

Maternal Outcomes and Early Childhood Caries: A Systematic Review and Meta-Analysis

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Abstract

Background: Early childhood caries (ECC) is severe dental problem amongst children of age less than 71 months. It remains a public health problem in both developed and developing countries worldwide. ECC risk factors reflect multifactorial characteristic and maternal factors play an important role. This review demonstrates a collaborative model of research that can well address this public health issue.

Aim: To assess the strength of nature of evidence regarding mother’s individual factors affecting ECC.

Methodology: Prospective cohorts and cross sectional studies focusing on maternal role in development of ECC conducted between the years 2002-2016 amongst children of age group of less than or equal to 71 months were

included following searches of PubMed and Google Scholar database.

Results: 20 studies were included finally after excluding those with poor quality or not fulfilling the inclusion criteria. It was inferred that exclusive breast feeding shields the child’s teeth from ECC as compared to mixed or exclusive bottle feeding upto one year post-natally. Mothers with low socio economic status, low education level and poor oral hygiene or oral health knowledge emerged as other potential risk factors for ECC.

Conclusion: If an attempt is made to arouse awareness among mothers regarding appropriate feeding, oral hygiene and concerned practices, a significant drop in the prevalence of ECC can be anticipated in future.

Keywords: Early childhood caries, Maternal, Mother, Systematic review, meta-analysis

Introduction

Early childhood caries (ECC) is severe dental problem amongst children of age less than 71 months. Over the decades this problem has amplified and diversified to engulf nearly all the continents of the globe. A higher prevalence in the range of 50-60% is seen in Iran, Senegal and Thailand among the 3-5-year-old age group. This is followed by the regions of Asia, Africa and Middle East with the wide range of 22-85%. However, USA, Japan and UK depict the decreasing trend in the prevalence of ECC.¹ The American Academy of Paediatric Dentistry (AAPD) defines ECC as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.²

Impact of ECC is far reaching from merely an oral cavity to overall development of a child, including the physical and mental development, social behaviour, performance in school and lifetime events. Dental caries predominantly mutilate the basic need of nutrition in a child followed by aesthetic and speech functions. Chronic pain and multiple visits to a dentist for the treatment compromise the very quality of life of a child. Further, seeking treatment for the same impinge the parents with both financial and psychological burden. All this can be obviated by having a sound knowledge about its etiological factors and following simple and practical ways to prevent their occurrence.

ECC risk factors reflect a multifactorial characteristic such as microbiological, psycho-social, socio-demographic and behavioural. Maternal factors encompasses all these factors such as maternal age, education, occupation, disease, psychiatric disorders, physical activity, level of S.mutans, marital status, socio economic status, smoking

status, exclusive breast feeding, diet during pregnancy, BMI during pregnancy, sharing of utensils³.

Research needs to identify the etiologic factors which can be controlled at early age of life for the prevention of ECC. As caries can be effectively prevented and controlled, an early diagnosis of risk factors can provide an opportunity to identify the children who are at a high risk for the disease and hence the disease can be circumvented. The approach used in this review demonstrates a model of research that can well address this cross disciplinary public health issue. Hence, the aim of this review is to assess the strength of nature of evidence regarding mother's individual factors affecting ECC.

Why Is This Review Important...?

- To assess the long term influence of maternal risk predictors on early childhood caries and its variation with the age of the child.
(It is hypothesised that with the growing age of child, the influence of environmental factors may eventually replace that of maternal factors)
- To assess the strength of nature of evidence regarding mother's individual factors affecting ECC.
- To include majority of the maternal factors effecting ECC under one head which are lacking in other systematic reviews.
- Most of the present reviews show heterogeneous results. So this review is an attempt to update and to come up with some conclusive results.

Materials and Methods

Data source and search strategy: Articles published in various journals in the past 15 years (2002-2016), which have documented the effect of maternal factors on early childhood caries were selected for the review. These 15 years of literature provides substantial number of studies reflecting influence of maternal factors on early childhood

caries. Abstracts of studies generated by the search strategy were checked for relevance, and then full reports of any study that might be suitable for the review were acquired. Cross references of the relevant articles were then checked. The primary outcome used in the review is the influence of maternal factors on early childhood caries. Any dilemma regarding the inclusion of a study was discussed by two reviewers (DA, AK) and decision was made accordingly.

Eligibility criteria: Prospective cohort, cross sectional and case control studies were included. Study population comprises children with age either less than or equal to 71 months and their mothers at different study settings. Only studies focussing exclusively on maternal role in development of ECC or those caregivers having more than 90% as mothers were included. Randomised controlled trials or interventional studies, poor quality studies or those with inadequate data or not meeting the search criteria were excluded.

Data extraction and management: We extracted details of study design, location and setting of the study (e.g. hospital-based, clinic based, community- based), method of recruitment to the study, dependent and independent variables, criteria used to measure ECC, sample size, eligibility and exclusion criteria and demographic descriptors

Quality assessment: Studies were evaluated with the help NIH scale. It is guidance for assessing the Quality of Observational Cohort and Cross-Sectional Studies by the national Heart, Lung and Blood Institute and studies were assessed to be of poor, fair and good qualities according to the range of score they fell in.

