aged 3-4 years were surveyed. Children with systemic diseases were excluded. The ethical approval for this study was obtained from the Institutional Ethics Committee of Wenzhou Medical University. The purpose and details of this study was explained, and written informed consent was obtained from parents or legal guardians.

Dental examination and diagnostic criteria

All eligible subjects received oral health examinations in the kindergarten. Only one calibrated examiner carried out the examination under natural light by using a World Health Organization (WHO) probe and a mouth-mirror. The examiners evaluated caries experience by using the WHO criteria [16] and without radiographs. 10% of children were re-examined to assess the intra-examiner reliability. Intra-examiner weighted kappa on tooth status was 0.96.

Data collection

Parents or other caregivers were asked to complete the survey questionnaire. Data were collected with the use of structured questionnaires. It mainly collected information included dietary lifestyle (e.g. frequency of snacks and drinks consumption, meals and drinks at night), and feeding habit (night-time nursing bottle use), oral hygiene practices (e.g. age brushing started and toothbrushing frequency), parental oral health behavior, utilization of dental services, and socio-demographic characteristic (e.g. parental education level, annual household income). Parental oral health knowledge about caries was collected.

Statistical analysis

The collected data were entered into Epidata software, version 3.1, and analyzed using SPSS version 19. The analysis first resulted in the reporting of descriptive statistics. Bivariate analyses were performed using the chi-square and Wilcoxon rank sum tests. We performed a t-test to test the differences in mean age between the children with and without caries. The risk factors associated with dental caries were

founded out using multivariable logistic regression model. P-value < 0.05 were considered of significance in this study.

Results

Caries experiences

A total of 693 children from six kindergarten were recruited for the study. 445 completed the dental examination, while the rest 248 children not examined as they were absent (often repeatedly) on the day of examination for undetermined reasons or of dental phobia.

Of the examined 445 children (mean age was 3.4 years), 206 (46.3%) were girls, and 239 (53.7%) were boys. The prevalence of ECC was 59.8%. The mean dmft score was 2.9 (standard deviation [17] = 3.7); the dmfs score was 4.9 (SD = 9.0). Prevalence of ECC in boys was 59.0%, while in girls was 60.7% (P=0.72). The mean dmft was 2.95 and was 2.74 in boys and girls (P=0.54).

The percentage of unrestored decayed teeth in this study was 93.7%. Approximately 30 percent (31.2%) of the children had four or more teeth with caries experience, consist of 80 percent of the decay.

Questionnaires were completed by the majority of parents (95%). There was no significant difference between ECC group and caries-free group.

Bivariate analysis

The relationship between ECC and dietary factors and oral hygiene practices were presented in Table 1. Out of the total sample, 38.8% children were breastfed, 37.1% children were formula fed, and 24.1% children were mixed with breastfed and formula fed; the prevalence of ECC of each group was 57.9%, 61.1%, and 59.8% respectively (P=0.84). Approximately 18% children had a history of sleeping with bottles. Dietary information collected showed that 13%, 57.9%, and 26.7% of the children consumed carbonated beverage, sweet snacks and candies/chocolate at least once a day. Out of the total sample, 17% children started toothbrushing before the age of 2; 74.2% children started toothbrushing when they were 2 to 3 years old; 8.7% children never have their teeth brushed. Approximately 50 percent (48.3%) children brushed their teeth at least once a day.

Table 2 showed the relationship between ECC and parental oral health behavior, socio-demographic factors and parents' oral health knowledge level. Out of total sample, 22% children brushed teeth under supervision every day; 69.7% children brushed teeth under supervision sometimes; 8.3% children performed unaided brushing; the prevalence of ECC of each group was 51.6%, 61.7%, and 62.9% respectively (P=0.14). Over 50 percent of children were from families with annual incomes of less than ¥100000, and 71 percent of mothers had no more than a high school education. No significantly difference was observed in different groups (P=0.21).

This study reported that 17.3% of the children had a previous visit to a dentist. Over 80 percent of children had never visit to a dentist in a year.

