



Prevalence of Dental Caries among Indian Children: A Meta-Analysis

Dr. V.K. Shivgotra, Dr. Manjeet Kumar, Dr. Himani Nanda* and Sapna Kumari

Department of Statistics

University of Jammu, Jammu-180006

ABSTRACT

Background: Dental caries is widely prevalent globally but the distribution and severity of dental caries varies across countries and regions. In India, there exists a need to assess the prevalence of dental caries for planning and implementation of oral health programs.

Objectives: To estimate the pooled prevalence of dental caries among male and female Indian population through systematic review and meta-analysis.

Materials and Methods: In this study, we have included various studies from different parts of India by searching databases like Google Scholar, Pub Med, etc. from the year 2000 to 2020. Meta-analysis was conducted using the random effect model in R software version 4.2.0. to compute the pooled prevalence of dental caries among the males and females Indian children along with 95% confidence interval.

Results: The prevalence of dental caries among the Indian children involved 19,244 male subjects and 16,976 female subjects from 27 studies. The pooled estimate of the prevalence of dental caries in the male children using the random effect model was 55.8% (95% CI: 48.8%-62.6%) whereas the prevalence of dental caries in the female population using the random effect model was 44.2% (95% CI: 43.4%- 4.9%) respectively.

Conclusions: Dental caries continues to be a prominent oral health problem among children in India. The pooled prevalence of dental caries among Indian male children was greater than the pooled prevalence of dental caries among Indian female children. This data could help health policy makers to tailor specific oral health interventions.

Keywords: Children, dental caries, meta-analysis, prevalence, systematic review

INTRODUCTION

Oral diseases such as dental caries, periodontal diseases, and tooth loss are major public health problems worldwide and poor oral health has a profound effect on general health and quality of life. [1] Oral health is integral to general health and essential for well-being and oral diseases qualify as major public health problems owing to their high prevalence and incidence. [2] Oral health is defined as a state of the mouth and its associated structures, where there is no disease or pain and able to function well to masticate food and state of teeth which are of socially acceptable appearance. [3]

The public health problems associated with oral diseases are a serious burden on countries all around the world. [4] Children are very important part of a country's demography and their health influences the future of the nation. The children suffering from poor oral health are twelve times more likely to have restricted activity days as compared to their healthy counterparts. [5] The World Health Organization (WHO) has

ranked dental caries, as number three among all chronic non-communicable diseases that require worldwide attention for prevention and treatment. [6]

Dental caries are most common among the spectrum of oral diseases and are still a major public health burden in developing countries, affecting 60%-90% of school children and a number of adults. [7] Children are more susceptible to dental caries, their primary teeth exfoliated and permanent dentition erupts into the mouth, their oral immunity is still in the building phase, they face the transition of dietary habits which changes from home to school. The predisposing factors for causing dental caries are active at this stage. [8]

Dental caries are highly prevalent among children and persists to be a significant public health problem. It has detrimental consequences on children's quality of life by inflicting pain, premature tooth loss, and malnutrition, eventually influencing overall growth and development. The children suffering from poor oral health are twelve times more likely to have restricted activity days as compared to their healthy counterparts. [9] Low income, poor oral hygiene, mother's schooling and fluorosis, enamel defects, various measures of low socioeconomic status, low level of parental education and cariogenic diet, all factors caries risk. [10]

Children in the mixed dentition stage are prone to poor oral hygiene because of carefree age, emotional stresses, increased frequency in the intake of refined sugar, soft and sticky food, shedding of deciduous, and eruption of permanent teeth. This period of child's age is critical from the point of view of the normal development of occlusion and preservation of first molars from dental caries which is one of the most important responsibilities of the profession. [11]

In India, children of all age groups are affected by dental caries, the trend indicates that there is an increase in oral health problems especially dental caries, which has been consistently increasing both in prevalence and in severity over last five decades. It has been observed that during 1940, the prevalence of dental caries in India was 55.5% and during 1960, it was reported to be 68%. [12] The National Oral Health Survey and Fluoride Mapping-2003 reported that the prevalence of dental caries among 12-year old children was 72.5% and among 15-year old children was 75.4%. [13]

Despite several attempts to cure caries and prevent the disease, its prevalence has increased over the last couple of decades. These changing trends in the prevalence of dental caries need continuous understanding and investigations. The present study was designed to access the prevalence of dental caries among male and female school going children of India.

MATERIALS AND METHODS

LITERATURE SEARCH

The search strategy, selection of publication and reporting of results for the review were conducted in accordance to the PRISMA guidelines. Research articles published between 2000 and 2020 were screened using databases such as MEDLINE/PubMed, Science Direct, Google Scholar, Cochrane, and Scopus. Search strings used for electronic screening of databases included the following: prevalence, dental caries, India, DMFT, cavitated lesion, non-cavitated lesion, root caries, incisor caries, smooth surface caries, occlusal caries, proximal caries, DMF, early childhood caries, premolar caries, molar caries, canine caries, coronal caries, pit and fissure caries, linear enamel caries, and age group ranging from 0 to 15 years.