Results

The original literature search (October 2016) was done from the studies published between the years 2002 to 2016. Out of 16895 from database PubMed, Google

Scholar, cross references, 506 relevant articles were selected after removing the duplicates and reviews. Abstracts of 107 articles were viewed from which 90 articles were short listed for full text reading which further narrowed down to 20 articles after removing those not fulfilling the inclusion criteria or owing to poor quality. This review finally included 20 studies.

Maternal exposure variables included in the review:

Maternal age at delivery, mother's education, mother's occupation, mother's oral hygiene, mother's habit of smoking, mother's socioeconomic status and breast or bottle feeding by child.

Result of individual maternal exposure factors

1) Feeding: Fifteen studies assessed the relationship between early childhood caries with feeding. Feeding was further classified into the following categories for the analysis.

a) Duration of breast feeding less than one year v/s more than one year: three studies (Morenike,⁷ S.shrutha¹³ and Patrica²²) assessed the effect of duration of breast feeding on early childhood caries under this category out of which two (S.shrutha¹³ and Patrica²²) showed a significant increase in ECC with duration of breast feeding.

b) Duration of breast feeding less than two year v/s more than two year: one study (PJ Prera²¹) reported a significant increase in ECC with duration of breast feeding. Kato¹⁷ reported an insignificant association between the two while Seval¹⁸ categorized duration of breast feeding at 9 months to 20 months and hence excluded.

c) Exclusive breast feeding for 6 months v/s mixed feeding, exclusive bottle feeding v/s mixed feeding and exclusive breast feeding v/s Exclusive bottle feeding:

Six (Morenike,⁷ N. Retanakumari,⁸ S.Shrutha,¹³ Seval,¹⁸ Alon,¹⁹ PJ Prera²¹), four (Morenike,⁷ N. Retanakumari,⁸

Seval,¹⁸ Alon¹⁹) and four studies (Morenike,⁷ N. Retanakumari,⁸ Seval,¹⁸ Alon¹⁹) assessed the association of exclusive breast feeding v/s mixed feeding, exclusive bottle feeding v/s mixed feeding and exclusive breast feeding v/s exclusive bottle feeding respectively but none of these showed any significant association.

The only author Alesandra⁴ reported significant increase in ECC with mixed feeding as compared to exclusive breast feeding or exclusive formula feeding; also a significant rise in ECC is seen in exclusive formula feeding as compared to exclusive breast feeding. Karl Peltzer⁶ reported the results of association of exclusive breast feeding for four months with early childhood caries and hence excluded. Kato¹⁷ showed a significant increase in ECC with breast feeding till two and a half years but beyond that no significant association was reported. PJ Prera²¹ also assessed mean deft which also showed non-significant results.

d) Nocturnal feeding present v/s absent– formula fed or other (non-breast feeding)

Five authors reported the association of ECC with nocturnal feeding out of which in only one study (PJ Prera²¹) where children were nocturnally formula fed showed a non - significant association while the other studies (Karl,⁶ Shrutha,¹³ Mohebbi²³) revealed a robust finding of significant increase in early childhood caries with nocturnal bottle feeding. Nunes⁵ assessed influence of nocturnal bottle feeding with infant formula on ECC and presented the results in the same line i.e. nocturnal bottle feeding increases the probability of having early childhood caries.

Finally, we pooled the data into **presence or absence of breastfeeding** irrespective of the duration of breast feeding: Only two studies showed the significant association between the two while that of Kato¹⁷ showed

an increasing trend of ECC with breast feeding till 3 years and not at 4years or 5 years.

Nocturnal breast feeding (PJ Prera²¹) and frequency of breast feeding (Shrutha¹³) were reported in singular studies, hence excluded.

2) Maternal age at delivery: There was an extreme variability with regard to categorization in maternal age at delivery. Hence, pooling of data was not feasible. However, we tried assessing the trend of association between ECC and maternal age but it was found to be non-significant.

3) Maternal education: Eleven studies revealed the relationship between caries and maternal education. Different studies categorized education at different levels. The data from the studies was categorized as under and following inference pertaining to education were found.

a) Illiteracy v/s Literacy: Four Studies (Ana Nunes,⁵ Karl Peltzer,⁶ Ridhi Narang,¹² WH Van²⁰) found association between illiterate and literate mothers with early childhood caries with only one (Karl Peltzer⁶) showing significant association while the other three reported an insignificant relation between the two.

b) 8 years v/s more: One study (Smith¹⁵) demonstrate that there is no significant difference in prevalence of childhood caries with maternal education up-till 8 years while 2 studies (Ana Nunes⁵ and Patricia²²) depicts a significant association between the maternal education upto 8 years and Early childhood caries.

c) High School v/s Post High School: A sturdy finding of decrease in ECC among children with Post High school maternal education was observed in all the four studies (Karl Peltzer⁶, Ridhi Narang,¹² Sarumathi¹⁴ and Tove¹⁶) included in this domain.

3) Maternal occupation: Three studies (Ana Nunes,⁵ Ridhi Narang¹² and Priyanka¹⁰) have reported an influence of maternal occupation on ECC. Only one study (Ridhi¹²)

has shown significantly low ECC in working mothers than non-working mothers while the other two do not state any significant association of mother's occupation with ECC.