Bivariate analyses relating to the caries experience at 3 years found six factors (age, the main caretaker, consumption of candies/chocolate, age toothbrushing started, parental check after toothbrushing, and parental dental knowledge levels) significantly related at $P<0.15$.

Multivariable logistic regression analyses

The final multivariable logistic regression analyses revealed age and parental dental knowledge levels were associated with the experience of ECC ($P<0.05$) (Table 3).

Discussion

This study showed that the prevalence of dental caries among 3-year olds children in Wenzhou was 59.8%; it was higher than the prevalence of ECC in 3-4 years old in Beijing (49%)[8]. On average, the prevalence of dental caries among 3 years old children in China was 50.8%[6]. In Asian countries, such as India[18] and Singapore[19], the prevalence of dental caries in preschool children was found to be 47.3% and 49% respectively. The prevalence of dental caries among 3 years old children in Japan was 14.7% [20]. In some developed countries, the prevalence was low which was largely attributed to increasing awareness of oral hygiene behaviors, increasing access to fluoridation, and parental concern about the dental health[18].

It has been reported that about 80 percent of decayed teeth was found in 25 percent of children [21]. Similarly, this study reported that approximately 30 percent (31.2%) of children had more than 3 teeth with caries experience, which consists of 80 percent of the total decay detected. In this study, the percentage of unrestored carious teeth was 93.7%. It may be due to the lack of public knowledge about primary prevention and the shortage of dental health workers.

This study depicted that older children were more vulnerable to develop dental caries. Data in Tanzania[22] and Nigeria[23]showed that increase with age children were more likely to develop caries. These results are likely to be due to caries progression exposed to early caries challenge, and caries susceptibility [24].

Our study showed a negative association between parental dental knowledge levels and the experience of ECC. Similarly, Chen et al reported that parental oral knowledge levels were associated with dmft scores [25]. During the early years of life, parents play a vital role in taking appropriate health-related action for their children. Positive attitude and health knowledge of parents is of paramount importance to child's quality of life [26].

This study depicted that age toothbrushing started and parental check after toothbrushing would be predictors of dental caries, while it was unable to found the association between frequency of toothbrushing and dental caries. A longitudinal prospective study has shown that the children who brushed their teeth less often at age 2 were more likely to develop caries at age 5 [27]. In this study, the effect of twice daily tooth brushing was probably in part attenuated because of unaided toothbrushing. Collett et al stated that child's oral health was associated with parent-supervised toothbrushing [28].

It was unable to found the association between breastfeeding and dental caries in this study. However, Kato T et al stated that there was an association between bottlefeeding and dental caries[29],[#12973] while another authors have not found such an association [22]. Tham et al stated that longer duration of breastfeeding up to age 12 months would be a protective factor for dental caries, while breastfed > 12 months would be a risk factor[13]. The relationship between breastfeeding and development of ECC is still a contentious issue and further investigations are needed.

However, there are some potential limitations of this study, such as recall bias and social desirability bias existed. In addition, the study has not assessed other potential indicators, including oral counts of mutans streptococci; maternal oral health status; and the numbers of people in the household. Further prospective studies are needed which would give a better insight into the complex multi-factorial etiology of dental caries.

Conclusions

The prevalence of ECC among Wenzhou 3-4 years old children was very high and most of the carious teeth were untreated. There appears to be a relationship between consumption of candies/chocolate, the age at which toothbrushing was started, whether parents supervised to brush or not, and parents' oral health knowledge level and ECC.

Bullet Points

Why this paper is important to paediatric dentists

The prevalence of ECC varies from population to population, this study provide the prevalence of ECC in Wenzhou China. Because of different study designs, statistical analysis techniques, definitions of dependent and independent variables, children's ages, and presence of confounders, the risk factors of ECC differ in part. Partial risk factors are still a contentious issue and further investigations are needed.

