

SURVEY

Prevalence and Risk Factors for Dental Caries among Preschool Children: A Cross-sectional Study in Eastern India

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ABSTRACT

Introduction: Dental caries is one of the major widespread health issues that continue to negatively affect the oral health of children globally.

Aim: To estimate the prevalence of dental caries and its risk factors among preschool children of Bhubaneswar, Odisha, India.

Materials and methods: The study was a community-based cross-sectional one among preschool children with (N = 425) participants recruited from the Anganwadi centers (AWCs) of Bhubaneswar, Odisha, India. By using a cross-sectional study design, dental caries was assessed using the World Health Organization (WHO) guidelines, and other socioeconomic and risk factors data were collected through parental interview using questionnaires. Caries was identified at both tooth and surface levels through visual dental examinations by trained and calibrated dentists. Logistic regression analyses were used to identify associations among variables and caries.

Results: The proportion of preschool children suffering from dental caries was found to be 47.29%. The multivariable-adjusted model depicted that longer duration of breastfeeding was a significant predictor as follows: Those who had breastfed for more than 36 months [adjusted odds ratio (AOR): 5.41; 95% confidence interval (CI): 2.97–9.85; p = 0.001], 12 to 24 months (AOR: 2.1; 95% CI: 1.04–4.36; p = 0.037), followed by increase in age 61 to 72 months (AOR: 5.39; 95% CI: 2.72–10.67; p = 0.001), 49 to 60 months (AOR: 2.53; 95% CI: 1.41–4.52; p = 0.002), more than two children in the family (AOR: 2.70; 95% CI: 1.55–4.69; p = 0.001), and children who did not brush the teeth under the parent's supervision (AOR: 2.70; 95% CI: 1.55–4.69; p = 0.001).

Conclusion: The study highlights the need to increase awareness about the oral health and hygiene among parents of preschool children in India.

Keywords: Breastfeeding, Dental caries, Oral hygiene behavior, Preschool children.

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INTRODUCTION

Dental caries is one of the major widespread health issues that continues to negatively affect the oral health of children globally.¹ The prevalence of dental caries varies across the different provinces in the USA 11 to 53%, in Sri Lanka 32.1%, and in India 44%.² In addition, the occurrence of dental caries in South Africa was found to be 23.3%,³ and in Pakistan 51%.⁴ According to the WHO, dental caries is defined as “the localized, post-eruptive, pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity.” It is a hastily succeeding disease among preschool children which involves the primary maxillary anterior teeth and posterior teeth, whereas the mandibular anterior teeth are less affected because of the rapid saliva formation which helps to wash out the ingredients required for bacterial growth.⁵ Dental caries commonly involves more than one aspect for causing the dental caries, such as the host (teeth), the substrate (sugary content food), bacteria, and time.⁶ Principally, the bacteria and sugary food together act to form an acid production that results in the formation of teeth cavitation.⁷ The bacteria which are mainly responsible for causing the dental caries are *Streptococcus mutans*, *Lactobacillus*, and other bacteria that are also linked, such as *Veillonella* spp, *Actinomyces* spp, and *Bifidobacterium* spp.⁸ The risk factors responsible for early childhood caries, such as the low socioeconomic status, poor underweight children,⁹ breastfeeding,¹⁰ changing lifestyle, and the poor dietary pattern of the parents¹¹ are all considered to be the predictors of dental caries. The burden of dental caries is increasing day by day due to the changing lifestyle and dietary pattern of the parents. Undoubtedly, dental caries is a major oral health problem; if it is left untreated, it can lead to the decayed tooth, severe pain, which affect the growth and maturation of secondary dentition (permanent dentition) which leads to malocclusion of teeth. There is also the possibility of compromised chewing habit and it can compromise the weight gain of the child. The situation

can be prohibited from having the thorough knowledge about the feeding and oral hygiene practices. Since no studies are available as per our knowledge regarding the prevalence and its risk factors associated with dental caries among the preschool children in Bhubaneswar, Odisha, India the aim of the study is to estimate the prevalence and its risk factors associated with dental caries among preschool children in Bhubaneswar, Odisha, India.

