

A systematic review and meta-analysis of the Prevalence of Dental caries among 3-15 years old in Lao PDR

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ABSTRACT

Background: The purpose of this systematic review was to determine the prevalence of dental caries in primary and permanent teeth among children aged 3 to 15 years in Laos between 2002 and 2024.

Methods: A systematic search was conducted in PubMed, Scopus, Web of Science, and Google Scholar. Databases were searched using relevant keywords to identify studies related to dental caries in the Lao population. The inclusion criteria were manuscripts published in English from 2002 to May 2024. Meta-Essentials software was used to analyze data separately for primary and permanent teeth. Random-effects and fixed-effects models were applied depending on the level of heterogeneity. Forest plots were used to evaluate caries prevalence in both dentitions.

Results: A total of 6,212 participants from 12 studies were included in the meta-analysis. The prevalence of dental caries in primary teeth showed a mean decayed, missing, and filled teeth (dmft) index of 5.76 (95% confidence interval [CI]: 2.55–14.06), with an average prevalence of 98.3%. For permanent teeth, the mean DMFT index was 1.31 (95% CI: 1.66–4.27), with an average prevalence of 44.8%.

Conclusion: These results demonstrate that the prevalence of dental caries in Laos is high. However, the available data do not provide comprehensive coverage of dental caries across all regions of Lao PDR. Therefore, future research should focus on assessing caries prevalence in a wider range of geographical regions throughout Laos.

Keywords: Dental decays, Systemic review, prevalence, Lao PDR

1. Introduction

One of the most common chronic diseases is tooth decay in world wide, with 2 billion people suffer from caries of permanent teeth and 514 million children suffer from caries of primary teeth⁽¹⁾

In Laos, there were many studies have been reported the prevalence of dental caries with high prevalence of dental caries among children 3-15 shown that, the prevalence of dental caries is 95.87% in primary teeth and 86.13% in permanent teeth⁽²⁾, similarly a study in 2010 reported that 82% primary decay teeth among Lao children 3 -5 years⁽³⁾ with mean decay DMFT score 5.5 of children and in 2013 for children with permanent teeth 93.6%⁽⁴⁾. According to the WHO program for improved oral health of children is giving high priority the main for improve oral health on community and population level.

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These studies highlight the high prevalence of dental caries in Laos in various age groups and need to a systemic review was conducted to identify the all relevant of reports due to variation from the reported dental caries prevalence across in Laos. Further, there was no systemic reviews on dental caries have been reported among Lao population. Hence, this systemic review and meta-analysis were conducted to estimate the proportion of dental caries across the Lao population by using data that already publication.

2. Aims and objective

Participants from the age 3 – 15 years from different part of Laos were covered in this meta-analysis of 11 studies.

3. Methodology

This systematic review was designed to be as a comprehensive followed the PRISMA guideline (5). The searched database included PubMed, web science, Scopus, Google scholar search strategy for each database by using key worlds to exact data, with free- text words. Study focused of review to determine the prevalence of Dental caries with mean of dmft and DMFT in children 3- to 15-year-old in Laos

Included Criteria

The eligibility criteria, there are any type of observational study design was evaluated in this review such as the prevalence of participants from 3 to 15 years old by using dmft, DMFT,WHO pro forma 1997, PUFA, by cross-sectional study, case control, prospective and retrospective study .Studies has to be published on 2002 until 2024.

Exclusion criteria

Studies were excluded if the data measured the incidence of other oral conditions, and did not consider dental caries , and no mention of dfmt/ DMFT with SD detail. studies written in other language were excluded.

Data collection process

Identified studies were collected and checked by the three reviewers. The studies found total 1780 that include from PubMed, and web sciences, the Endnote X7 was used for check the duplicate, with 1735 studies were removed. 45 with full text read studies were further screen, and 29 studies were reported for age interval than 3 to 15 years Studies and mention with special needs for treatment. 16 Full text articles were eligibility, 4 Non availability of standard deviation of dmft/ DMFT score and not availability of average dmft/DMFT scores. Finally 12 studies were suitable for satisfy of this meta-analysis (Fig.1)

Data analysis

The statistical program Meta-Essentials software (6) was used for analysis. The meta analysis using Random effect or fixed effect model. If heterogeneity was present, then the random effect model was used. The fixed effect was used when the heterogeneity was absence. Forest plots were used for demonstrated the effect of each studies.