SELECTION OF STUDIES

All identified research papers were independently reviewed by all the authors. Disagreements between the authors were resolved by considering the facts mentioned in the PRISMA checklist.

INCLUSION CRITERIA

The studies in the mentioned database with full-text articles published in English were screened for analysis. The studies were conducted in the Indian population and were prevalence studies conducted after the year 1999. The inclusion criteria composed of observational studies (case-control, cohort, and cross-sectional) conducted on the prevalence of dental caries in India, on patient population aged 0-15 years.

EXCLUSION CRITERIA

The studies with non-specific data, inadequately designed, editorials, letters, case reports, conference proceedings, ongoing observational studies, reviews and studies that did not report statistical tests for dental caries were excluded from the present analysis. Some studies in which calculated proportions acted as outliers were also excluded from the study to ensure normal distribution of the data.

DATA EXTRACTION

Data extraction was performed by reviewers and then confirmed by the second reviewer, and the whole process was discussed by all the reviewers. The information from eligible studies were extracted which encompassed author's name, study-period, number of participants, population characteristics (age range and dentition), geographic location, type of study, gender, number of cases, etc. was extracted and the data were summarized in the form of a table.

STATISTICAL ANALYSIS

Statistical analyses were performed using R software version 4.2.0. A random effects model was employed in all meta-analysis procedures. The random effect model assumes that observed estimates of treatment effect can vary across studies because of real differences in the treatment effect in each study as well as sampling variability (chance). Variation (heterogeneity) across studies must also be considered. The random effect meta-analysis allows for heterogeneity by assuming that underlying effects follow a normal distribution. Cochran's Q and I^2 were used to incorporate heterogeneity in the studies and 95% confidence intervals (CIs) were reported in the analysis. Forest plots and funnel plots were used for graphical representation of the meta-analysis. The squares in the forest plot represent the effect estimates of individual studies with their 95% CI of the prevalence of dental caries with size of squares proportional to the weights assigned to each study in the met-analysis. The diamond represents the overall result and 95% CI of the random effect meta-analysis. The funnel plots were used to investigate publication bias in the study. The inverted funnel shows that there is no publication bias, whereas the asymmetric funnel plot may suggest publication bias. The dots in the funnel plot represent the studies involved in the meta-analysis.

LITERATURE REVIEWED

Figure 1 summarizes search strategy carried out. Our search strategy identified approximately 540 articles. Of these, 260 duplicate articles were excluded. We also excluded 185 articles after screening the title and abstract. The full text of the remaining 95 articles was screened and 65 articles were further excluded due to lack of inclusion criteria and 27 articles were finally included in the study.

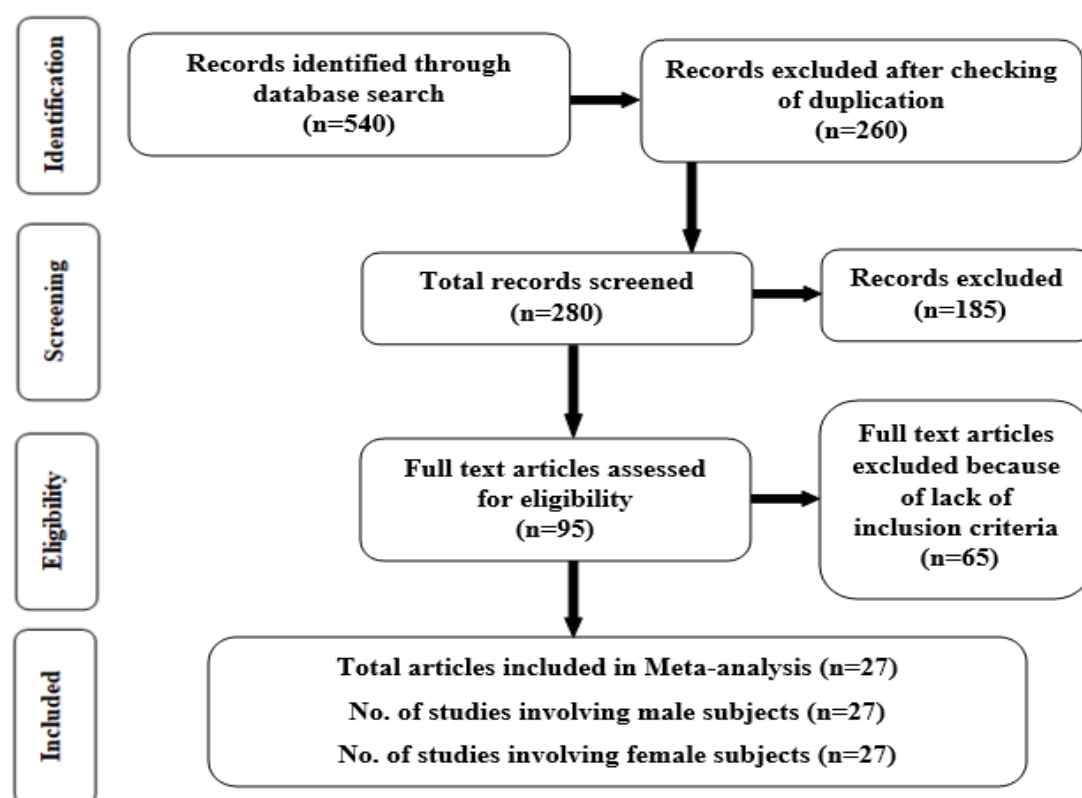


Figure 1 Flowchart showing the selection process of relevant studies.