4) Maternal smoking: Four studies assessed the relationship of smokers with early childhood caries. Two studies considered maternal smoking during pregnancy (Alessandra,⁴ Karl Peltzer⁶) while the other two (Kato¹⁷ and Tove¹⁶) recorded smoking status till the time of study since pregnancy into account. Studies also reported environmental exposure & secondary smoke. One study (Karl Peltzer⁶) had only two mother smokers and was excluded due to inadequate participants. Kato¹⁷ categorized smokers as light and heavy and reported higher caries in heavy smokers but it was non-significant. To overcome the heterogeneous classification of smokers across studies maternal smoking was dichotomized (present or absent). All studies reported insignificant relationship with smoking. However, Alessandra⁴ reported mothers smoking more than five cigarettes per day during pregnancy showed significantly higher risk for the development of caries ($p < 0.01$). Nonetheless when dichotomised, the results were insignificant.

5) Maternal oral hygiene: Morenike⁷ showed a low prevalence of ECC in children with good maternal knowledge while 4 other authors (Parampreet,⁹ Priyanka,¹⁰ Smith¹³ and N. Ratnakumari⁸) revealed increase in children's caries with increase in maternal caries.

6) Maternal socio economic status: Five studies (Alessandra,⁴ Karl Peltzer,⁶ Morenike,⁷ Ridhi¹² and Sarumathi¹⁴) have observed the influence of socio economic status of mother on early childhood caries. They have been classified into:

a) Low v/s medium: Four studies (Alessandra,⁴ Karl Peltzer,⁶ Morenike⁷ and Ridhi¹²) fall under this domain, out of which 3 (Alessandra,⁴ Morenike⁷ and Ridhi¹²) showed a significant decrease in early childhood caries

with medium socio economic status as compared to low socio economic status while Karl Peltzer⁶ did not find any significant association between the two.

b) Low v/s high level: A unanimous result has been observed in this category as all the five studies document a significant association between maternal socio economic status and early childhood caries with increase in childhood caries in mothers with poor socio economic status than those with higher socio economic status.

c) On the basis of minimum wages: Only 3 studies have classified on this basis with again two studies (Nunes,⁵ Patrica²²) reporting significant decrease in ECC with equals to or more than 2 times the minimum wages while one study (Smith¹⁵) showed no significant association between the two.

Discussion

The purpose of this review is to pool and critically appraise the studies assessing maternal factors influencing early childhood caries. Though a several number of such factors can be enumerated but since only few of them present substantial documented literature, we have contoured our review accordingly. NIH quality assessment tool was employed for cross sectional and observational cohort studies short listed for the review, thereby removing poor quality studies and retaining fair and good quality ones. However, owing to cross sectional designs of most of the studies, only few could be stamped as good quality.

Every study conducted had specific population and study setting. Few were field studies while others were hospital based studies thereby leading to selection bias. The method of recording the primary outcome i.e. early childhood caries also varied. Most of the studies^{5,6,7,8,11,12,13,14,16,18,22,23} included utilised WHO 1997 criteria for it while Kato¹⁷ and W.H.Van Palenstein²⁰ did not advocate any standardised criteria. Similar heterogeneity

was witnessed in regard to socio economic status as only two authors^{7,12} applied the standard scales while rest of the studies used proxy for the same. Moreover, these standardised scales cannot be generalised for population all over the world.

Feeding, despite being one of the universal maternal factor studied for ECC showed diversified format of outcomes. Few studies^{8,11,13} have not well specified the type of feeding and others did not account for either duration or frequency of breastfeeding. Majority of the studies did not account for content of the formula fed to children. However, Seval Ölmez and Alon Livny have discussed it and postulated the results correspondingly. Wherever mentioned, duration of breast feeding has been classified differently by different authors. Few authors^{7,13,22} have recorded the data for one year or more while others^{18,21} have accounted for two years or more. Further data regarding nocturnal feeding was found to be highly divergent.

This review has resulted in some robust finding with respect to maternal association with early childhood caries. Role of confounding factors like mother's or children's physical or mental health, diet, mode of delivery, mother's sharing of utensils and children's oral hygiene practices on the final outcomes cannot be overlooked as they have the tendency to mask and modulate the true associations. Child's tooth brushing behaviour, oral hygiene habits, systemic health, diet, dental visits and fluoride supplements in any form are the potent confounders.

Studies have reported that exclusive breast feeding have protective effect against early childhood caries only in initial one year. However, children who were breastfed beyond 12 months had an increased prevalence of dental caries. Amongst those who continued to be breastfed after 12 months, there was a further increased risk of caries in

children who were breastfeeding including nocturnal feeding during sleep, cariogenic foods/drinks in the diet, or inadequate oral hygiene practices.

Mother's low education level, poor socio economic status and oral hygiene are directly related to higher prevalence of dental caries in their children. This result is in accordance to other reviews^{24,25,26}. It reflects the role of oral health awareness and corresponding purchasing power for learning, adapting and maintaining adequate oral hygiene techniques into practice. Overall, the heterogenic nature of the studies and various confounding variables included limit the reliability of results. More clarity is required regarding influence of mother's occupation and smoking status on ECC. Therefore, further research is required considering these aspects so that evidences can be systematized into one coherent body of knowledge.

Conclusion

This review pools the various maternal factors governing dental caries in children upto 71 months of age. It is quite clear from this systematic review that exclusive breast feeding shields the child's teeth from ECC as compared to mixed or exclusive bottle feeding. However, breast feeding beyond one year increases the probability of ECC. Nonetheless, nocturnal bottle feeding irrespective of its content causes early childhood caries.