MATERIALS AND METHODS

This study was conducted using a cross-sectional plan based on the preschool children in Bhubaneswar, Odisha, India readily regarded as the temple city of India. It contains nearly about 213,000 under 6 years age, out of which in urban and rural areas, there are 81,000 and 131,000 respectively.¹² The ethical authorization for the study was taken from the Institutional Ethical Committee of Asian Institute of Public Health along with the permission from the local authority, and informed consent was taken individually from the study participants. The target population of our study consisted of children between 3 and 6 years of age and their mothers. Inclusion criteria: Children between 3 and 6 years of age who were enrolled in AWCs of Bhubaneswar, Odisha, India and their parents who had signed the informed consent. Exclusion criteria: Children who were absent from the AWCs at the time of screening and their parents who had not given the informed consent. The sample size after calculation was found to be 380, but keeping the probability of participants' absence from the AWCs, the sample size was increased by 11% and the final sample size was set at 425. A total of 425 participants were calculated with the help of OpenEpi sample size calculator based on the prevalence 44%² along with 95% CI, 5% precision, and power 80%. The random type of sampling method was used for recruiting the 425 participants. A total of 35 AWC were selected from the Bhubaneswar randomly along with their participant's household members. The information about the sociodemographic, socioeconomic factors of the household, feeding, and oral hygiene practices of the parents was obtained using a structured questionnaire. For probing the preschool children, WHO probe and mouth mirror were used for diagnosing dental caries. The WHO guidelines 2013 were followed. The examination was carried out in direct sunlight under the presence of their parents and for sterilization of the instruments, disinfectant solutions and a pressure cooker were used. The examination was carried out under the supervision of an experienced dentist. Prior to this examination, calibration was done; kappa test was used for 26 participants. The mutual agreement between the two examiners was found to be 0.90. The predictor variables for this study

are as follows: Age, gender, religion, caste, number of children in a family, socioeconomic status, longer duration of breastfeeding, and brushing under supervision. The data were entered with the help of EpiInfo version 7.2.1.0 for data cleaning, and analysis of the data was done using the STATA version 11.0. Descriptive type of statistics was used for analyzing the estimation of the variables, and analytical statistics were used to find out the risk factors associated with dental caries among preschool children along with the help of a multivariable logistic regression model which was used for adjusting the probable confounders. To present these conclusion, 95% CI, odds ratio (OR), and a p -value < 0.05 were considered for significance of the study.

RESULTS

Table 1 gives information about the sociodemographic profile of the participants. Out of 425 preschool children, 211 (49.65%) belonged to rural settings and 214 (50.35%) were from urban slums. Of the 425 participants examined, 201 (47.30%) were male and 224 (52.70%) were female; 180 (42.35%) were between 36 and 48 months, 124 (29.18%) were between 49 and 60 months, and 121 (28.47%) were between 61 and 72 months. A majority of the participants had two children, 194 (45.65%), followed by 126 (29.65%) who had three children, and 105 (24.70%) had one child. Since the study was carried out in the AWCs of urban slum and the rural areas, it was difficult to capture the higher socioeconomic class which consisted of only 15 (3.53%) of the participants, whereas the lower and middle class had higher percentages, 259 (60.94%) and 151 (35.53%) respectively. Table 2 shows that a total of 425 study participants were examined for dental caries among the preschool children in Bhubaneswar, Odisha, India. Out of 425, 224 (52.71%) were caries-free, whereas 201 (47.29%) had dental caries. Graph 1 states that among the study participants, higher age group 61 to 72 months have greater prevalence (46%) of caries as compared with the younger age group 36 to 48 months (21%), and 49 to 60 months (33%) respectively. Table 3 depicts the relationship between dental caries among preschool children and its associated risk factors, such as age, gender, socioeconomic status, child's birth order in a family, feeding, and oral hygiene practices of the mother or caretakers. The proportion of preschool children with dental caries increased significantly and was associated with the increase in age ($p = 0.001$), increased number of children ($p = 0.001$), and middle and low socioeconomic status ($p = 0.001$). It also showed that the increased duration of breastfeeding ($p = 0.001$) was significantly associated with dental caries among preschool children. Also, more children who did not brush the teeth under supervision ($p = 0.001$) were found to be associated

