



The Prevalence of Dental Caries in Laos: A Systematic Review and Meta-analysis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Dental caries is one of health problem and most common chronic disease among children. The purpose of this systematic review are to determine the prevalence of dental caries in primary teeth, and permanent teeth among 3 to 15 years, between 2002 to 2024 throughout Lao PDR.

Methods: A systematic search of PubMed, Scopus, Web of Science, Google scholar. search strategy for database by using key worlds to exact data pertaining to dental caries in Lao population, the studies inclusion criteria manuscripts published in English language from 2002 to May of 2024, the studies was used the Meta-Essentials version software for analyzed separately for primary and permanent teeth and deduced using the random effect model, fixed effect models, which had insignificant heterogeneity and forest plots were used to evaluate caries prevalence in both dentitions.

Result: In total 6212 subjects were included in a meta-analysis from 12 studies. The prevalence estimate of dental caries for primary teeth the mean of decay- missing filled teeth (dmft) index was 5.76 (95%confidence interval (CI):2.55-14.06) with average prevalence 98.3%. For the permanent teeth, the mean DMFT was 1.31 with 95% confidence interval (CI:1.66-4.27) and average was 44.8%.

Conclusion: This result indicates that the prevalence of dental caries in Laos is high, the available data does not provide a complete of dental caries across of Laos. Therefore, research should be focused on the prevalence for more geographical region in Laos.

Keywords: Dental caries; chronic diseases; prevalence; Laos.

1. INTRODUCTION

Dental caries is one of the most common chronic diseases world wild, 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], similiary 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% [4,5,6,7].

According to the WHO program for improved oral health of children is giving high priolity the main for improve oral health on community and population level. 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.

1.1 Objective

The purpose of this systematic review are to determine the prevalence of dental caries in primary teeth, and permanent teeth among 3 to 15 years, between 2002 to 2024 throughout Lao PDR.

2. METHODOLOGY

This systematic review was designed to be as a comprehensive followed the PRISMA guideline [8]. 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.

2.1 Criteria of Included Studies

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.

2.2 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 dmft/DMFT with SD detail. studies written in other language were excluded.

2.3 Data Collection Process

Identified studies were collected and checked by the three reviewers. The total number of studies found were 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).