Mothers with low socio economic status and poor oral hygiene or oral health knowledge emerged as other potential risk factors for ECC. Post high school maternal education has a positive influence on drop in ECC. However, maternal occupation or smoking level had no impact on child's dental caries status.

Therefore, if an attempt is made to arouse awareness among mothers regarding appropriate feeding, oral hygiene and concerned practices, a significant drop in the prevalence of ECC can be seen in future.

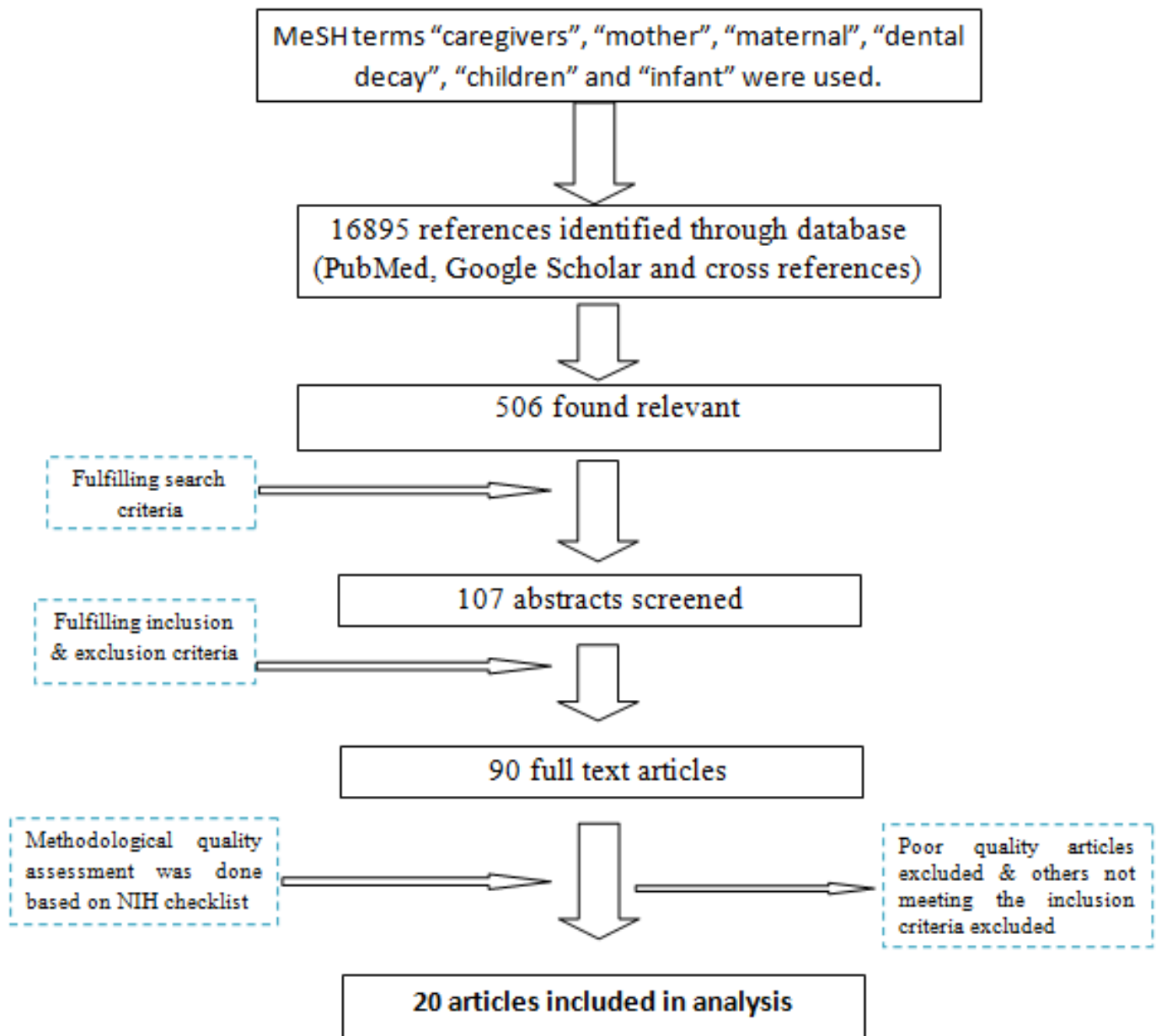
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Legends Figures and Tables

Figure 1: Search Strategy



Tables 1: Studies Characteristics

S.No.	Author (Country, Year)	Study Design	Sample Size	Average Children's Age (Years)	Independent Variables	Caries Detection Criteria
1.	Alessandra Majorana (California, 2014)	Cross sectional	2623 children	2.5	Breast feeding , SES and smoking	ICDAS
2.	Ana Margarida Melo Nunes (Brazil, 2012)	Cross sectional	260 children	3	Mother's educational level, family income (minimum wages), mother's occupation outside home, information about oral health, nocturnal bottle-feeding with infant formula.	dmft
3.	Karl Peltzer (Thailand, 2015)	Prospective cohort study	597 children	3	Smoking during pregnancy, mother's age at child's birth, mother's schooling at child's birth, household income.	dmft, dmfs
4.	Morenike O Folayan (Nigeria,2015)	Cross sectional	497 children	6	SES, maternal age at birth, infant feeding practices, oral hygiene status	dmft
5.	N. Retnakumari (India, 2012)	Cross sectional	350 children	3	Maternal age, feeding practices	dmfs
6.	Parampreet Pannu (India, 2014)	Cross sectional	100 children	3-6	Mother's salivary MS count	dmft, dmfs
7.	Priyanka Sharma (India, 2016)	Cross sectional	100 children	1-5	Mother's salivary MS count, mother's occupation	MS count
8.	Ray Masuma (Uganda & Tanzania, 2012)	Cross sectional	Manyara =1221 children; Kampala= 816 children	3	Current breastfeeding	dmft
9.	Ridhi Narang	Cross	512 children		Mother's education,	dmft