Abbreviations

Dmfs: Decayed, missing, and filled surfaces; dmft: Decayed, missing, and filled teeth; ECC: Early childhood caries; SD: Standard deviation; WHO: World Health Organization.

Declarations

Ethics approval and consent to participate:

This study was approved by the institutional review board of School and Hospital of Stomatology, Wenzhou Medical University. The purpose and details of this study was explained, and written informed consent was obtained from parents or legal guardians of the participants.

Consent for publication:

Not applicable

Availability of data and materials:

The datasets analyzed during the current study will not be publicly available to protect patient confidentiality.

Competing interests:

The authors declare that they have no actual or potential conflicts of interest.

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Author's contributions:

LM designed the studies, carried out the dental examination and drafted the manuscript; ZW performed the statistical analysis and participated in its design; QL collected data, performed data analysis and made the charts in the manuscript; and XW carried out the studies, collected data, and helped to draft the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1: Relationship between ECC and dietary factors and oral hygiene practices

Variable(n)	Caries experience		p-value
	Yes(%)	No(%)	
Breastfeed or not			
almost bottle feed(157)	61.1	38.9	0.84
mixed feed (102)	59.8	40.2	
almost breastfeed(164)	57.9	42.1	
Slept with bottles			
never(348)	60.1	39.9	0.741
sometimes(39)	53.8	46.2	
always(36)	61.1	38.9	
Consumption of carbonated beverage			
<1 time/day (368)	57.9	42.1	0.183
1 time/day (37)	70.3	29.7	
≥1 time/day (18)	72.2	27.8	
Consumption of sweet snacks			
<1 time/day (178)	57.9	42.1	0.561
1 time/day (200)	59.5	40.5	
≥1 time/day (45)	66.7	33.3	
Consumption of candies/chocolate			
<1 time/day (310)	56.8	43.2	0.14
1 time/day (91)	68.1	31.9	
≥1 time/day (22)	63.6	36.4	
Sugary snack/drinks at night			
never(66)	53.0	47.0	0.37
sometimes(278)	59.7	40.3	
always(79)	64.6	35.4	
Age Toothbrushing started			
< 2 years (72)	50.0	50.0	0.14
2-3 years (314)	60.8	39.2	
never (37)	67.6	32.4	
Frequency of Toothbrushing			
≥2 time/day (51)	56.9	43.1	0.881
1 time/day (153)	60.8	39.2	
< 1 time/day (219)	59.4	40.6	

Table 2: Relationship between ECC and parental oral health behavior, socio-demographic characteristics and parents' oral health knowledge level

Variable(n)	Caries experience		p-value	
	Yes(%)	No(%)		
Help with toothbrushing				
once a day (93)	51.6	48.4	0.206	
sometimes (295)	61.7	38.3		
never (35)	62.9	37.1		
Check after toothbrushing				
once a day (66)	50.0	50.0	0.14	
sometimes (302)	60.3	39.7		
never (55)	67.3	32.7		
Annual family income				
¥50000 or less (42)		66.7	33.3	0.209
¥50000 to ¥100000 (187)		55.1	44.9	
¥100000 to ¥200000 (135)		65.2	34.8	
more than ¥200000 (59)		55.9	44.1	
Mother' education level				
less than high school(95)		62.1	37.9	0.176
high school or GED (222)		62.2	37.8	
attended college (106)		51.9	48.1	
Parents' oral health knowledge				
Good (79)		51.9	48.1	0.095
Medium level (202)		58.9	41.1	
Poor (142)		64.8	35.2	

Table 3: Multiple logistic regression analysis for the risk of the caries experience at 3 years

Characteristic	Coefficient	P-value	OR	95%CI
Age	0.083	0.001	1.086	[1.032-1.143]
Consumption of candies/chocolate	0.314	0.099	1.369	[0.942-1.990]
Age toothbrushing started	0.376	0.08	1.457	[0.957-2.218]
Parental check after toothbrushing	0.335	0.09	1.398	[0.949-2.06]
Parent's oral health knowledge level	0.294	0.044	1.341	[1.008-1.785]