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Original article

Factors associated with developmental defects of enamel and early childhood caries among Anganwadi children in Bangalore District : a cross-sectional study

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ABSTRACT

Introduction: Understanding risk factors for early childhood caries (ECC) is necessary to the implementation of preventive and restorative measures. Objective: To determine the factors associated with developmental defects of enamel and early childhood caries among Anganwadi children in Bangalore District.**Materials and Methods**: A longitudinal study recruited 200 mother-child pairs in Anganwadis in Bangalore District. Sociodemographic information, maternal and feeding factors were collected from the mothers through interview. The children underwent dental examination and the developmental defects of enamel and caries were assessed using WHO criteria. **Results**: Majority of the participants were aged 20-24 years at the time of delivery, reported normal and full term delivery with normal weight children. About 30(15%) children had caries experience(Mean caries experience: 0.64±1.64). Twenty two (11%) participants had developmental defects of enamel**.** There was no statistically significant association between developmental defects of enamel and birthweight [OR= 0.875 (95% CI 0.1856-4.1256)]type of feeding practices [OR= 0.4466 (95% CI 0.1717-1.1618)] duration of breast feeding [OR= 1.4583 (95% CI 0.5622-3.7829)] whereas statistically significant association was observed between developmental defects of enamel and dental caries [OR=2.786 (95% CI 1.003-7.7382)]. **Conclusions**: There was an association between developmental defects of enamel and early childhood caries among Anganwadi children in Bangalore District. There is need to institute strategies for the prevention of developmental defects of enamel and ECC considering its prevalence.

Introduction

Early childhood caries (ECC) is one of the most prevalent chronic conditions in childhood. Besides ECC children are also affected by developmental defects of enamel (DDE).[1] DDE (enamel hypoplasia, demarcated, diffuse opacity) in the primary dentition are visible deviations from the normal translucent appearance of tooth enamel resulting from damage of the enamel organ during amelogenesis. [2] Teeth with enamel defects have retentive areas that can lead to the build-up of bacterial plaque, facilitating the progression of carious lesions.[3] Premature birth[4] an absence of breastfeeding [5,6] low birth weight [6,7] social aspects and systemic problems in childhood[7] are the main causes of DDE. Some studies have addressed the influence of DDE on the occurrence of ECC, especially among preschool children [8-12] Under-nutrition and childhood infections during the period of tooth development were associated with enamel defects in socioeconomically underprivileged communities.[13]

Integrated Child Development Scheme(ICDS) is the world's most unique and largest programme for early childhood development programme, which is being

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operated for the past three decades.[14]The Anganwadi Programme, started by the Government of India in 1975 as part of the ICDS, is a grassroots programme that reaches out to women in rural areas and urban slums, to educate them on matters of basic health and hygiene, nutrition, pre-natal and post-natal maternal and childcare and child rearing. It caters to children in the 0-6 age group.[15] Despite evidence linking DDE with dental caries in the primary dentition, studies considering its prevalence and early life course determinants are scarce in India. The aim of the present study was to study the factors associated with developmental defects of enamel and early childhood caries among Anganwadi children in Bangalore District.

MATERIALS AND METHODS

This study is a part of a longitudinal study that was conducted in Birth Cohorts Enrolled in Anganwadis in Bangalore District from 2013 - 2016. Ethical approval was obtained from the Institutional Ethical Committee and Permission of the Director of Women & Child Development, Government of Karnataka was obtained. Informed Consent was obtained from the mothers

Training and calibration of the principal investigator was done in the Department of Public Health Dentistry, GDCRI, Bangalore. A pilot study was performed on 20 mothers to check the feasibility of the study in Bangalore District during July – September 2013. Prevalence of early childhood caries in various studies is about 17-78%. Assuming prevalence of early childhood caries to be 50%, relative precision to be 15% and tolerable error (α) to be 5% the sample size has been computed as 200.

Multistage random sampling procedure was followed to recruit the study samples. Out of six divisions in Bangalore District,Bangalore South was selected randomly. In Bangalore South Kengeri(Urban) and Kaggalipura(Rural) were randomly selected. Out of 29 Anganvadi Centres in Kengeri, and 35 Anganvadi Centres 10 Centres each were chosen randomly. From these 20 centres 200 Children aged less than 6 months enrolled in the Anganwadi and their mothers were recruited.

A structured proforma was used for data collection. This proforma consist of demographic information, maternal factors and clinical assessment. Clinical examination included assessment of dental caries and DDE according to WHO Oral Health Surveys: Basic Methods.[16] The data was collected from mother and children during working hours in their respective Anganwadis. Demographic information and other details were obtained by personal interview. Oral examination of the children was performed with the child seated on the mothers lap under natural light by a single investigator using mouth mirror and CPI probe, Infection control and sterilization measures were observed throughout the study.

Statistical Analysis

Data collected was entered in a MS Excel sheet. The descriptive and analytical statistics were computed with the Statistical Package of Social Sciences (SPSS) version 16 software. Analytical statistics was done to find out the association between the study variables. A p value of <0.05 was considered as significant.

