

Dental Caries Scenario Among 5, 12 and 15-Year-old Children in India- A Retrospective Analysis

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ABSTRACT

Objectives: Dental caries is the most prevalent dental disease and children are one of the most affected groups. Thus, the present study was conducted to assess the average dental caries prevalence across different WHO index age groups (5, 12 & 15 years) for the past fifteen years.

Materials and Methods: Literature search was performed electronically in various search engines like google scholar, PubMed, Copernicus, etc. using Dental caries and India as MeSH terms. Articles from the past 15 years reporting on dental caries prevalence and experience in India were searched and this online searching strategy collected and listed 781 articles. After evaluating their titles and abstracts, only 30 articles fulfilled the inclusion and exclusion criteria & were finally selected for complete review and data collection. Five articles which were hand searched were also included. Pooled estimates were calculated for different index age groups and different regions

(Northern and Southern) separately with a confidence interval of 95% both for prevalence and experience of dental caries.

Results: The pooled prevalence of dental caries was found to be highest in 15 year olds followed by 5 and 12 years (62.02%, 48.11% & 43.34% respectively). Weighted mean was also found to be highest for 15 years, followed by 5 and 12 years (2.56±6.508, 2.49±7.78, 1.48±3.292 respectively). Pooled prevalence and weighted mean for the Northern India region was found to be more in all the index age groups as compared to the Southern India region.

Conclusion: More than 40% of the children in India have shown dental caries in both primary and permanent teeth in the past 15 years. Also, Northern region was found to be more affected by dental caries than Southern region. Since children are seen as the future of the nation, this data could be helpful in the planning of oral health care services by the concerned authorities in the community.

Keywords: Caries experience, Developing countries, Prevalence, WHO index age groups

INTRODUCTION

Health of one's teeth has a direct impingement on the overall health and personality of an individual [1]. Dental caries is one of the most common oral diseases that affects 60-90% of schoolchildren [2]. It is the most common chronic disease of childhood (6-12 years) that not only interferes with speech, self-esteem and daily routine activities, but its pain also affects normal nutrition intake and thus results in underweight children with abnormal cognitive development. Dental caries is a disease of multifactorial origin. There are various host, agent and environment factors which affect the dental caries status of individuals. Among these factors; age, race, ethnicity, cultural factors and diet are few of the factors which vary with different regions and different individuals & play a pivotal role in effecting the dental caries status [3].

A large variation has been seen in the trends of dental caries among the index age groups as suggested by WHO worldwide [4,5]. It is observed that the American Region (AMRO) and the Europe Region (EURO) present a risk of 1.14 and 1.10 times higher than the average in the world. The African Region (AFRO) was with 19% lower risk compared to the average of all countries surveyed, followed by Southern Eastern Asian Region SEARO region [6]. In most highly developed countries like USA, UK, Japan, etc. there was a precipitous increase in prevalence and incidence of the disease during 1920's to 1950 [4]. Most significant recent epidemiological event has been the spectacular fall in caries prevalence in the countries of the western world. Thus, primarily due to the increased use of fluorides from all sources, especially toothpastes, a decrease in dental caries among children in highly developed countries started to emerge around 1970, and the percentage of caries free children in different age categories have increased since then. But changing trend has been seen in the developing countries like India

and Thailand, which have reported an increase in dental caries. This could be ascribed to the increased availability and use of processed sugars and underutilization of preventive services in the developing countries [3,7].

In 1940, the prevalence of dental caries in 5 and 12-year-old schoolchildren in India were 55.5% and it jumped to 68% in the 1960 and climbed to 89% in subsequent years [8-10]. Prevalence of dental caries was about 50% in 5 year old children and close to 84.1% in older age population as reported by National oral health survey and fluoride mapping 2002-2003 [11-14].

The index age group of children, according to WHO (5, 12 and 15 years) presents a vulnerable population for the development of dental caries. The age of 12 years has been considered as the "Global monitoring age for dental caries" [14]. Also, the vast and varied cultural difference existent in our country made the dental caries scene more challenging. Thus, to appreciate the changing trends of dental caries amongst the said age groups and over the defined geographical distribution areas, an attempt of systematic analysis from the available point prevalence studies was done.

Thus, the present study was conducted with the aim to determine the average dental caries prevalence and experience across different WHO index age groups (5, 12 and 15 years) over the past fifteen years. This information may be helpful for the oral health care planning as basic dental caries data is lacking.