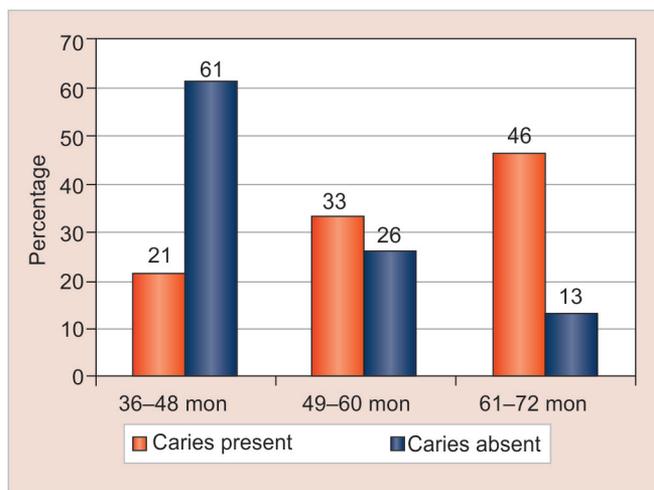
Table 1: Sociodemographic characteristics of the participants (N = 425)

Variables	n	%
<i>Place of living</i>		
Rural	214	49.65
Urban slums	211	50.35
<i>Gender</i>		
Male	201	47.29
Female	224	52.71
<i>Age of the children (months)</i>		
36–48	180	42.35
49–60	124	29.18
61–72	121	28.47
<i>Child's birth order in a family</i>		
1st	105	24.70
2nd	194	45.65
3rd and above	126	29.65
<i>Birth weight of the children (gm)</i>		
<2,500	81	19.06
>2,500	344	80.94
<i>Religion</i>		
Hindu	358	84.23
Muslim	49	11.53
Christian	18	4.24
<i>Caste</i>		
General	160	37.65
OBC	140	32.94
SC	81	19.06
ST	44	10.35
<i>Father's education</i>		
No formal education	50	11.77
Primary school (class up to 7)	110	25.88
High school (class up to 10)	178	41.88
College or higher	87	20.47
<i>Mother's education</i>		
No formal education	68	16.00
Primary school (class up to 7)	143	33.65
High school (class up 8 to 10)	178	40.70
College or higher	41	9.65
<i>Occupation of the mother</i>		
Service	10	2.35
Business	4	0.94
Agricultural labor	8	1.88
Factory/construction labor	19	4.47
Housewife	384	90.36
<i>Occupation of the father</i>		
Service	61	14.35
Business	85	20.00
Factory/construction labor	146	34.35
Driving	51	12.01
Agriculture	82	19.29
<i>Socioeconomic class</i>		
Lower class	259	60.94
Middle class	151	35.53
Upper class	15	3.53

with dental caries. However, no association was found between dental caries with the gender of the children ($p = 0.40$), caste ($p = 0.92$), and religion ($p = 0.27$). Table 4 shows the logistic regression model determining the risk factors for dental caries among preschool children. The

Table 2: Prevalence of dental caries among preschool children (N = 425)

Characteristics	Present		Absent	
	n	%	n	%
Dental caries	201	47.29	224	52.71



Graph 1: Age-wise distribution of dental caries among preschool children (N = 425)

model had been adjusted for gender, caste, religion, and socioeconomic status. The multivariable-adjusted model depicted that a longer duration of breastfeeding was a significant predictor for those who had breastfed for more than 36 months (AOR: 5.41; 95% CI: 2.97–9.85; $p = 0.001$), 12 to 24 months (AOR: 2.1; 95% CI: 1.04–4.36; $p = 0.037$), followed by increase in age 61 to 72 months (AOR: 5.39; 95% CI: 2.72–10.67; $p = 0.001$), 49 to 60 months (AOR: 2.53; 95% CI: 1.41–4.52; $p = 0.002$), more than two children in the family (AOR: 2.70; 95% CI: 1.55–4.69; $p = 0.001$), and children who did not brush the teeth under the parent's supervision (AOR: 2.70; 95% CI: 1.55–4.69; $p = 0.001$).

DISCUSSION

Dental caries is usually considered as the most widespread persistent dental predicament that occurs during the early juncture of existence.¹³ Concern and consideration are crucial to avert dental caries among the preschool children. The four risk factors that were found to be concurrent with dental caries among preschool children are: The longer duration of breastfeeding followed by the increasing age of the child, a mounting number of children in a family, and children who did not brush the teeth under the parent's supervision.