	(India, 2013)	sectional		3	mother's occupation and socioeconomic status	
10.	Santhebachalli Prakasha Shrutha (India, 2013)	Cross sectional	2000 children	3-5	Frequency of breastfeeding /day, duration of breast feeding /day, duration of bottle feeding	dmft
11.	Sarumathi T (India, 2013)	Cross sectional	527 children	3-5	Socio economic status, mother's education	dmft
12.	Smith RE (United States, 2002)	Cross sectional	60 children	3-5	Mother's salivary MS count	MS count
13.	Tove I Wigen (Norway, 2011)	Cohort	1607 children	1-5	Maternal smoking, maternal education	dmft
14.	Tsuguhiko Kato (Japan, 2015)	Longitudinal	43383 children	1-5.5	Maternal age at delivery, maternal educational attainment, maternal smoking status, breast feeding	Not standardized
15.	Seval Ölmez (Turkey, 2003)	Cross sectional	95 children	5	Method of feeding, duration of breast or bottle-feeding,	dft
16.	Alon Livny (Jerusalem, 2007)	Cross sectional	102 children	1-3	Feeding practices, maternal education level and mother oral hygiene	dmft
17.	W.H. Van Palenstein Helderma (Burma, Rangoon, 2005)	Cross sectional	198 children	3-4	Mother's education, total number of breast feedings and total exposure time of breast feeding	Not standardized
18.	Priyantha Julian Perera (Sri Lanka, 2014)	Cross sectional	246 children	3-5	Overnight feeding practices, maternal education level, monthly family income and feeding pattern	dmft
19.	Patricia Correa-Faria	Cross sectional	593 children	3-5	Breast feeding, bottle feeding, duration of	dmft

	(Brazil, 2013)				breastfeeding and duration of bottle feeding	
20.	Mohebbi SZ (Iran, 2007)	Cross sectional	504 children	1-3	Feeding method, duration of breastfeeding, burden of night time breastfeeding, burden of night time milk bottle feeding and feeding at bedtime	dmft

Table 2: List of Bias across Studies

S.No.	Author	Quality As Per NIH Guidelines	Study Design	Selection Bias	Information Bias	Measurement Bias	Analytic Bias
1.	Alessandra Majorana	Good	CS	Y	Y	N	N
2.	Ana Margarida	Good	CS	Y	Y	N	N
3.	Karl Peltzer	Good	CO	N	Y	N	N
4.	Morenike O Folayan	Good	CS	Y	Y	Y	Y
5.	N. Retnakumari	Fair	CS	Y	Y	Y	N
6.	Parampreet Pannu	Fair	CS	Y	-	-	-
7.	Priyanka Sharma	Fair	CS	Y	Y	Y	Y
8.	Ray Masumo	Good	CS	Y	Y	N	N
9.	Ridhi Narang	Fair	CS	N	Y	Y	N
10.	Santhebachalli Prakasha	Fair	CS	N	Y	Y	N
11.	Sarumathi T	Fair	CS	N	Y	N	Y
12.	Smith RE	Fair	CS	Y	Y	N	Y
13.	Tove I Wigen	Good	CO	N	Y	N	N
14.	Tsuguhiko Kato	Fair	CO	Y	Y	Y	N
15.	Seval Ölmez	Fair	CS	Y	Y	Y	N
16.	Alon Livny	Fair	CS	N	Y	Y	N
17.	W.H. van Palenstein	Fair	CS	N	Y	Y	N
18.	Priyantha Julian Perera	Fair	CS	Y	Y	Y	N
19.	Patrícia Corrêa-Faria	Fair	CS	Y	Y	Y	N
20.	Mohebbi SZ	Fair	CS	Y	Y	Y	N