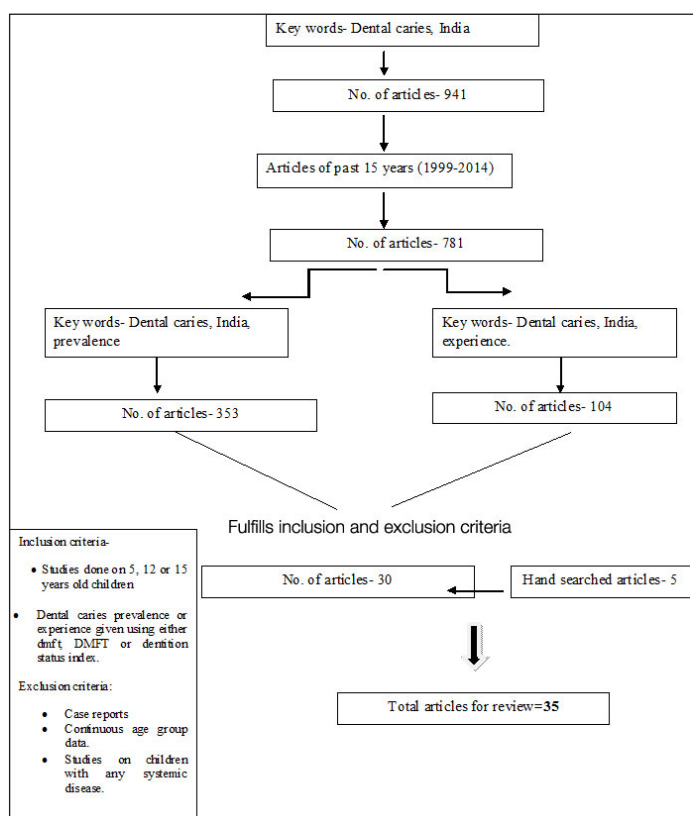
MATERIALS AND METHODS

Study design: Retrospective study

Data Source: All the articles published in dental journals in the past 15 years, which have studied dental caries prevalence in India were selected for the study.

SEARCH STRATEGY

A search strategy was performed electronically in several search engines like Pubmed Central, Embase, Google Scholar, etc. using dental caries among 5,12 and 15 years children in India as research question and Dental caries and India as MeSH terms. Out of the total 941 articles which appeared 781 articles of the past 15 years (1999-2014) were selected for inspection. A total of 457 articles were retrieved based of search words i.e. dental caries prevalence (353 articles) or experience (104 articles). Altogether the 457 articles were individually studied and out of these, 30 articles which fulfilled both inclusion and exclusion criteria were chosen for inspection. Five articles which were hand searched were also admitted in the study [Table/Fig-1].



[Table/Fig-1]: Flowchart showing the method of extraction of 35 articles

The studies satisfying the following criteria were included

- Published from 1999-2014
- 5, 12 or 15 years old children
- Dental caries assessed by DMF/dmf index

Full text of all these 35 articles were retrieved by electronic and manual search from the library. [Table/Fig-2] shows all the articles included in the analysis.

Data extraction- A template was prepared in Excel spreadsheet to extract the following data from the articles. Each article was read by principal investigator (H K); the articles were searched for dental caries prevalence in WHO indexed age groups (5, 12 & 15years) separately and following data was extracted:Year of the study, Age group, Study area,Study population, Study design,Mean DMFT/dmft with Standard deviation,total prevalence of dental caries.

In order to assess the trend of dental caries in different index age groups and different regions (Northern, Southern, Eastern & West), studies were grouped age wise and then region wise. Those regions in which 2 or less than 2 articles were found for each age group were excluded from further deliberations.