Prevalence and Dental Caries

The present study shows that the proportion of preschool children suffering from dental caries was found to be 47.29%. A similar type of proportion was found in

Table 3: Association between dental caries among preschool children and sociodemographic characteristics, breastfeeding, and oral hygiene practice (N = 425)

Characteristics	Present		Absent		p-value
	n	%	n	%	
Age (months)					
36–48	43	21.39	137	61.16	0.001*
49–60	66	32.84	58	25.89	
61–72	92	45.77	29	12.95	
Gender					
Male	100	49.75	101	45.09	0.40
Female	101	50.25	123	54.91	
Child's birth order in a family					
1st	27	13.43	78	34.82	0.001*
2nd	81	40.30	113	50.45	
3rd	93	46.27	33	14.73	
Religion					
Hindu	161	80.10	197	87.95	0.271
Muslim	28	13.93	21	9.38	
Christian	12	5.97	6	2.68	
Caste					
General	69	34.33	91	40.63	0.927
OBC	75	37.31	65	29.02	
SC	35	17.41	46	20.54	
ST	22	10.95	22	9.82	
Socioeconomic class					
Upper class	4	1.99	11	4.91	0.001*
Middle class	39	19.40	112	50.00	
Lower class	158	78.61	101	45.09	
Duration of giving breastfeeding (months)					
0–12	31	15.42	120	53.57	0.001*
13–24	27	13.43	49	21.88	
>24	143	71.14	55	24.55	
No	136	39.42	209	60.58	
Child brushes teeth under parent supervision					
Yes	33	16.42	128	57.14	0.001*
No	168	83.58	96	42.86	

*Signifies that the p-value is less than 0.05 and is statistically significant

Kanpur 48%,¹⁴ Marathahalli 40%,¹⁵ and Wardha district of Maharashtra 31.81%.¹⁶ On average, the occurrence of dental caries among preschool children in India was 44%.² In contrast to other countries, the number of dental caries in South Africa was 23.3%,³ whereas in Uganda and Tanzania, it was found to be very low, 3.7, and 17.6% in Kampala.¹⁷ In Kosovo, which is a European country, the commonness of dental caries among preschool children was 17.36%.¹⁸ In Sudan, the dominance of dental caries was found to be high, 64.6%.¹⁹ In Asian countries, such as Sri Lanka and Pakistan, the distribution of dental caries was found to be 38.18⁷ and 51%⁴ respectively. The prevalence of dental caries among preschool children shows a similar trend to ours in our neighboring countries, as it was mainly due to sharing of similar kind of intellectual behavior, nutritional model, and socioeconomic category of the people,²⁰ whereas in rapidly growing countries, the prevalence was low as compared with budding and

Table 4: Logistic regression model determining risk factors for dental caries among preschool children (N = 425)

Characteristics	OR (95% CI)	AOR (95% CI)	p-value
Age of the children (months)			
36–48	Ref	Ref	Ref
49–60	3.62 (2.21–5.92)	2.53 (1.41–4.52)	0.002*
61–72	10.01 (5.89–17.34)	5.39 (2.72–10.67)	0.001*
Gender			
Male	Ref	Ref	Ref
Female	0.82 (0.56–1.21)	1.15 (0.68–1.93)	0.596
Religion			
Hindu	Ref	Ref	Ref
Muslim	1.63 (0.89–2.98)	0.90 (0.36–2.29)	0.839
Christian	2.44 (0.89–6.66)	1.97 (0.38–10.20)	0.416
Caste			
General	Ref	Ref	Ref
OBC	1.52 (0.96–2.40)	1.08 (0.55–2.11)	0.820
SC	1.00 (0.58–0.72)	0.85 (0.42–1.74)	0.671
ST	1.31 (0.67–2.57)	0.71 (0.24–2.10)	0.547
Child birth order in a family			
1st	Ref	Ref	Ref
2nd	2.07 (1.22–3.49)	1.36 (0.71–2.58)	0.347
3rd	8.14 (4.50–14.70)	2.91 (1.38–6.14)	0.005*
Socioeconomic class			
Upper class	Ref	Ref	Ref
Middle class	0.95 (0.28–0.3.18)	0.79 (0.19–3.29)	0.876
Lower class	4.30 (1.33–13.87)	2.19 (0.54–8.79)	0.269
Duration of giving breastfeeding (months)			
0–12	Ref	Ref	Ref
13–24 months	2.13 (1.1547–3.94)	2.13 (1.04–4.36)	0.037*
>24 months	10.06 (6.08–16.63)	5.41 (2.97–9.85)	0.001*
Children brushes their teeth under any supervision			
Yes	Ref	Ref	Ref
No	6.78 (4.29–10.72)	2.70 (1.55–4.69)	0.001*