Table 1: Distribution of study participants (mothers) according to Maternal Factors

Number	Urban N=100	Rural N=100	Total N=200
Mother's age at the time of delivery(years)			
≤20	20(20)	30(30)	50(25)
21-24	59(59)	31(31)	90(45)
25-35	21(21)	39(39)	60(30)
Type of Delivery			
Normal	64(64)	68(68)	132(66)
1. Caesarian	36(36)	32(32)	68(34)
2. Forceps	0(0)	00(0)	00(0)
3. Duration			
4. Preterm	1(1)	01(1)	02(1)
5. Full term	99(99)	99(99)	198(99)
Birthweight			
Very low(< 1.5 kg)	0(0)	0(0)	00(0)
Low(< 2.5 kg)	15(15)	11(11)	26(13)
Normal(≥2.5 kg)	85(85)	89(89)	174(87)
Complications during Delivery			
Yes	4(4)	3(3)	07(3.5)
No	96(96)	97(97)	193(96.5)
Maternal infection during pregnancy			
Yes	0(0)	0(0)	0(0)
No	100(100)	100(100)	200(100)
Nutritional problems during Pregnancy			
Yes	0(0)	0(0)	0(0)
No	100(100)	100(100)	200(100)
Long term medication during pregnancy			
Yes	0(0)	03(3)	03(1.5)
No	100(100)	97(97)	197(98.5)

Figures in the parenthesis indicate percentage

Table 2: Distribution of study participants (children) according to developmental defects of enamel

Developmental defects of enamel	Urban N=80	Rural N=82	Total N=162
Present	**10(12.5)**	**10(12.19)**	**20(12.35)**
Absent	**70(87.5)**	**72(87.81)**	**142(87.65)**
Mean	**0.46± 1.48**	**0.37±1.22**	**0.41±1.35**

p=0.65

Figures in the parenthesis indicate percentage

RESULTS

The response rate was 81 % (162/200). In this study the proportion of Females [103(51.5%)] were slightly higher than males [97(48.5)] which was similar in rural. In urban, males[53(53%)] were slightly higher proportion than females[47(47)]. Most of the participants were Hindus [126(63%)] followed by Muslims [70(35%)].Borewell[131(65.5%)] was the main source of drinking water followed by tap water[64(32%)]. Most of the parents had education upto high school followed by middle school and Intermediate or post high school diploma. This was similar in urban and rural areas.

Mother's age at the time of delivery was 20-24 years among most of the participants [90(45)]. This was similar in urban whereas near equal distribution was observed in rural areas in all the age groups. Majority reported normal delivery [132(66%)], full term [198(99%)], and normal weight [174(87%)]with no history of complications during delivery. None of them reported maternal infection and nutritional problems during pregnancy. Very few reported long term medications during pregnancy [03(1.5%)]. This was similar in urban and rural areas (Table 1)

About 30(15%) participants had caries experience(dmft≥1)[urban: 11(11%); rural: 19(19%)] Mean caries experience of the participants was 0.64±1.64 [urban: 0.49±1.34; rural: 0.68±1.6]. In this study, 22(11%) participants had developmental defects of enamel [urban: 11(11%); rural: 11(11%)].The mean number of teeth with developmental defects of enamel 0.42±1.35[urban: 0.45±1.45; rural: 0.38±1.24]. (Table 2)

There was no significant association between birthweight and developmental defects of enamel among study participants [OR=0.875 [95% CI 0.1856-4.1256]. This was similar in rural areas [OR=2.3214 [95% CI 0.4097-13.155] whereas in urban areas it could not be assessed (Table 3).

There was no association between developmental defects of enamel and type of feeding practices [OR= 0.4466 (95% CI 0.1717-1.1618)]. This was similar in urban whereas in rural areas significant association was found [OR= 0.2222 (95% CI 0.0563-0.8772)]. There was no association between developmental defects of enamel and duration of breast feeding [OR=1.4583 (95% CI 0.5622-3.7829)]. This was similar in urban and rural areas (Table 4)

There was statistically significant association between developmental defects of enamel and dental caries among study participants[OR=2.786 **(**95% CI 1.003-7.7383**)]** whereas the association in urban **[**OR=3.3214(95% CI 0.7121-15.4926)] and rural areas **[**OR= 2.5333(95% CI 0.6328-10.142) **]** were not significant (Table 5)

Table 3: Association between birthweight and developmental defects of enamel among study participants (children)

Birthweight & Developmental defects of enamel	Urban N=80		Rural N=82		Total N=162	
	Absent	Present	Absent	Present	Absent	Present
Birthweight						
Low	9(11.25)	0(0)	7(8.54)	2(2.44)	16(9.88)	2(1.23)
Normal	61(76.25)	10(12.5)	65(79.27)	8(9.76)	126(77.78)	18(11.11)
Odds Ratio	NA		2.3214 [95% CI 0.4097-13.155]		0.875 [95% CI 0.1856-4.1256]	

Figures in the parenthesis indicate percentage

DISCUSSION

Developmental defects of enamel is a common occurrence in primary teeth.[1] A series of factors can affect ameloblastic function and lead to the development of enamel defects.[6] Studies have found that DDE may be a risk factor for ECC.[3,12] Risk factors for the development of enamel defects may be more common in populations with a low socioeconomic status. [6] Hence, it is necessary to gain an understanding of the factors associated with the prevalence of DDE and ECC among Anganwadi children in Bangalore District.