The investigate publication bias were constructed by funnel plot and Egger's test for small study effect was performed to assess the degree of asymmetry by $P < 0.05$ was considered as significant.

Data extraction

The details of information were extracted from those publications, the data of tooth decay were separating by primary and permanent teeth in the table (table 1) and (table 2). Eight articles included both primary and permanent teeth (Sun-Gil Park et al,2023, Yong soo Park et al,2023, Dong-Hyeon Kim et al, 2023, Jae-Geun Ka et al,2019,Sjobbe Besseling et al, 2013,Nithasack Phommavongsa et al, 2014, Nithasack Phommavongsa et al, 2015, Nithasack Phommavongsa et al, 2016) (2),(7), (8), (9), (4) , (10) , while only two study reported caries in primary teeth (Sakpaseuth S et al, 2010, Homsavath et al, 2024) (3),(11), and two articles reported caries in permanent teeth(Gisela Ladda Tayanin et al, 2002, Nanna Jurgensen et al, 2009) (12),(13)

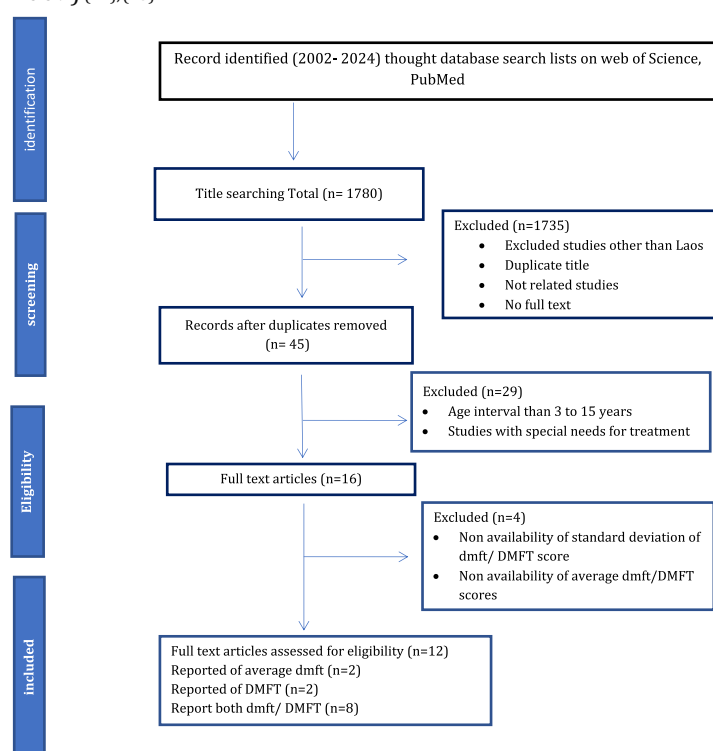


Fig.1. PRISMA Flow Chart

4. Results

Table1: studies and data relate to carries in primary teeth

Author	Year	Age (years)	Sample Size	Prevalence (%)	Mean dmft	SD
Sakpaseuth S et al	2010	3–4	400	82	0.02	5.5
Homsavath et al	2024	3–5	400	92	8.7	4.75
Sjobbe Besseling et al	2013	5–7	109	93.6	0.15	0.5
Jae-Geun Ka et al	2019	6	100	88	5.3	3.91
Yong-Soo Park	2023	6	300	89.8	5.52	3.80
Chae Young Rhee et al	2021	6	513	91.62	13.51	12.44
Sun-Gil Park et al	2023	6	121	95.87	7.40	3.82
Yong Soo Park et al	2023	6	99	94.95	6.47	4.22
Dong-Hyeon Kim et al	2023	6	95	88.42	5.14	3.81
Nithasack Phommavongsa et al	2014	6	35	–	7.09	3.80
Nithasack Phommavongsa et al	2015	6	31	–	7.26	4.30
Nithasack Phommavongsa et al	2016	6	43	–	8.26	4.47
Nithasack Phommavongsa et al	2014	7	47	–	5.00	3.65
Nithasack Phommavongsa et al	2015	7	26	–	7.12	3.42
Nithasack Phommavongsa et al	2016	7	35	–	5.06	3.46
Nithasack Phommavongsa et al	2014	8	28	–	2.86	2.72
Nithasack Phommavongsa et al	2015	8	50	–	4.82	3.18
Nithasack Phommavongsa et al	2016	8	33	–	3.94	3.07