*Signifies that the p-value is less than 0.05 and is statistically significant

underdeveloped countries which was mainly due to increasing awareness about the oral hygiene practices, importance of fluoridation for prevention of dental caries, effective dental awareness given to the people, and parental concern about the dental health.²¹

Sociodemographics and Dental Caries

This study was unable to show the relationship between gender and dental caries. A similar type of study in Jammu & Kashmir showed that gender had no relationship with dental caries.²² However, in some other studies, it had been shown that male child was one of the predictors of dental caries, boys were more inclined to develop dental caries as compared with the girl child, as it may be due to males being given precedence in Indian perspective²⁰ and in some studies, girl children were more on verge of producing dental caries as compared with the boys because girls have an early flare-up of teeth as compared with the boys, which results in longer time contact with the oral environmental factors which

leads to dental caries.²³ In contrast to other countries, in Sri Lanka, girl child was more prone to dental caries as compared with the male child² and in some studies, it showed that gender had no significant difference with dental caries among preschool children.¹⁹ This study showed that increasing age of the children was related to dental caries. A similar type of study conducted in Jammu and Kashmir²² and Bangalore¹¹ showed that increase in age of the children was associated with dental caries. The possible reason could be that the standard of living of the parents and children changes with the evolution of years.²⁴ This study was able to show that more than two children were associated with dental caries among preschool children. A similar type of study done in Sri Lanka showed that more than two children had a relationship with dental caries among preschool children.²⁵ The probable reason could be that the parents distribute their care equally to all of their children the importance of oral hygiene; the care they can provide to a single child, they could not provide the same level of oral hygiene to their subsequent babies.²⁶ The socioeconomic status of a family plays a very important role in developing dental caries among preschool children. However, this study failed to show the relationship between socioeconomic status and dental caries. A similar type of study conducted in Sudan showed a similar result that the socioeconomic status plays no role in dental caries.¹⁹ However, a study done in Brazil shows that low socioeconomic status had a positive relationship with dental caries and the probable reason could be the reluctance to reward the dental services, and poor awareness about the good oral hygiene practices.²⁶

Breastfeeding and Dental Caries

This study depicted that increasing duration of breastfeeding was found to be a significant risk factor for developing dental caries among the young growing children. A similar type of study was conducted in Brazil²⁷ and Southwestern Nigeria²⁸ where they depicted that increasing duration of the breastfeeding had a positive relationship with dental caries among preschool children. One of the significant reviews suggested that mother's milk contains the oligosaccharide which acts as a component for bacteria to grow and results in developing dental caries due to prolonged exposure to breastfeeding.²⁹

Oral Hygiene Practice and Dental Caries

This study was able to show that children who did not brush the teeth under the supervision of the parents had a strong positive relationship with developing of dental caries. A similar type of result was shown in Bangalore about children who did not brush the teeth under supervision and who were more to develop dental

caries as compared with the children who brushed the teeth under the supervision of parents.¹¹ One of the dissimilar studies found that brushing under the supervision of the parents had no association with dental caries.²⁴

Methodological Consideration

This study used the random sampling technique, which means that every accomplice had an equal opportunity to fall into this study. The multivariable logistic regression model was computed for controlling the confounders. Apart from the strength, the study finds some limitations; since it was a cross-sectional in nature, a contributing temporality cannot be recognized between the exposure and the outcome.