*CO= cohort, CS=cross-sectional

Table 3: Excluded Studies

S.No.	Study Title And Author	Reason For Exclusion
1.	Association of parental health literacy with oral health of Navajo Nation pre-schoolers; A. G. Brega	Mother percentage not specified
2.	Oral health, sociodemographic factors, dietary and oral hygiene practices in Jordanian children; A. Sayegh	Mother percentage not specified
3.	A qualitative study of the factors that influence mothers when choosing drinks for their young children; Alexandria Hoare	Maternal factors not specified
4.	Early childhood feeding practices and dental caries in preschool children: a multi-centre birth cohort study; Amit Arora	Intervention involved
5.	Association between prolonged breast-feeding and early childhood caries: a hierarchical approach; Ana Margarida Melo Nunes	Duplicate from master article
6.	Caries prevalence and risk factors among children aged 0 to 36 months; Ana Paula Pires dos Santos	Mother percentage not specified
7.	Validation and Impact of Caregivers' Oral Health Knowledge and Behavior on Children's Oral Health Status ; Anne R Wilson	Low(77%) mother percentage
8.	Maternal Oral Bacterial Levels Predict Early Childhood Caries Development; B.W. Chaffee	Intervention involved
9.	Association of long-duration breastfeeding and dental caries estimated with marginal structural models; Benjamin W. Chaffee	Intervention involved
10.	Feeding Practices in Infancy Associated with Caries Incidence in Early Childhood; Benjamin W. Chaffee	Maternal outcomes not mentioned
11.	Early Childhood Caries: Prevalence and Risk Factors in Seoul, Korea; Bo-Hyoung Jin	Mother percentage not specified
12.	Early Feeding Practices and Severe Early Childhood Caries in Four-Year-Old Children from Southern Brazil: A Birth Cohort Study; C.A. Feldens	Intervention involved
13.	Child, neglect and oral health; Caroline Barbosa Lourenço	Poor quality
14.	High caries prevalence and risk factors among young preschool children in an urban community with water fluoridation; Catherine H. L. Hong	Mother percentage not specified
15.	Immigrant-native differences in caries-related knowledge, attitude, and oral health behaviors: a cross-sectional study in Taiwan ; Chih-Chang Chen	No data on ECC
16.	Relationships Between Caregivers' Responses to Oral Health Screening Questions and Early Childhood Caries; Christopher R. Roberts	Mother percentage not specified
17.	Does maternal oral health predict child oral health-related quality of life in adulthood?Dara M Shearer1 D.M. Shearer	children age more than 72 months

18.	Linking Mother and Child Access to Dental Care; David Grembowski	Maternal outcomes not mentioned
19.	Parents' Oral Health Literacy and its Impact on their Children's Dental Health Status; Effat Khodadadi	Mother percentage not specified
20.	Severe early childhood caries and behavioral risk factors among 3-year-old children in Lithuania; Eglė Slabšinskienė	Mother percentage not specified
21.	Predictors of Dental caries among children 7–14 years old in Northwest Ethiopia: a community based cross-sectional study; Fenta A Ayele	Children 7 to 14 years
22.	Knowledge, attitudes and behavior of Italian mothers towards oral health: questionnaire validation and results of a pilot study; Gianna Maria Nardi	No data on ECC
23.	Mothers' Caries Increases Odds of Children's Caries ; J.A. Weintraub	Children age more than 7 years
24.	Breast feeding practices as cultural interventions for early childhood caries in Cree communities; Jaime Cidro	Intervention involved
25.	A Longitudinal Study of Dental Caries Risk among Very Young Low SES Children; John J. Warren	Intervention involved
26.	Influence of First-Time Mothers' Early Employment on Severe Early Childhood Caries in Their Child; Kamila Plutzer	Intervention involved
27.	Evaluating the effectiveness of oral health education program among mothers with 6-18 months children in prevention of early childhood caries; Kavita Manchanda	Intervention involved
28.	Social and behavioural determinants of early childhood caries; KB Hallett	Mother percentage not specified
29.	Association Between Breastfeeding and Dental Caries in Japanese Children; Keiko Tanaka	Poor quality
30.	The Influence of Mothers' Lifestyle and Health Behavior on Their Children: An Exploration for Oral Health; Keramat Nourijelyani	Children average age 11.6 years
31.	The Effect of Prolonged and Exclusive Breast-Feeding on Dental Caries in Early School-Age Children; M.S. Kramer	Intervention involved
32.	Effects of Prolonged and Exclusive Breastfeeding on Child Behavior and Maternal Adjustment: Evidence From a Large, Randomized Trial; Michael S. Kramer	Intervention involved
33.	Urban Mexican-American mothers' beliefs about caries etiology in children; Kristin S. Hoefft	Children age 10 years
34.	Parental smoking behavior and caries experience in preschool children; Leroy RLeroy R	Mother percentage not specified