STUDY CHARACTERISTICS

We included 27 studies of dental caries among the Indian children population in this meta-analysis. The included articles consisted of 27 studies based on male and female children population in India.

Meta-analysis of the prevalence of dental caries among the Indian children involved 19,244 male subjects from 27 studies. The pooled estimate of the prevalence of dental caries in the male children using the random effect model was 55.8% (95% CI: 48.8%-62.6%). (Table 1) Significant heterogeneity ($I^2 = 99.0\%$ and Cochran's $Q = 2530.44$, $p < 0.0001$) among the 27 studies was found. (Table 2) The forest plot (Figure 2) and the funnel plot (Figure 3) represents proportion of subjects affected by dental caries in each study and the pooled estimate of the prevalence of dental caries among the male children respectively.

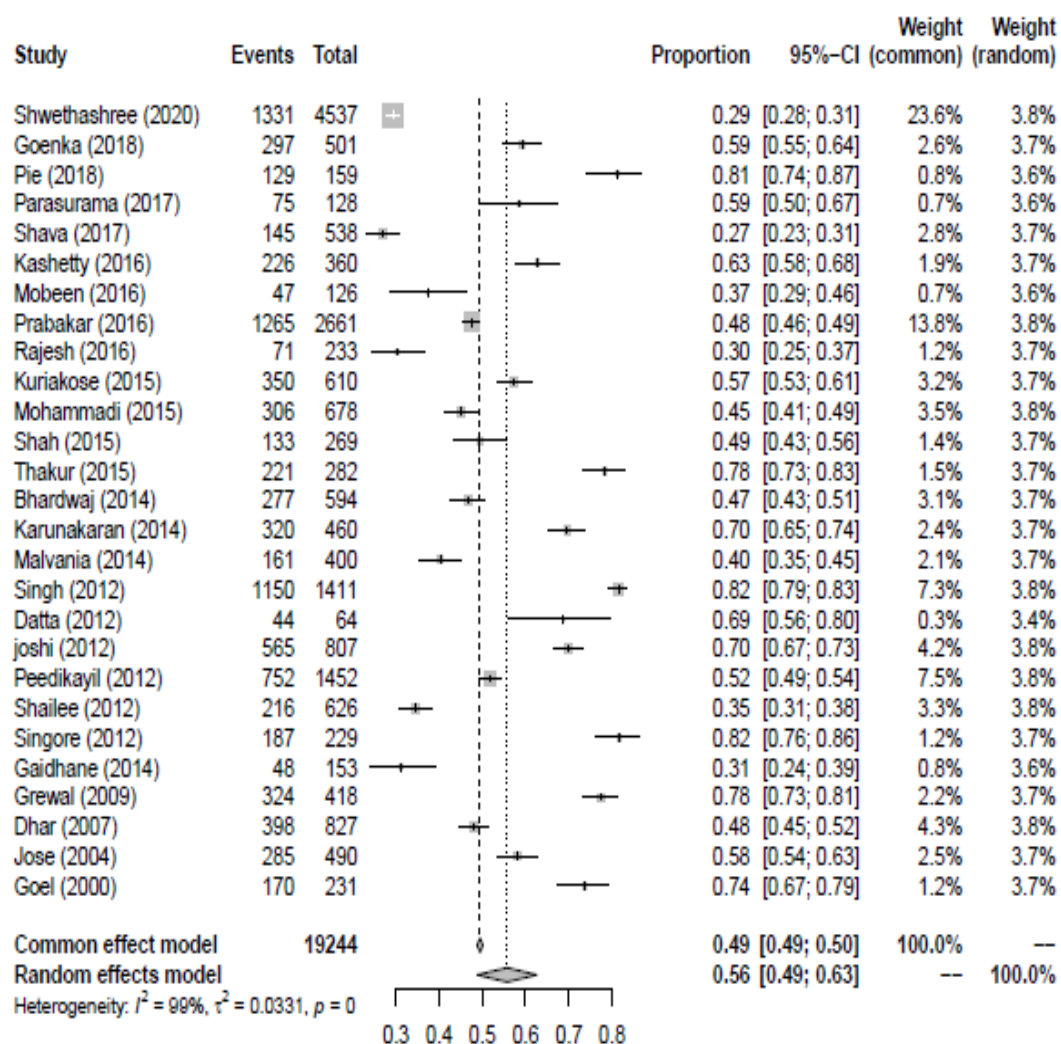
Similarly, meta-analysis of the prevalence of dental caries in the female children included 16,976 subjects from 27 studies. The pooled estimate of prevalence of dental caries in the female population using the random effect model was 44.2% (95% CI: 43.4%- 4.9%). (Table 3) Significant heterogeneity ($I^2 = 98.5\%$ and Cochran's $Q = 1708.75$, $p < 0.0001$) among the 27 studies was found. (Table 4) The forest plot (Figure 4) and the funnel plot (Figure 5) represents proportion of subjects affected by dental caries in each study and the pooled estimate of the prevalence of dental caries among the male children respectively.