CONCLUSION

This study depicted that the increase in age, increased number of children, longer duration of breastfeeding, and the children who did not brush the teeth under the parent's supervision were more vulnerable to develop dental caries. These are some of the risk factors obligatory to evaluate in future, such as the microbiological colony level of the *S. mutans* and hereditary history of the parents. The oral health education should be given at the grassroots level in AWCs where it is generally regarded as the education hub for the financially backward preschool children and this can be set as a platform for giving oral health education to preschool children and their mothers or caretakers. There is also a need for giving behavioral change training to the parents for changing the concept of longer duration of breastfeeding and oral hygiene practices so that it can help to reduce the burden of dental caries among the preschool age group which is the most vital period for the maturation of the teeth.

REFERENCES

1. Javed F, Feng C, Kopycka-Kedzierawski DT. Incidence of early childhood caries: A systematic review and meta-analysis. *J Investig Clin Dent* [Internet] 2016;(August):1-6. Available from: <http://doi.wiley.com/10.1111/jicd.12238>.
2. Perera PJ, Abeyweera NT, Fernando MP, Warnakulasuriya TD, Ranathunga N. Prevalence of dental caries among a cohort of preschool children living in Gampaha district, Sri Lanka: a descriptive cross sectional study. *BMC Oral Health* [Internet]. *BMC Oral Health* 2012 Nov 13;12(1):49. Available from: <http://www.biomedcentral.com/1472-6831/12/49>.
3. Ali M. Early Childhood Caries in children 12-24 months old in Mitchell's Plain, South Africa. University of the Western Cape; 2008.
4. Dawani N, Nisar N, Khan N, Syed S, Tanweer N. Prevalence and factors related to dental caries among pre-school children of Saddar town, Karachi, Pakistan: a cross-sectional study. *BMC Oral Health* [Internet]. *BMC Oral Health* 2012 Dec