Overall Females were slightly higher proportion than males. This is in line with few studies.[1,6] Whereas other studies have reported slightly higher proportion of males than females.[2,9] Most of the participants [90(45%)] were 20-24 years at the time of delivery.

In the current study 30(15%)of the participants had caries experience [Mean caries experience : 0.64±1.64] which is lower than the earlier studies wherein the proportion ranged from 31.9 -43.3% [1,3,8-10] with a mean dt being 1.1-3.9[8,10,11]

Studies have reported the prevalence of developmental defects of enamel from 22.7-78.9% [1-3,6-11] wherein Males being predominantly affected in a study [7] while other studies could not find significant difference[8,12] In this study, 22(11%) participants had developmental defects of enamel with a mean number of teeth affected being 0.42±1.35. The proportion of children affected was similar in urban and rural areas while mean number of teeth affected was more in urban than rural areas although difference was not significant.

Association between prematurity and developmental defects of enamel is often debated with some studies have concluded significant association (OR=2.6; 95% CI=1.0-6.4) [5] while other studies have not [4,6] In this study only two children were preterm hence the association could not be determined.

Studies have reported the association between low birth weight and developmental defects of enamel (RR=3.44; CI=1.72-7.37)[4,6] while normal

Table 4 :Association between feeding practices and developmental defects of enamel among study participants (children)

Feeding practices & Developmental defects of enamel	Urban N=80		Rural N=82		Total N=162	
	Absent	Present	Absent	Present	Absent	Present
Type of feeding						
Breast Feeding	50(62.5)	7(8.75)	54(65.85)	4(4.88)	104(64.2)	11(6.8)
Both Breast and bottle feeding	20(25)	3(3.75)	18(21.95)	6(7.32)	38(23.46)	9(5.54)
Odds Ratio	0.9333 [95% CI 0.2193-3.9731]		0.2222* [95% CI 0.0563-0.8772]		0.4466 [95% CI 0.1717-1.1618]	
Duration of breast feeding(months)						
Upto 12 months	41(51.25)	7(8.75)	31(37.8)	5(6.1)	72(87.8)	12(7.41)
More than 12 months	29(36.25)	3(3.75)	41(50)	5(6.1)	70(43.2)	8(4.94)
Odds Ratio	1.6504 [95% CI 0.3955- 6.9221]		1.3226 [95% CI 0.3517- 4.9732]		1.4583 [95% CI 0.5622-3.7829]	

p<0.01 Figures in the parenthesis indicate percentage

birth weight (equal or more than 2500 g) was associated with lower odds of having developmental defects of enamel [OR= 0.2 (95% CI 0.1-0.7)][2.] However in the current study non significant association between birthweight and developmental defects of enamel among study participants was found. A study has concluded association between maternal infections, malnutrition and postnatal infections and developmental defects of enamel .[12] In this study none of the mothers reported infections, malnutrition during pregnancy and postnatal infections in their children.

Children who were not breast-feed were more likely to be associated with developmental defects of enamel (OR=3.2; 95% CI=1.2-8.4) [5,7] In this study there was no association between developmental defects of enamel and type of feeding practices. Various studies have reported significant association between developmental defects of enamel and dental caries

Table 5: Association between developmental defects of enamel and dental caries among study participants (children)

Variables	Urban N=80		Rural N=82		Total N=162	
	dmft=0	dmft≥1	dmft=0	dmft≥1	dmft=0	dmft≥1
Developmental defects of enamel						
Present	7(8.75)	3(3.75)	6(7.32)	4(4.88)	13(8.02)	7(4.32)
Absent	62(77.5)	8(10)	57(69.51)	15(18.29)	119(73.46)	23(14.20)
Odds Ratio	3.3214(95% CI 0.7121-15.4926)		2.5333(95% CI 0.6328-10.142)		2.786 (95% CI 1.003-7.7382)	

Figures in the parenthesis indicate percentage

[1,3,8-11] Due to the structural defects of the tooth surface the adhesion and colonisation of cariogenic bacteria occurs [3,12] hence predisposing to the development of carious lesions. In this study there was significant association between developmental defects of enamel and dental caries among study participants**.**

The present study has certain limitations. Although longitudinal study design was used association between various factors and developmental defects of enamel and caries could not be found as reported in other studies which may be attributed to sociodemographic variables and the methods of assessment. Government policies towards public health should concentrate their efforts on building healthy environments. The prevention of developmental defects of enamel can be achieved through the periodical follow-up of pregnant mothers by a multidisciplinary team. Although developmental defects of enamel were not significantly associated with the development of dental caries, understanding the prevalence and distribution of these defects can contribute towards the control of associated oral conditions.

CONCLUSIONS

There was statistically significant association between developmental defects of enamel and ECC. Considering the prevalence of developmental defects of enamel and ECC in this study it is essential to identify children at greater risk of developing carious lesions and establish appropriate preventive and intervention measures in the early childhood.

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