STATISTICAL ANALYSIS

Average proportion, standard error, confidence interval, weighted mean and significant caries index value were found for each group

S.No	Author	Age Group	Region
1.	Mittal M et al., 2014 [13]	5-year-old	Northern India
2.	Sohi RK et al., 2012 [1]		Northern India
3.	Tewari S 2012 [15]		Northern India
4.	Sarumathi T et al., 2013 [16]		Southern India
5.	Singh S 2012et al., [17]		Southern India
6.	Singh A 2011et al., [7]		Southern India
7.	Tyagi, R 2008 [18]		Southern India
8.	Savannah S 2005 [19]		Southern India
9.	Mahejabeen R et al., 2006 [20]		Southern India
10.	Mahesh KP et al., 2005 [21]		Southern India
11.	Angola AV et al., 2005 [22]		Southern India
12.	Rao VN et al., 2012 [23]		Southern India
13.	Praveena S et al., 2013 [24]		Southern India
14.	Shankar S et al., 2012 [25]		Southern India
15.	Dash JKA et al., 2002 [10]		Eastern India
16.	Mittal M et al., 2014 [13]	12-year-old	Northern India
17.	Shailee F et al., 2013 [26]		Northern India
18.	Bhardwaj et al., 2013 [27]		Northern India
19.	Garewal H et al., 2011 [11]		Northern India
20.	Goyala A et al., 2007 [28]		Northern India
21.	Sohi RK et al., 2012 [1]		Northern India
22.	Munjaj V et al., 2013 [29]		Northern India
24.	Singh G et al., 2014 [30]		Northern India
23.	Rai B et al., 2006 [31]		Northern India
25.	Baskaradossa KJ et al., 2013 [32]		Southern India
26.	Hebbal M et al., 2012 [33]		Southern India
27.	Chandra S et al., 2008 [34]		Southern India
28.	Prashanth ST et al., 2011 [35]		Southern India
29.	Singh A 2011 [36]		Southern India
30.	Das UM 2009 [37]		Southern India
31.	Mahesh KP et al., 2005 [21]	Southern India	
32.	Kulkarni, S 2002 [38]	Southern India	
33.	Praveena S 2013 [24]	Southern India	
34.	Gupta B et al., 2013 [39]	Southern India	
35.	Christian B 2009 [40]	Southern India	
36.	David J et al., 2005 [41]	Southern India	
37.	Retnakumari N et al., 1999[42]	Southern India	
38.	Rao VN et al., 2012 [23]	Southern India	
39.	Ravishankar PL et al., 2013 [43]	Eastern India	
40.	Sharda J et al., 2013 [44]	West India	
41.	Shailee F t al 2013 [26]	15-year-old	Northern India
42.	Bhardwaj KV et al., 2013 [27]		Northern India
43.	Goyala A et al., 2007 [28]		Northern India
44.	Munjaj V et al., 2013 [29]		Northern India
45.	Basuaradossa KJ et al., 2013 [32]		Southern region
46.	Chandra S et al., 2008 [34]		Southern region
47.	Kulkarni SS et al., 2012 [38]		Southern region
48.	Praveena S et al., 2013 [24]		Southern region
49.	Gupta B et al., 2013 [39]		Southern region
50.	Dash JK et al., 2002 [10]		Eastern region

[Table/Fig-2]: Articles included in the present retrospective analysis

using the following formulas where p is proportion, m is mean, SD is the standard deviation, SE is standard error and n is the total sample:

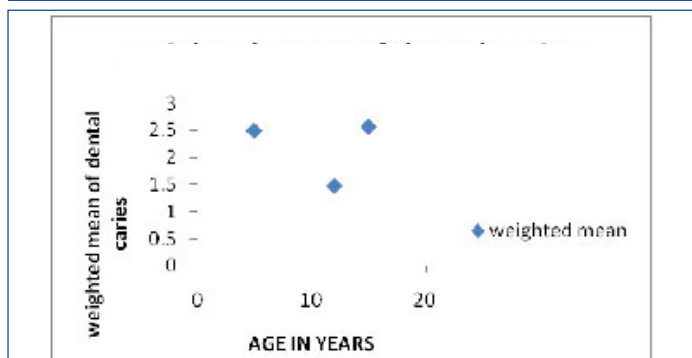
1. Average proportion= $p_1 \times n_1 + p_2 \times n_2 + \dots + p_n \times n_n / n_1 + n_2 + \dots + n_n$
2. Weighted mean (W) = $m_1 \times n_1 + m_2 \times n_2 + \dots + m_n \times n_n / n_1 + n_2 + \dots + n_n$
3. Combined S.D = $\text{Sum of } SD_1^2 \times n_1 + SD_2^2 \times n_2 + \dots + SD_n^2 \times n_n / n_1 + n_2 + \dots + n_n$
4. S.E calculation in case of mean DMFT/dmft= $SD/\text{SQRT } n$
5. S.E calculation in case of prevalence of dental caries = $\text{SQRT average proportion}(1-\text{average proportion})/\text{total sample}$
6. C. I= Weighted Mean $\pm (1.96 \times \text{S.E})$
7. SIC value= $m_1 \times n_1 + m_2 \times n_2 + \dots + m_n \times n_n / n_1 + n_2 + \dots + n_n$ (1/3rd of the population with a higher DMFT score in each group)