Table 1: Prevalence of dental caries among Indian male children

Study Name	N	Cases	95%CI	%W (Random)
Shwethashree (2020)	4537	1331	0.29 [0.28-0.31]	3.8
Goenka (2018)	501	297	0.59 [0.55-0.64]	3.7
Pie (2018)	159	129	0.81 [0.74-0.87]	3.6
Parasuraman (2017)	175	75	0.43 [0.39-0.47]	3.7
Sharva (2017)	538	145	0.27 [0.23-0.31]	3.7
Kashetty (2016)	360	226	0.63 [0.58-0.66]	3.7
Mobeen (2016)	126	47	0.37 [0.29-0.46]	3.6
Prabakar (2016)	2661	1265	0.48 [0.46-0.49]	3.8
Rajesh (2016)	233	71	0.30 [0.25-0.37]	3.7
Kuriakose (2015)	610	350	0.57 [0.53-0.61]	3.7
Mohammadi (2015)	678	306	0.45 [0.41-0.49]	3.8
Shah (2015)	269	133	0.49 [0.43-0.56]	3.7
Thakur (2015)	282	221	0.78 [0.73-0.83]	3.7
Bhardwaj (2014)	594	277	0.47 [0.43-0.51]	3.7
Karunakaran (2014)	460	320	0.70 [0.65-0.74]	3.7
Singh (2012)	400	161	0.40 [0.35-0.45]	3.7
Mungal (2012)	1411	1150	0.82 [0.79-0.83]	3.8
Datta (2012)	64	44	0.69 [0.56-0.80]	3.4
Joshi (2012)	807	565	0.70 [0.67-0.73]	3.8
Peedikayil (2012)	1452	752	0.52 [0.49-0.54]	3.8
Shailee (2012)	626	216	0.35 [0.31-0.38]	3.8
Singore (2012)	229	187	0.82 [0.76-0.86]	3.7
Gaidhane (2014)	153	48	0.31 [0.24-0.39]	3.6
Grewal (2009)	418	324	0.78 [0.73-0.81]	3.7
Dhar (2007)	827	398	0.48 [0.45-0.52]	3.8
Jose (2004)	490	285	0.58 [0.54-0.63]	3.7
Goel (2000)	231	170	0.74 [0.67-0.79]	3.7

Table 2: Tests of heterogeneity among studies of Indian male children

Test of heterogeneity	Prevalence	LCI 95%	HCI 95%
Pooled Statistics	0.5577	0.4881	0.5019
Heterogeneity	9.87	9.20	10.58
I^2	99.0	98.8	99.1
Cochran's Q	2530.44		
χ^2 , p	0.0001		
τ^2	0.0331		

**Figure 2: Forest plot of the meta-analysis of prevalence of dental diseases among Indian male children**

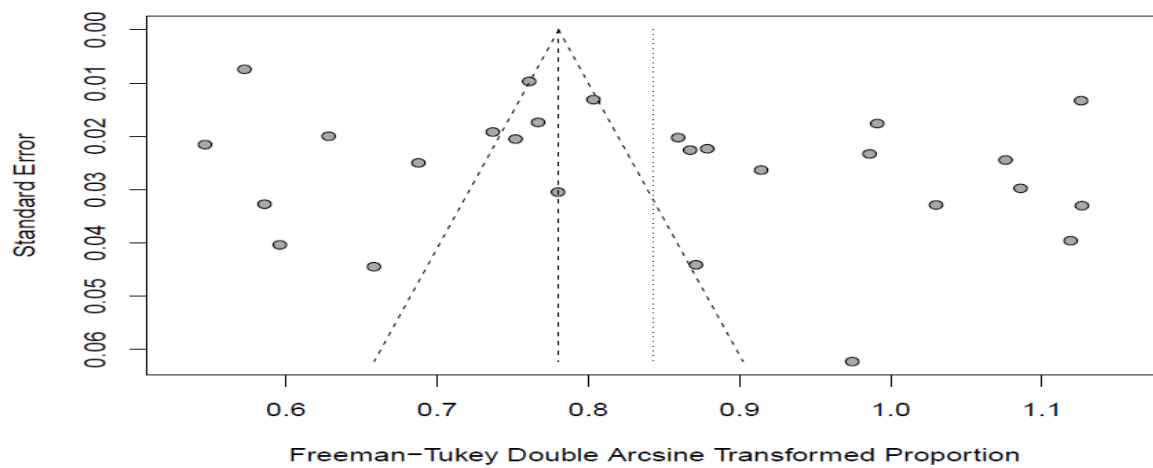


Figure 3: Funnel plot of the meta-analysis of prevalence of dental diseases among Indian male children