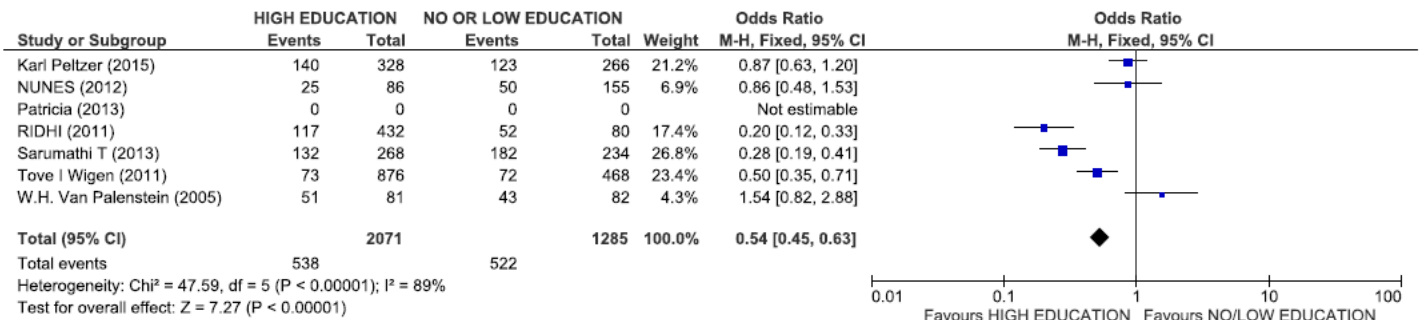
35.	Infant Breast-feeding and Childhood Caries: A Nine-year Study; Dr. Liang Hong	Mother percentage not specified
36.	Impact of dental orientation given to mothers during pregnancy on oral health of their children; Lilian Rigo	Intervention involved
37.	Risk factors associated with deciduous tooth decay in Iraqi preschool children; Mahmood Dhahir	Poor quality
38.	The relation between family socioeconomic trajectories from childhood to adolescence and dental caries and associated oral behaviours; Marco Aure´lio Peres	Children age more than 15 years
39.	Association between knowledge of caries preventive practices, preventive oral health habits of parents and children and caries experience in children resident in sub-urban Nigeria; Morenike O Folayan	Children age 8-12 years
40.	Association of Maternal-Child Characteristics as a Factor in Early Childhood Caries and Salivary Bacterial Counts; Nazan Kocatas Ersin	Low(47%) mother percentage
41.	The influence of mothers' lifestyle and health behavior on their children: an exploration for oral health; Nourijelyani K	Full article not found
42.	Association of Early Childhood Caries With Breastfeeding and Bottle Feeding in Southwestern Nigerian Children of Preschool Age; Olatosi OO	Full article not found
43.	Association between early childhood caries and maternal caries status: A cross-section study in São Luís, Maranhão, Brazil; Pedrita Mara do Espírito Santo de Souza	Intervention involved
44.	Early childhood caries and infant oral health:Paediatricians' and family physicians' knowledge,practices and training; Preeti Prakash	Maternal outcomes not mentioned
45.	Passive smoking and children's teeth; R M Bland	Maternal outcomes not mentioned
46.	Socio-behavioural factors and early childhood caries: a cross-sectional study of preschool children in central Trinidad ; Rahul Naidu	Maternal outcomes not mentioned
47.	Mutans Streptococci Colonization in Relation to Feeding Practices, Age and the Number of Teeth in 6 to 30-Month-Old Children: An <i>in vivo</i> Study; Rajesh Sharma	Poor quality
48.	Caregiver Knowledge and Attitudes of Preschool Oral Health and Early Childhood Caries (ECC); Robert J Schroth 2007	Low(77%) mother percentage
49.	Prevalence and risk factors of caregiver reported Severe Early Childhood Caries in Manitoba First Nations children: results from the RHS Phase 2 (2008-2010); Robert J. Schroth	Poor quality

50.	Factors related to children's caries: a structural equation modelling approach ; Rong Min Qiu	Mother percentage not specified
51.	Breast-feeding and early childhood caries: an assessment among Brazilian infants; A. Rosenblatt	Poor quality
52.	Bottle-Feeding Practices During Early Infancy and Eating Behaviors at 6 Years of Age; Ruowei Li	No data on ECC
53.	Transmission of mutans streptococci in mother-child pairs; S. G. Damle	Poor quality
54.	Early Maternal Psychosocial Factors Are Predictors for Adolescent Caries; S. Nelson	Children age is 3, 8 and 14 years
55.	Caregiver acceptability and preferences for preventive dental treatments for young African-American children; Sally H. Adams	Mother percentage not specified
56.	Dental caries in relation to socio-behavioral factors of 6-year-old school children of Udaipur district, India; Santhosh Kumar Tadakamadla	children age 6 years
57.	Association of Parental Stress and Early Childhood Caries; Seyed Ebrahim Jabbarifar	Mother percentage not specified
58.	Maternal Dental Anxiety and its Effect on Caries Experience Among Children in Udaipur, India; Shabnam Gulzar Khawja	children age 3 to 14 years
59.	Salivary Cortisol as a Biomarker to Explore the Role of Maternal Stress in Early Childhood Caries; Sharat Chandra Pani	Single article
60.	Secondhand smoke and incidence of dental caries in deciduous teeth among children in Japan: population based retrospective cohort study; Shiro Tanaka	Maternal outcomes not mentioned
61.	Maternal Transmission of Mutans Streptococci in Severe-Early Childhood Caries; Stephen C. Mitchell	Poor quality
62.	Protocol for assessing maternal, environmental and epigenetic risk factors for dental caries in children; Surani Fernando	Protocol
63.	Maternal Oral Mutans Streptococci (MS) Status, Not Breastfeeding, Predicts Pre-eruptive Infant Oral MS Status; Susan G. Reed	Intervention involved
64.	Social aspects of dental caries in the context of mother-child pairs; Suzely Adas Saliba	Poor quality
65.	Longitudinal study of prolonged breast or bottle feeding on dental caries in Japanese children; Takuro Yonezu	Mother percentage not specified
66.	Early childhood caries and its relationship with perinatal, socioeconomic and nutritional risks: a cross-sectional study; Valdeci Elias dos Santos Junior	Maternal outcomes not mentioned
67.	Knowledge and attitude of parents or caretakers regarding transmissibility of caries disease; Vivien T. SAKAI	No data on ECC