Table 2: studies and data relate to carries in permanent teeth

Author	Year	Age (years)	Sample Size	Prevalence (%)	Mean dmft	SD
Nanna Jurgensen et al.	2009	12	621	56	1.80	0.09
Jae-Geun Ka et al.	2019	15	100	64	2.20	2.49
Jae-Geun Ka et al.	2019	12	99	35.35	0.75	1.28
Yong-Soo Park et al.	2023	12	102	50	1.35	2.31
Yong-Soo Park et al.	2023	15	101	40.2	0.82	1.25
Gisela Ladda Tayanin et al.	2002	12	100	91	4.60	8.00
Sjobbe Besseling et al.	2013	8–10	61	88.5	1.38	1.50
Sjobbe Besseling et al.	2013	11–12	125	76.8	1.44	1.80
Chae-Young Rhee et al.	2021	12	537	53.92	1.59	2.07
Chae-Young Rhee et al.	2021	15	490	57.14	2.04	2.85
Sun-Gil Park et al.	2023	12	138	86.13	3.30	2.47
Sun-Gil Park et al.	2023	15	85	80	4.99	4.15
Yong-Soo Park et al.	2023	12	102	50	1.35	1.86
Yong-Soo Park et al.	2023	15	107	51.40	1.15	1.00
Dong-Hyeon Kim et al.	2023	12	96	45.83	1.08	1.55
Dong-Hyeon Kim et al.	2023	15	97	44.33	1.16	1.90
Nithasack Phommavongsa et al.	2013	6	44	–	0.45	0.50
Nithasack Phommavongsa et al.	2014	6	35	–	0.43	0.81
Nithasack Phommavongsa et al.	2015	6	31	–	0.29	0.60
Nithasack Phommavongsa et al.	2016	6	43	–	0.12	0.45
Nithasack Phommavongsa et al.	2013	7	34	–	0.91	0.71
Nithasack Phommavongsa et al.	2014	7	47	–	0.43	0.68
Nithasack Phommavongsa et al.	2015	7	26	–	0.46	0.58
Nithasack Phommavongsa et al.	2016	7	35	–	0.54	0.95
Nithasack Phommavongsa et al.	2013	8	50	–	0.98	0.59
Nithasack Phommavongsa et al.	2014	8	28	–	1.21	1.50
Nithasack Phommavongsa et al.	2015	8	50	–	0.86	0.90
Nithasack Phommavongsa et al.	2016	8	33	–	0.55	0.62
Nithasack Phommavongsa et al.	2013	9	41	–	1.17	0.70
Nithasack Phommavongsa et al.	2014	9	52	–	1.04	1.24
Nithasack Phommavongsa et al.	2015	9	38	–	1.03	1.17
Nithasack Phommavongsa et al.	2016	9	51	–	1.02	0.93
Nithasack Phommavongsa et al.	2013	10	31	–	1.19	0.70
Nithasack Phommavongsa et al.	2014	10	36	–	1.00	1.31
Nithasack Phommavongsa et al.	2015	10	48	–	1.17	0.83
Nithasack Phommavongsa et al.	2016	10	33	–	1.12	1.05

Primary teeth

Seventeen studies reported caries in the primary teeth were included in the meta-analysis. The sum of sample size was 2465 of these studies, the prevalence of caries in the primary teeth, that was 98.3% rang 82% to 95.87% . A heterogeneity test was run before constructing a forest plot. The test $P=0.02$, and index of heterogeneity $I^2 = 43.58\%$ there was significant, suggesting the Random effect model was used when constructing a forest plot (Fig.2) the estimated caries prevalence dmft in primary teeth of 3-8 years old was 5.76 confidence interval CI:(2.55 - 14.06) . A funnel plot was also construction to study publication bias. Visual in section of funnel plot revealed a symmetrical arrangement of data points, suggesting of publication bias (Fig.3). Egger's test was used for applied to test the symmetry of the funnel plot, which $P<0.01$.