Table 3: Prevalence of dental caries among Indian female children

Study Name	N	Cases	95%CI	%W (Random)
Shwethashree (2020)	4525	1335	0.30 [0.28-0.31]	3.8
Goenka (2018)	499	258	0.52 [0.47-0.56]	3.8
Pie (2018)	140	105	0.75 [0.67-0.82]	3.6
Parasuraman (2017)	185	88	0.47 [0.45-0.50]	3.8
Sharva (2017)	562	187	0.33 [0.29-0.37]	3.8
Kashetty (2016)	398	245	0.62 [0.57-0.66]	3.7
Mobeen (2016)	74	47	0.64 [0.57-0.74]	3.5
Prabakar (2016)	1832	860	0.47 [0.45-0.49]	3.8
Rajesh (2016)	194	66	0.34 [0.27-0.41]	3.7
Kuriakose (2015)	719	370	0.51 [0.48-0.55]	3.8
Mohammadi (2015)	462	122	0.26 [0.22-0.31]	3.7
Shah (2015)	184	59	0.32 [0.25-0.39]	3.7
Thakur (2015)	356	286	0.80 [0.76-0.84]	3.7
Bhardwaj (2014)	606	311	0.51 [0.47-0.55]	3.8
Karunakaran (2014)	390	240	0.62 [0.57-0.66]	3.7
Malvania (2014)	627	127	0.20 [0.17-0.24]	3.8
Singh (2012)	317	126	0.40 [0.34-0.45]	3.7
Datta (2012)	50	38	0.76 [0.62-0.87]	3.3
Joshi (2012)	793	541	0.68 [0.65-0.71]	3.8
Peedikayil (2012)	1478	696	0.47 [0.45-0.50]	3.8
Shailee (2012)	385	163	0.42 [0.37-0.47]	3.7
Singore (2012)	243	187	0.77 [0.71-0.82]	3.7
Gaidhane (2014)	177	57	0.32 [0.25-0.40]	3.7
Grewal (2009)	304	237	0.78 [0.73-0.82]	3.7
Dhar (2007)	760	344	0.45 [0.42-0.49]	3.8
Jose (2004)	578	295	0.51 [0.47-0.55]	3.8
Goel (2000)	196	133	0.68 [0.61-0.74]	3.7

Table 4: Tests of heterogeneity among studies of Indian female children

Test of heterogeneity	Prevalence	LCI 95%	HCI 95%
Pooled Statistics	0.4416	0.4341	0.4491
Heterogeneity	8.11	7.48	8.78
I^2	98.5	98.2	98.7
Cochran's Q	1708.75		
χ^2, p	0.0001		
τ^2	0.0332		