RESULTS

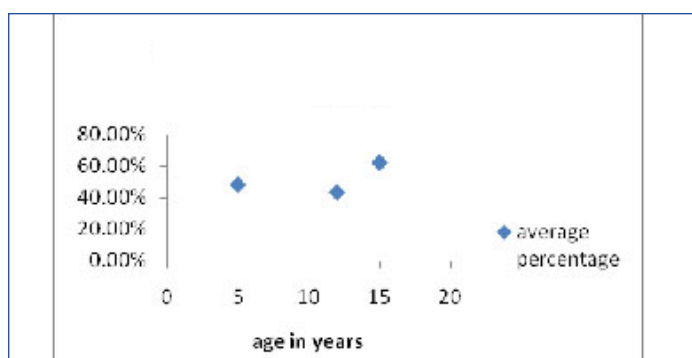
[Table/Fig-3] describes the caries prevalence and experience among 5, 12 and 15 years age group children from all the reviewed articles from 1999-2014. Prevalence of Dental caries was 48.11%, 43.34% and 62.02% among 5, 12 and 15 years age group children. Weighted Mean (\pm S.D) DMFT for 5, 12 and 15 years of age group was 2.49 ± 7.78 , 1.48 ± 3.292 and 2.56 ± 6.508 respectively and Mean Significant caries index score was 3.30, 2.73 and 3.75 respectively. Weighted means and proportion of dental caries for all the index age groups have been shown in [Table/Fig-4,5] respectively. Region wise distribution of dental caries [Table/Fig-6,7] in the past 15 years (1999-2014) shows more prevalent in the Northern region among all the index age groups with maximum prevalence (76.06 %) among 15 year age group. Significant caries index score (4.10) was also found to be maximum in 15 years age group. Mean DMFT

Age	DMFT		SIC index score	Proportion the children affected	
	Mean \pm S. D	Confidence Interval*	Mean	%	Confidence Interval*
5years	2.49 \pm 7.78	2.25-2.72	3.30	48.11	47.3-48.9
12years	1.48 \pm 3.292	3.23-3.36	2.73	43.34	0.42-34-0.44.3
15years	2.56 \pm 6.508	2.35-2.76	3.75	62.02	0.60.5-0.63.5

[Table/Fig-3]: Caries prevalence and experience among index age groups
*Confidence interval calculated at 95%



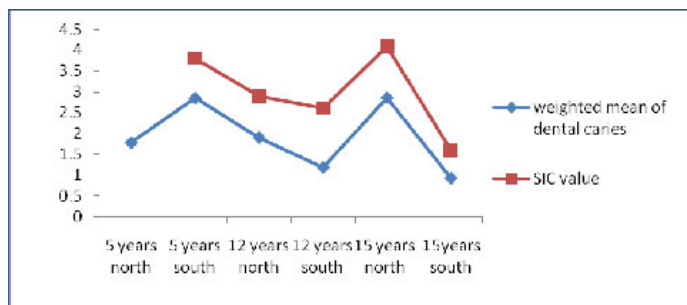
[Table/Fig-4]: Weighted mean of Dental Caries in the index age groups



[Table/Fig-5]: Proportion of Dental Caries in the index age groups

Age	Region	Mean DMFT/dmft Score	95% Confidence Interval	SIC index score	Proportion of children affected	
					% age	CI
5years	Northern region	1.78 \pm 2.15	1.66-1.89	NA*	57.2 %	0.485-0.658
	Southern region	2.85 \pm 10.22	2.45-3.24	3.81	46.97 %	0.469-0.469
12years	Northern region	1.90 \pm 4.42	1.76-2.03	2.90	57.17 %	0.555-0.587
	Southern region	1.19 \pm 2.57	1.11-1.26	2.61	34.13 %	0.327-0.355
15years	Northern region	2.86 \pm 7.48	2.58-3.13	4.10	76.06 %	0.742-0.778
	Southern region	0.934 \pm 1.51	0.86-1.01	1.60	39.27 %	0.367-0.418

[Table/Fig-6]: Caries Prevalence and experience among index age groups in Northern and Southern India
*NA- Enough data was not available for calculation



[Table/Fig-7]: Distribution of weighted mean of dental caries and SIC value among the 3 age groups in Northern and Southern region

for 5, 12 and 15 years age group for Northern region was found to be 1.78 ± 2.15 , 1.90 ± 4.42 and 2.86 ± 7.48 respectively, whereas for Southern region was found to be 2.85 ± 10.22 , 1.19 ± 2.57 and 0.934 ± 1.51 .