- 27;12:59. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3543838&tool=pmcentrez&rendertype=abstract>.
5. Congiu G, Campus G, Lugliè PF. Early Childhood Caries (ECC) prevalence and background factors: a review. *Oral Health Prev Dent* 2014;12(1):71-76.
 6. Yadav K, Prakash S. Dental caries: a review. *Asian J Biomed Pharm Sci* 2016;53(6):1-7.
 7. Kumarihamy SL, Subasinghe LD, Jayasekara P, Kularatna SM, Palipana PD. The prevalence of Early Childhood Caries in 1-2 yrs olds in a semi-urban area of Sri Lanka. *BMC Res Notes* [Internet] 2011 Sep 9;4(336):1-6. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3228513&tool=pmcentrez&rendertype=abstract>.
 8. Aas JA, Griffen AL, Dardis SR, Lee AM, Olsen I, Dewhirst FE, Leys EJ, Paster BJ. Bacteria of dental caries in primary and permanent teeth in children and young adults. *J Clin Microbiol* 2008 Apr;46(4):1407-1417.
 9. Gaur S, Nayak R. Underweight in low socioeconomic status preschool children with severe early childhood caries. *J Indian Soc Pedod Prev Dent* [Internet] 2011 Oct-Dec;29(4):305-309. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22016314>.
 10. Kato T, Yorifuji T, Yamakawa M, Inoue S, Saito K, Doi H, Kawachi I. Association of breast feeding with early childhood dental caries: Japanese population-based study. *BMJ Open* [Internet] 2015 Mar 20;5(3):e006982. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4368903&tool=pmcentrez&rendertype=abstract>.
 11. Prakash P, Subramaniam P, Durgesh BH, Konde S. Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: a cross-sectional study. *Eur J Dent* 2012 Apr;6(2):141-152.
 12. Operations District of Census, ODISHA. District census handbook; 2011. p. 24.
 13. Dogan D, Dülgergil Ç, Mutluay A, Yildirim I, Hamidi M, Çolak H. Prevalence of caries among preschool-aged children in a central Anatolian population. *J Nat Sci Biol Med* [Internet] 2013 Jul;4(2):325-329. Available from: <http://www.jnsbm.org/text.asp?2013/4/2/325/116995>.
 14. Prakasha Shrutha S, Vinit GB, Giri KY, Alam S. Feeding practices and early childhood caries: a cross-sectional study of preschool children in Kanpur district, India. *ISRN Dent* [Internet] 2013 Dec 5;2013:275193. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=387076&tool=pmcentrez&rendertype=abstract>.
 15. Singh S, Vijayakumar N, Priyadarshini HR, Shobha M. Prevalence of early childhood caries among 3-5 year old preschoolers in schools of Marathahalli, Bangalore. *Dent Res J (Isfahan)* 2014;9(6):710-714.
 16. Khatib N, Zodpey S, Zahiruddin Q, Gaidhane A, Patil M. Prevalence and determinant of early childhood caries among the children attending the Anganwadis of Wardha district, India. *Indian J Dent Res* [Internet] 2013 Mar-Apr;24(2):199-205. Available from: <http://www.ijdr.in/text.asp?2013/24/2/199/116677>.
 17. Masumo R, Bardsen A, Mashoto K, Åström AN. Prevalence and socio-behavioral influence of early childhood caries, ECC, and feeding habits among 6-36 months old children in Uganda and Tanzania. *BMC Oral Health* [Internet] 2012 Jul 26;12(1):24. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3434064&tool=pmcentrez&rendertype=abstract>.
 18. Begzati A, Berisha M, Meqa K. Early childhood caries in preschool children of Kosovo—a serious public health problem. *BMC Public Health* [Internet] 2010 Dec 24;10(1):788-795. Available from: <http://www.biomedcentral.com/1471-2458/10/788>.
 19. Awooda EM. Caries prevalence among 3-5 years old children in Khartoum state—Sudan. *Innov J Med Heal Sci* [Internet] 2013;3(2):42-44. Available from: <http://innovativejournal.in/index.php/ijmhs/article/view/476>.
 20. Mahejabeen R, Sudha P, Kulkarni SS, Anegundi R. Dental caries prevalence among preschool children of Hubli: Dharwad city. *J Indian Soc Pedod Prev Dent* 2006 Mar;24(1):19-22.
 21. Pitts NB, Boyles J, Nugent ZJ, Thomas N, Pine CM. The dental caries experience of 5-year-old children in Great Britain (2005/6). Surveys co-ordinated by the British Association for the study of community dentistry. *Community Dent Health* 2007 Mar;24(1):59-63.
 22. Shah AF, Batra M, Aggarwal V, Dany SS, Rajput P, Bansal T. Prevalence of early childhood caries among preschool children of low socioeconomic status in district Srinagar, Jammu and Kashmir. *Int Arch Integr Med* [Internet] 2015;2(3):8-13. Available from: <http://iaimjournal.com/wp-content/uploads/2015/03/2-Prevalence-of-early-childhood-caries.pdf>.
 23. Kurian J, Renganathan S, Gurusamy K, Shivashankarappa PG. Association between early childhood caries and age and gender specific height, weight and mid upper arm circumference of school children in Puducherry—"a comparative study". *Biol Med Eng Sci Rep* 2016;2(1):13-17.
 24. Hallett KB, O'Rourke PK. Social and behavioural determinants of early childhood caries. *Aust Dent J* 2003 Mar;48(1):27-33.
 25. Wellappuli N, Amarasena N. Influence of family structure on dental caries experience of preschool children in Sri Lanka. *Caries Res* 2012;46(3):208-212.
 26. Correa-Faria P, Martins-Junior PA, Vieira-Andrade RG, Marques LS, Ramos-Jorge ML. Factors associated with the development of early childhood caries among Brazilian preschoolers. *Braz Oral Res* [Internet] 2013 Jul;27(4):356-362. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1806-83242013000400356&lng=en&nrm=iso&lng=en.
 27. Azevedo TD, Bezerra AC, de Toledo OA. Feeding habits and severe early childhood caries in Brazilian preschool children. *Pediatr Dent* 2005 Jan-Feb;27(1):28-33.
 28. Olatosi OO, Sote EO. Association of Early childhood caries with breastfeeding and bottle feeding in Southwestern Nigerian children of preschool age. *J West African Coll Surg* 2014 Jan-Mar;4(1):31-53.
 29. Ribeiro NM, Ribeiro MA. Aleitamento materno e cárie do lactente e do pré-escolar: uma revisão crítica. *J Pediatr (Rio J)* [Internet] 2004 Nov;80(5):s199-s210. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0021-75572004000700012&lng=pt&nrm=iso&lng=pt.