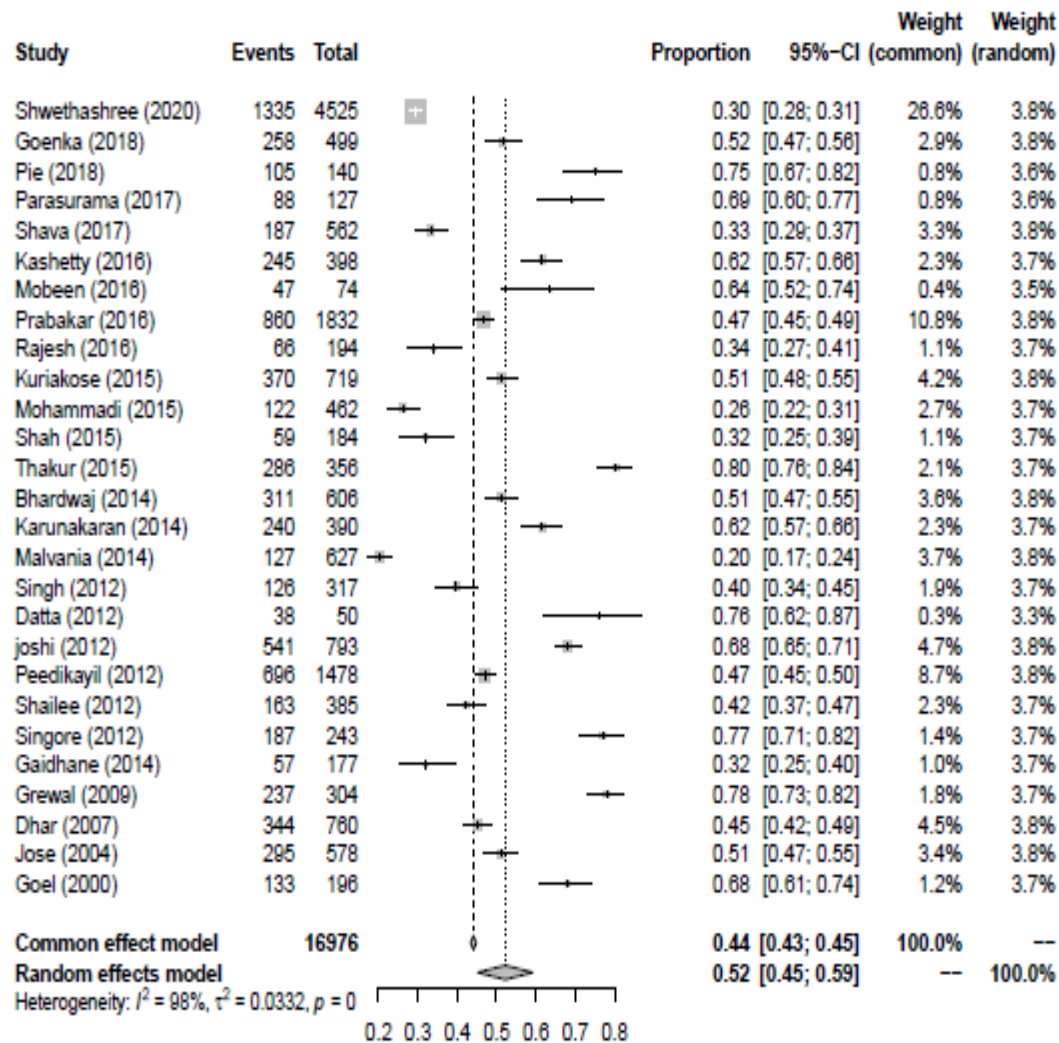


Figure 4: Forest plot of the meta-analysis of prevalence of dental diseases among Indian female children

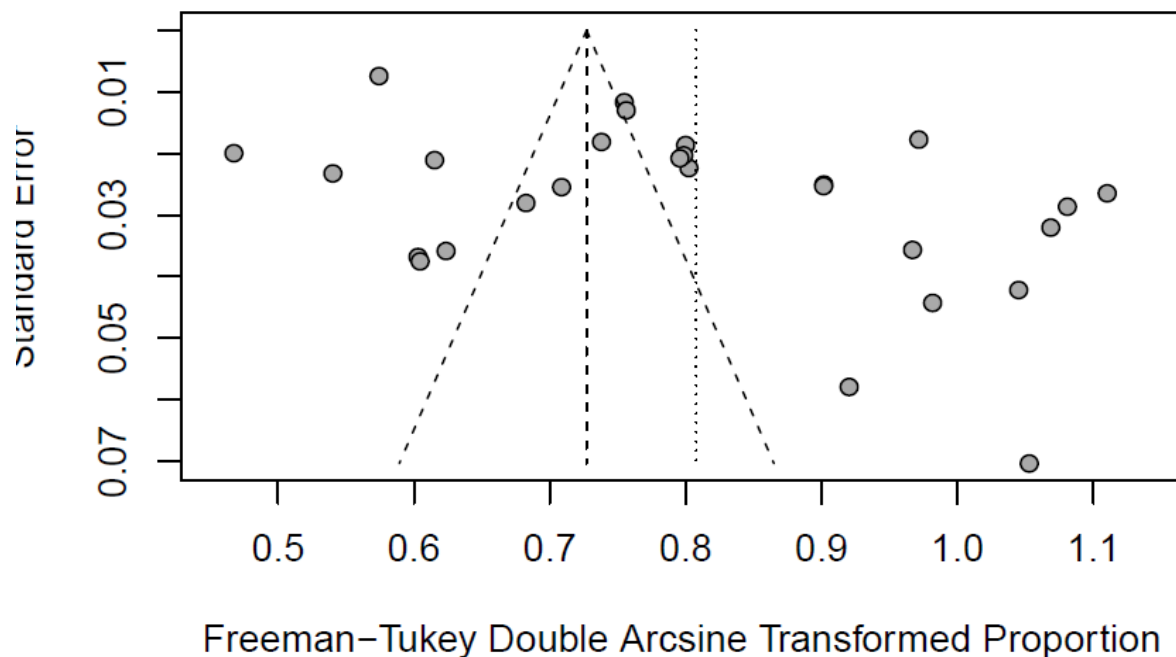


Figure 5: Funnel plot of the meta-analysis of prevalence of dental diseases among Indian female children

DISCUSSION

Dental caries is one of the major neglected health problems in developing countries. The present study concentrated on all studies reporting the prevalence of dental caries among the Indian children. Twenty-seven studies met the inclusion requirements and were finally included in this systematic review. Also, this systematic review and meta-analysis study provided valuable information about the prevalence and severity of dental caries in Indian children.

As per our review and analysis, the overall prevalence of dental caries among male Indian children was 55.8% (95% CI: 48.8%-62.6%) which was less than the prevalence (57.4%) reported by Kuriakose *et al.* [23] in Trivandrum, India. The highest prevalence of dental diseases was (81.6%) reported by Singore *et al.* [36] in Uran, Raigad district, Maharashtra. Similar findings were reported by Munjal *et al.* [31] and Grewal *et al.* [38] in their respective studies. The lowest prevalence of dental caries among the male Indian children was (26.9%) observed by Shava *et al.* [18] in Bhopal, India. Shwethashree *et al.* [14] and Rajesh *et al.* [22] also showed a similar pattern of low prevalence of dental diseases among male subjects which was (29.3%) and (30.4%) in their respective studies.