Permanent teeth

Thirteenth studies reported caries in the permanent teeth there were included in the meta-analysis. The total sample of these studies was 3747 sample size, the percentage of population with caries teeth with average prevalence 44.8% rang from 35.3% to 93.6%. A heterogeneity test was run before construction a forest plot and the result of test by heterogeneity by $p=0.11$, and index of heterogeneity $I^2=23.11\%$, no significant. Therefore, a fixed effect model was used showing the forest plot as (Fig.4). The prevalence of dental caries DMFT among 6 to 15 years old was 1.31 with 95% CI (1.66- 4.27). A funnel plot was constructed to estimate the publication bias. The data points in the funnel suggestive of publication bias (Fig.5). The Egger's test was used for further test the symmetry, the result were significant by $P<0.01$.

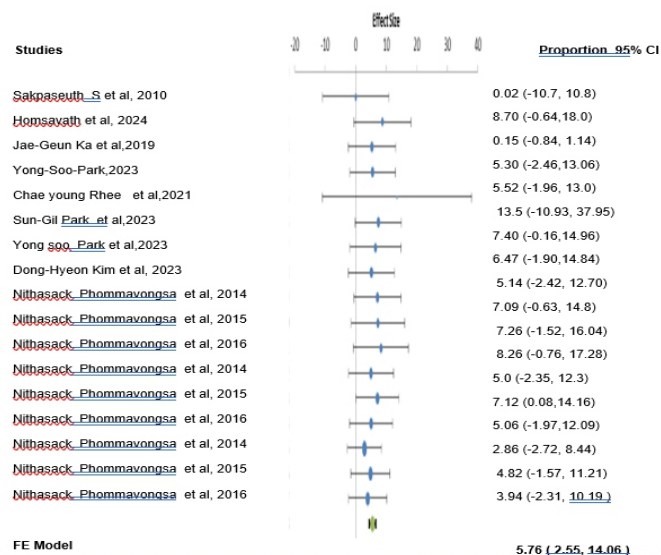


Fig.2. Effect estimates for caries prevalence in primary teeth

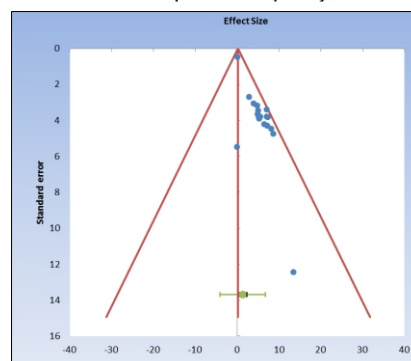


Fig.3. Funnel plot showing the prevalence of dental caries as proportion of primary teeth