DISCUSSION

Dental caries is the most prevalent oral disease worldwide. With the innovation of various significant preventive measures and generalized increased awareness among the masses, there has been a changing trend concerning the distribution of dental caries among the indexed ages. The present systematic analysis highlights the dental caries trends among the index age groups of 5, 12 and 15 years in India. Caries prevalence varied in different studies and this may be attributed to different study populations, different study settings, local differences in eating habits, varied cultural practices, oral cleaning habits, fluoride content of water, etc. As the study population was limited to the index age groups and were further classified into the geographic zones of the country (Northern & Southern), a pooled estimate regarding the same was calculated.

The index age group of 5, 12 and 15 years are of interest due to their relation to the level of caries in both primary and permanent age groups as they are global monitoring ages for dental caries [45]. The systematic analysis showed that the pooled prevalence of dental caries among 15 years was found to be maximum followed by 5 and 12 years. This was rather similar to the results found in National oral Health Survey conducted in 2004 in India [14]. High prevalence in 15 years could be attributed to the high intake of sweets, poor oral hygiene, and general negligence of oral health in this age group. High caries experience among 5-year-old could be attributed to the factors such as a diet higher in sugars and/or the inability of a young child to properly brush teeth on their own. Besides this, lack of preventive measures in India could be another reason which increases the peril. The low caries experience was witnessed in 12 year age group when compared to 5 year age group. This can be ascribed to the fact that WHO index does not record incipient caries, but puts down only when the caries involves dentin, resulting in slight underestimation of caries in 12 year groups [15]. In the present review Significant Caries Index value also had the same trend with 15 years experiencing the maximum mean SIC value, followed by 5 and 12 years. This SIC value for 12-year-old (3.30)

is less than that found in other Asian countries like Bhutan (2.9) and more than that in Nepal (2.5). When compared to European countries like Spain and Sweden the SIC value for 15 years old was more in Spain (5.2) but less for 12-year-old (3.5) whereas in Sweden for 12 years old SIC value was much less than that in India (2.52) [46]. Fluoridation of water supplies is an important reason behind the decreasing dental caries trend in western world.

All the studies conducted in all the regions (Northern, Southern, Eastern and west) of India were considered in the recapitulation, but very few studies were conducted among the index age groups of Eastern and west region of India; therefore, weighted prevalence could not be calculated for these two regions. The present systematic review revealed that Northern area was found to have more prevalence of dental caries as compared to the Southern region in all the index age groups. The likely cause behind this could be attributed to the changing lifestyle and eating habits of population in Northern India [46].

LIMITATIONS

Although weighted prevalence was calculated for different index age groups and different regions of India, the changing trend of dental caries with years (time) was not evaluated. Besides, the bulk of the studies included in the present systematic review were cross-sectional descriptive, which held their own limitations in terms of methodological issues, generalizability, and internal validity.

CONCLUSION

The present systematic review indicated the high load of dental caries in the 15 year old followed by 5 and 12 years (average prevalence of caries=62.02%, 48.11% and 43.34% respectively); Also it was seen that in all the index age groups, studies conducted in the Northern region of India had more caries prevalence as compared to Southern region. The review thus concluded that since urbanization is rapid in India, oral health promotion with the help of primary preventive measures like behaviour modification through dental health education, oral hygiene instructions and dietary instructions along with preventive treatment could be provided through the medium of schools to decrease caries prevalence among the index age groups of children. Since children are seen as the future of the nation, this data could be helpful in the planning of oral health care services by the concerned authorities in the community. Also, it is recommended that further epidemiological studies assessing the prevalence and experience of dental caries among the said age groups should be conducted in Eastern and west regions of the country to supplement the limited data available at present. This will further aid in the overall evaluation of all the 4 regions of our country giving a more complete picture of the caries trends.

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