The estimated overall prevalence of dental diseases among female children of India was 44.2% (95% CI: 43.4%-4.9%), which was higher than the prevalence (42.3%) reported by Shailee *et al.* [35] in Shimla, Himachal Pradesh, India. The highest prevalence of dental caries among female Indian children was observed by Thakur *et al.* [26] in Thane district of Maharashtra, India. Grewal *et al.* [37], Singore *et al.* [35], Dutta *et al.* [32] and Pie *et al.* [16] also reported similar high prevalence of dental caries among female children. The lowest prevalence of dental diseases was (20.2%) reported by Malvania *et al.* [29] in Vadodara, Gujarat and (26.4%) reported by Mohammadi *et al.* [24] in Channagiri Taluk in Davangere district of Karnataka, India.

CONCLUSIONS

The study focused on all articles reporting the prevalence of dental caries among Indian children. The findings of present study suggests that the prevalence of dental caries among Indian male children was 55.8%, whereas the prevalence of dental caries among Indian female children was 44.2%. The pooled prevalence of dental caries among Indian male children was greater than pooled prevalence of dental caries among Indian female children. The findings of this study suggests that the prevalence of dental caries is a major health concern affecting at least half of the Indian children. These findings can help in better targeting of interventions and health policy formation.

LIMITATIONS

One of the main limitations is that the studies conducted in subjects with different bio-social characteristics have been included in the present meta-analysis. Also the pooled estimate of prevalence of dental caries among Indian children does not provide an overview of the problem of dental caries.

REFERENCES

1. Jose A, Joseph MR. Prevalence of dental health problems among school going children in rural Kerala. *J Indian Soc Pedod Prev Dent*, 2003; 21: 147-51.
2. The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century-the approach of the WHO Global Oral Health Programme.
3. Yewe, Dyer M. The definition of oral health. *Br Dent J.*, 1993; 174 (7): 224-25.
4. World Health Organization. Oral Health Surveys-Basic Methods. 5th ed. Geneva:WHO; 2013.
5. Goel R, Vedi A, Veerasha KL, Sogi GM, Gambhir RS. Oral hygiene practices and dental caries prevalence among 12 and 15 years school children in Ambala, Haryana A cross-sectional study. *J Clin Exp Dent*, 2015; 7: 374-379.
6. Marrs JA, Trumbley S, Malik G. Early childhood caries: Determining the risk factors and assessing the prevention strategies for nursing intervention. *Pediatr Nurs.*, 2011; 37: 9-15
7. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ*, 2005; 83 (9): 661-69.
8. Leghari M, Tanwir F, Orth C, Ali H. Dental caries prevalence and risk factors among school children age 12-15 years in Malir, Karachi. *Pak Oral Dental J*, 2012; 32:484.
9. 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* 2012; 12:59.
10. Basha S, Swamy HS. Dental caries experience, tooth surface distribution and associated factors in 6- and 13- year- old school children from Davangere, India. *J Clin Exp Dent*; 2012; 4: 210-216.
11. Joshi N, Sujana S, Joshi K, Parekh H, Dave B. Prevalence, severity and related factors of dental caries in school going children of Vadodara city-An epidemiological study. *J Int Oral Health*, 2013; 5: 35-39.
12. Damle SC, Patel AR. Caries prevalence and treatment need amongst children of Dharavi, Bombay, India. *Community Dent Oral Epidemiol.* 1994; 22 (1): 62-63.
13. National Oral Health Survey and Fluoride Mapping. India: Dental Council of India Publication; 2002-2003.
14. Shwethashree M, George PS, Prakash B, Smitha MC, Shabadi N, Murthy MRN *et al.* Prevalence of oral diseases among school children of Mysuru and Chamarajanagar districts, Karnataka, India. *Clinical Epidemiology and Global Health.* 2020; 8: 725-727.
15. Goenka P, Dutta S and Mishra P. Prevalence of Dental Caries in Children of Age 5 to 13 Years in District of Vaishali, Bihar, India. *International journal of clinical pediatric dentistry*, 2018; 11 (5): 359-364.
16. Pai NG, Acharya S, Vaghela J and Mankar S. Prevalence and risk factors of dental caries among school children from a low socio economic locality in Mumbai, India. *International Journal of Applied Dental Sciences*, 2018; 4 (1): 203-207.
17. Parasuraman G, Krishna YG, Kaviya M, Jain NA, Rajendiran P, Dutta R. A study on the prevalence of dental caries among the school-going children in Tamil Nadu. *International Journal of Community Medicine and Public Health*, 2017; 4 (10): 3582-3589.
18. Sharva V, Khare P, Reddy V, Jain M, Khare A, Singh P. Dental caries prevalence and treatment needs among 12 and 15 years old School going children of rural and urban areas of Bhopal district, India. *Journal of Indian Association of Public Health Dentistry*, 2017; 5: 340-343.