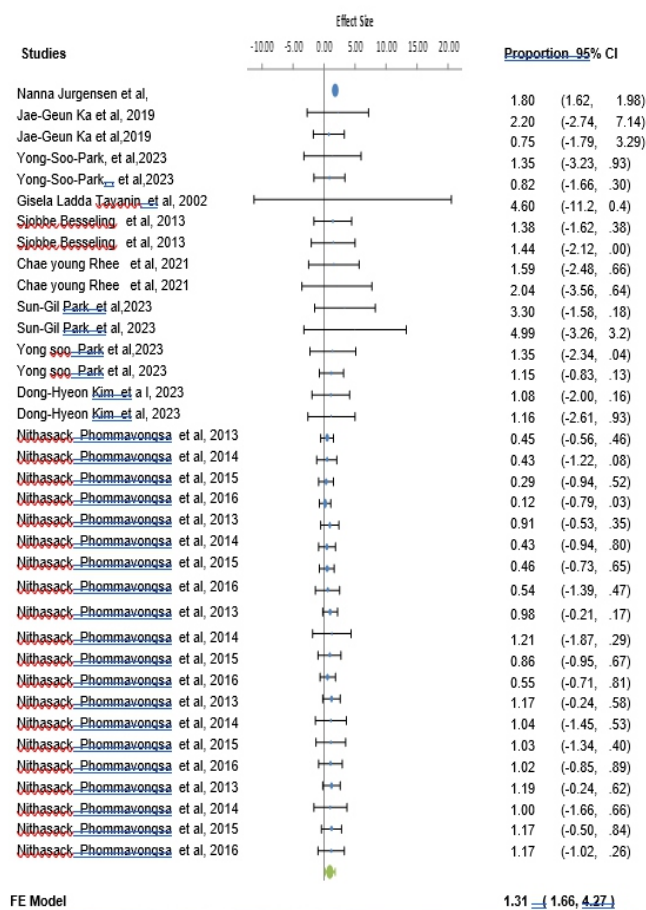


Fig.4. Effect estimates for caries prevalence in permanent teeth

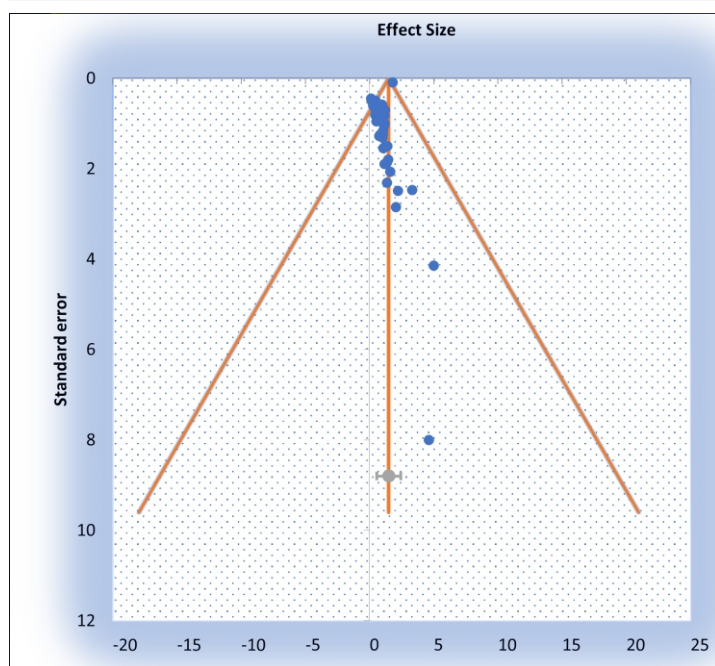


Fig.5. Funnel plot showing the prevalence of dental caries as proportion of permanent teeth

5. Discussion

This study aimed to systemic review studies to evaluating the prevalence of dental caries in Laos from 2002 to 2024. There were identified 12 studies, as well as for primary and permanent and mixed dentition separate in to two groups, this systematic review and meta-analysis set out to evaluated of the combined variance prevalence of dental caries in Lao population. In 1999 the fluoride concentration in the drinking waters has been estimated in some provinces of Lao People's Democratic

Republic, however the drinking water fluoride has low concentration was 0.0 and 0.5ppm in some place in Laos(), even though the oral health program such as toothbrush education, fluoride mouth rinsing program, fluoride topical application, and sealant in primary school were provide(). Most of studies on dental caries were high in various geographical area.

The present study in 3 – 15 years with 98.3% under 6 years and 44.8% in patients above 6 years, this finding is congruence with result of the study in 2019 was reported that the prevalence of dental caries with 82% among 1161 student 6-10 years in Vientiane()", similarly in the India 2005 among children 5-7 years old(), the decayed primarily teeth index was 94.30%, and studied in 2014 among 12 and 15 year the prevalence of permanent teeth in 47.80 and 44%(). With high percentage of dental caries in children with untreated dental caries in primary dentition was significantly highest in underweight children(). The included of this present review showed of heterogeneity $I^2 = 43.58$ and 23.11 for primary teeth and permanent teeth, respectively, With proportion 5.76 (2.55 - 14.06) and 1.31 (1.66 - 4.27) Heterogeneity index had significant in outcome of dmft and DMFT, this more higher than reported in Saudi children 2023 with dmft index 4.14 (3.11-5.18) and permanent teeth was lower with DMFT1.28(0.93-1.64)⁰

The strength of current review is the low heterogeneity between the studies include for analysis. However, there were some limitation such as some of them did not mention age groups of participants, number of articles was limited, reported with this mention limitations, future studies should focus on factors correlate with prevention and need for nation level base for equal representative of urban and rural of whole country

6. Conclusion

The average score of dmft/DMFT in primary and permanent teeth, the carie proportion 5.76 rang from 2.55 to 14.06 and 1.31 from 1.66 to 4.27 for primary teeth and permanent teeth. This indicates that the prevalence of dental caries in Laos is high, however, the current data do not provide all dental caries in whole of Laos. This study indicated to measure of prevention should be strategies to reduce prevalence of dental caries for Lao population.

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