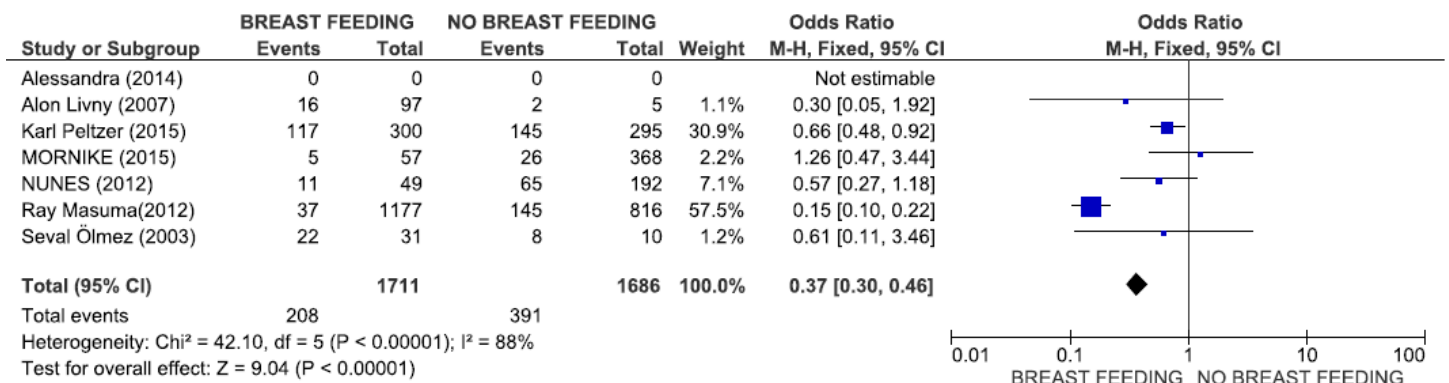
68.	Effects of breast-feeding duration, bottle-feeding duration and non-nutritive sucking habits on the occlusal characteristics of primary dentition; Xiaoxian Chen	No data on ECC
69.	Characterizing Diversity of Lactobacilli Associated with Severe Early Childhood Caries: A Study Protocol; Yihong Li	Protocol, children age upto 8.3 years
70.	Association Between Nocturnal Breastfeeding and Snacking Habits and the Risk of Early Childhood Caries in 18- to 23-Month-Old Japanese Children; Yoshimi Nakayama	Mother percentage not specified

Legends Graph

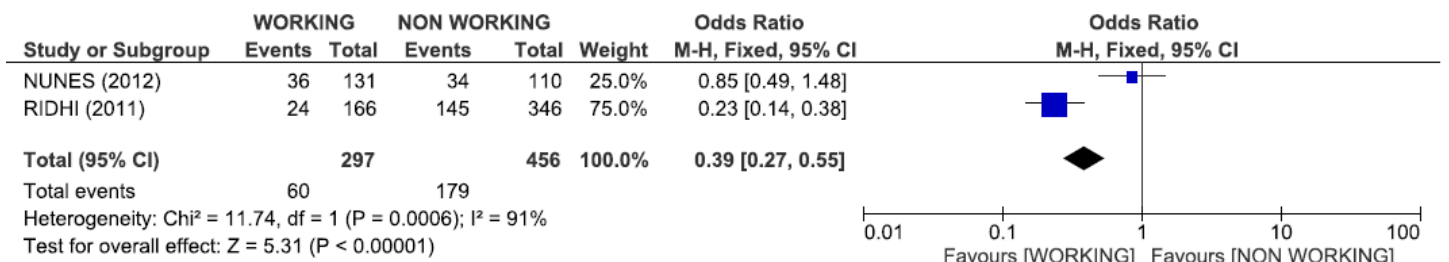
Graph 1



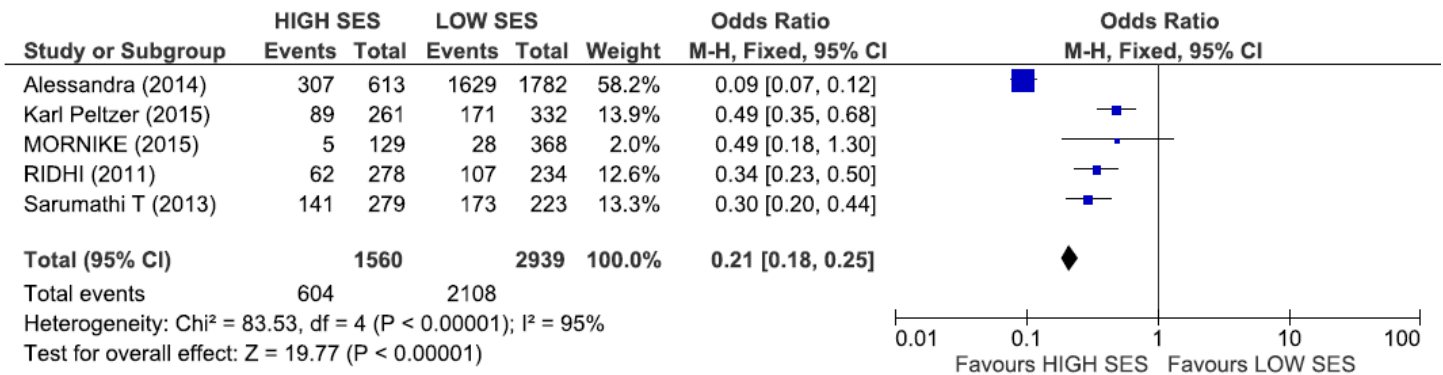
Graph 2



Graph 3



Graph 4



Graph 5