19. Kashetty MV, Patil S, Kumbhar S, Patil P. Prevalence of dental caries among 3–6 years old Anganwadi children in Mudhol town, Karnataka, India. *Journal of Indian Association of Public Health Dentistry*, 2016; 14: 403-408.
20. Mobeen N and Ramakrishnan M. Prevalence of dental caries in the school-going children in RBI staff quadrant school. *Int J Cur Res Rev*, 2016; 8 (22): 10-12.
21. Prabakar J, John J and Srisakthi D. Prevalence of dental caries and treatment needs among school going children of Chandigarh. *Indian J Dent Res*, 2016; 27 (5): 547-552.
22. Rajesh SS and Venkatesh P. Prevalence of dental caries among school going children in south India. *International Journal of Medical Science and Public Health*, 2016; 5 (4): 700-704.
23. Kuriakose S, Prasannan M, Remya K, Kurian J and Sreejith K. Prevalence of early childhood caries among preschool children in Trivandrum and its association with various risk factors. *Contemp Clin Dent*, 2015; 16 (1): 1-5.
24. Mohammadi SN, Prashant GM, Kumar PGN, Sushanth VH and Imranulla M. Dental caries status in 6-14 year old school children of rural Channagiri, Davangere: A cross-sectional survey. *Journal of Indian Association of Public Health Dentistry*, 2015; 13: 389-392.
25. Shah AF, Batra M, Kabasi S, Dany SS, Rajput P and Ishrat A. Dental caries experience among 6-12 year old school children of Budgam district, Jammu and Kashmir state, India. *Asian Pac. J. Health Sci.*, 2015; 2 (1): 55-59.
26. Thakur AM and Baburaj MD. Prevalence of dental health problems among school going children in rural areas of Thane district, Maharashtra. *International Journal of Dentistry and Oral Science*, 2015; 2 (7): 106-110.
27. Bhardwaj VK. Dental caries prevalence in individual tooth in primary and permanent dentition among 6-12 year old school children in Shimla, Himachal Pradesh. *International Journal of Health and Allied Sciences*, 2014; 3 (2): 125-128.
28. Karunakaran R, Somasundaram S, Gawthaman M, Vinodh S, Manikandan S and Gokulnathan S. Prevalence of dental caries among school going children in Namakkal district: A cross-sectional study. *Journal of Pharmacy and Bioallied Sciences*, 2014; 6 (1): 160-161.
29. Malvania EA, Ajithkrishnan CG, Thanveer K and Hongal S. Prevalence of dental caries and treatment need among 12 years old school going children in Vadodara city, Gujarat, India: A cross-sectional study. *Indian Journal of Oral Sciences*, 2014; 5 (1): 1-9.
30. Singh S, Vijayakumar N, Priyadarshini HR and Shobha M. Prevalence of early childhood caries among 3-5 year old preschoolers in schools of Marathahalli, Bangalore. *Dental Research Journal*, 2012; 9 (6): 710-714.
31. Munjal V, Gupta A, Kaur P and Garewal R. Dental caries prevalence and treatment needs in 12 and 15 year old school children of Ludhiana city. *Indian J Oral Sci*. 2013; 1: 27-30.
32. Datta P and Datta PP. Prevalence of dental caries among school children in Sundarban, India. *Epidemiol Open Access*, 2013; 3 (4): 1-4.
33. Joshi N, Sujan S, Parekh K and Dave B. Prevalence severity and related factors of dental caries in school going children of Vadodara city. *Int J Oral Dent Health*, 2013; 5 (4): 35-39.
34. Paadikayil FC, Kottayi S, Kenchamba V and Jumana MK. Dental caries prevalence and treatment needs of school going children in Kannur district, Kerala. *SRM Journal of Research in Dental Sciences*, 2013; 4 (2): 51-53.
35. Shailee F, Sogi G, Sharma K and Nidhi P. Dental caries prevalence and treatment needs among 12 and 15 year old school children in Shimla city, Himachal Pradesh, India. *Indian J Dent Res*, 2012; 23 (5): 579-584.
36. Shingore P, Jogani V, Sevekar S, Patil S and Jha M. Dental caries prevalence among 3 to 14 year old school children, Uran, Raigad district, Maharashtra. *J Contemp Dent*, 2012; 2 (2): 11-14.

37. Gaidhane A, Patil M, Khatib N, Zodpey and Syed Q. Prevalence and determinant of early childhood caries among the children attending the Anganwadis of Wardha district, India. *Indian J Dent Res*, 2011; 24 (3): 1-7.
38. Grewal H, Verma M and Kumar A. Prevalence of dental caries and treatment needs in the rural child population of Nainital district, Uttaranchal. *Indian J Soc Pedo Prev Dent*, 2009; 27 (4): 224-226.
39. Dhar V, Jain A, Dyke T and Kohli A. Prevalence of gingival diseases, malocclusion and fluorosis in school-going children of rural areas in Udaipur district. *J Indian Soc Pedod Prev Dent*, 2007; 25 (2): 103-105.
40. Jose A and Joseph R. Prevalence of dental health problems among school going children in rural Kerala. *J Indian Soc Pedod Prev Dent*, 2003; 21 (4): 147-151.
41. Goel P, Sequeira P and Peter S. Prevalence of dental disease amongst 5-6 and 12-13 year old school children of Puttur municipality, Karnataka state India. *Indian J Soc Pedo Prev Dent*, 2006; 18 (1): 11-17.