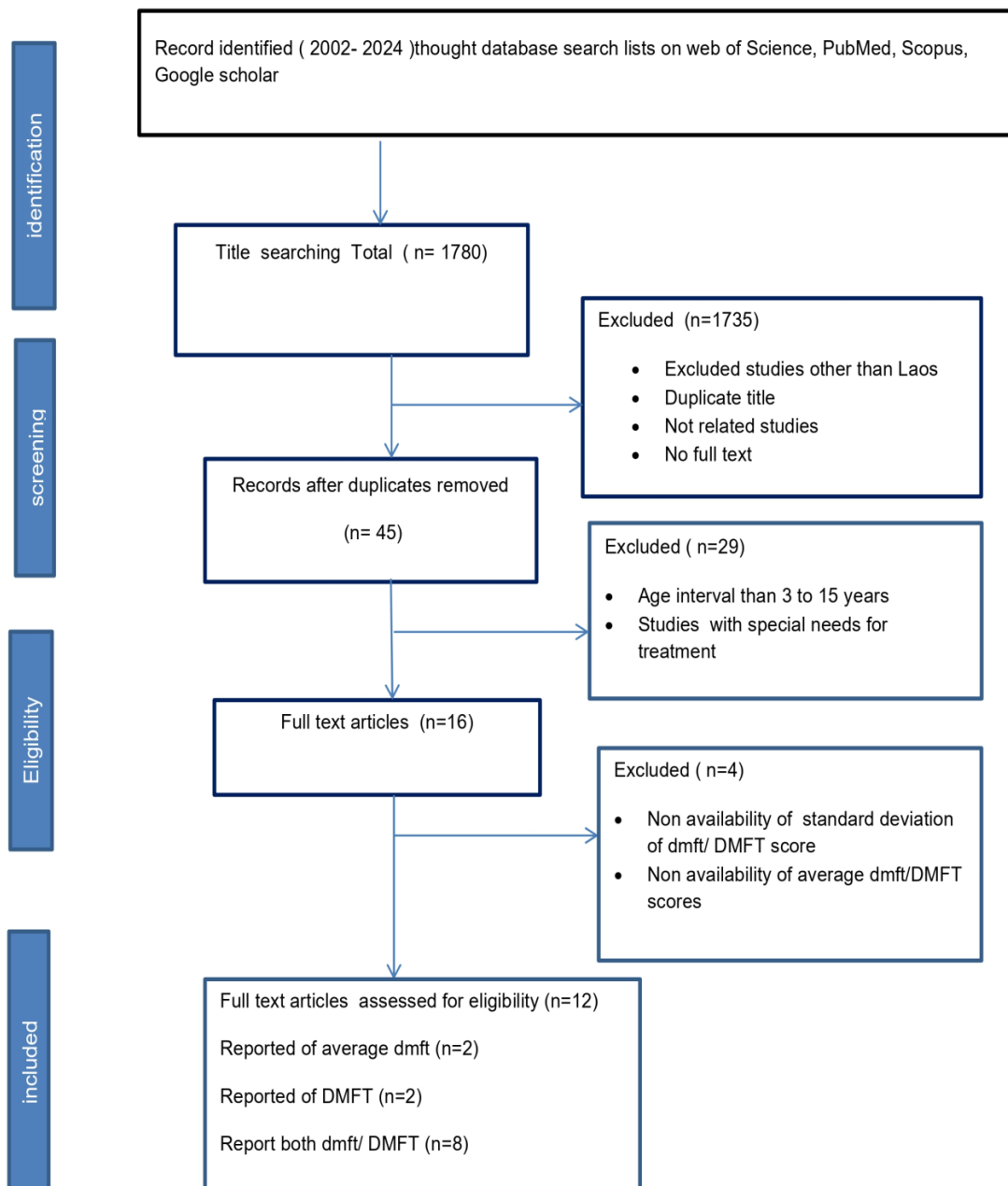


Fig.1. PRISMA Flow Chart

2.4 Data Analysis

The statistical program Meta-Essentials software [9] 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.

2.5 Data Extraction

The details of information were extracted from those papers, the data of caries 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-GeunKa et al, 2019, Sjobbe Besseling et al, 2013, Nithasack et al, 2018) [2,4,10,11,12,23], while only two study

reported caries in primary teeth (Sakpaseuth et al, 2010, Homsavath et al, 2024) [3,13] , and two articles reported caries in permanent teeth (Gisela Ladda Tayanin et al, 2002, Nanna Jurgensen et al,2009) [14,15].

3. RESULTS

3.1 Primary Teeth

Seventeen studies reported caries in the primary teeth were included in the meda- 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 pot 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 $P < 0.01$.

Table1. Studies and data relate to carries in primary teeth

Author name, Year	Age	Sample size	Prevalence percentage	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	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	3.8
Chae young Rhee et al,2021	6	513	91.6	13.51	12.44
Sun-Gil Park et al,2023	6	121	95.8	7.4	3.82
Yong soo Park et al,2023	6	99	94.9	6.47	4.22
Dong-Hyeon Kim et al, 2023	6	95	88.4	5.14	3.81
Nithasack Phommavongsa et al, 2014	6	35	-	7.09	3.8
Nithasack Phommavongsa et al, 2015	6	31	-	7.26	4.3
Nithasack Phommavongsa et al, 2016	6	43	-	8.26	4.47
Nithasack Phommavongsa et al, 2014	7	47	-	5	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 name , Year	Age	Sample size	prevalence percentage	Mean dmft	SD
Nanna Jurgensen et al,	12	621	56%	1.8	0.09
Jae-Geun Ka et al, 2019	15	100	64%	2.2	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	40.20%	0.82	1.25
Gisela Ladda Tayaninet al,1999	12	100	91%	4.6	8
Sjobbe Besseling et al, 2013	8-10	61	88.50%	1.38	1.5
Sjobbe Besseling et al, 2013	11-12	125	76.80%	1.44	1.8
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	3.3	2.47
Sun-Gil Park et al, 2023	15	85	80%	4.99	4.15
Yong sooPark et al,2023	12	102	50%	1.35	1.86
Yong sooPark et al, 2023	15	107	51.40%	1.15	1
Dong-Hyeon Kimet a l, 2023	12	96	45.83%	1.08	1.55
Dong-Hyeon Kimet al, 2023	15	97	44.33%	1.16	1.9
NithasackPhommavongsaet al, 2013	6	44	-	0.45	0.5
NithasackPhommavongsaet al, 2014	6	35	-	0.43	0.81
NithasackPhommavongsaet al, 2015	6	31	-	0.29	0.6
NithasackPhommavongsaet al, 2016	6	43	-	0.12	0.45
NithasackPhommavongsaet al, 2013	7	34	-	0.91	0.71
NithasackPhommavongsaet al, 2014	7	47	-	0.43	0.68
NithasackPhommavongsaet al, 2015	7	26	-	0.46	0.58
NithasackPhommavongsaet al, 2016	7	35	-	0.54	0.95
NithasackPhommavongsaet al, 2013	8	50	-	0.98	0.59
NithasackPhommavongsaet al, 2014	8	28	-	1.21	1.5
NithasackPhommavongsaet al, 2015	8	50	-	0.86	0.9
NithasackPhommavongsaet al, 2016	8	33	-	0.55	0.62
NithasackPhommavongsaet al, 2013	9	41	-	1.17	0.7
NithasackPhommavongsaet al, 2014	9	52	-	1.04	1.24
NithasackPhommavongsaet al, 2015	9	38	-	1.03	1.17
NithasackPhommavongsaet al, 2016	9	51	-	1.02	0.93
NithasackPhommavongsaet al, 2013	10	31	-	1.19	0.7
NithasackPhommavongsaet al, 2014	10	36	-	1	1.31
NithasackPhommavongsaet al, 2015	10	48	-	1.17	0.83
NithasackPhommavongsaet al, 2016	10	33	-	1.12	1.05

3.2 Permanent Teeth

Thirty six 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 $P < 0.01$.

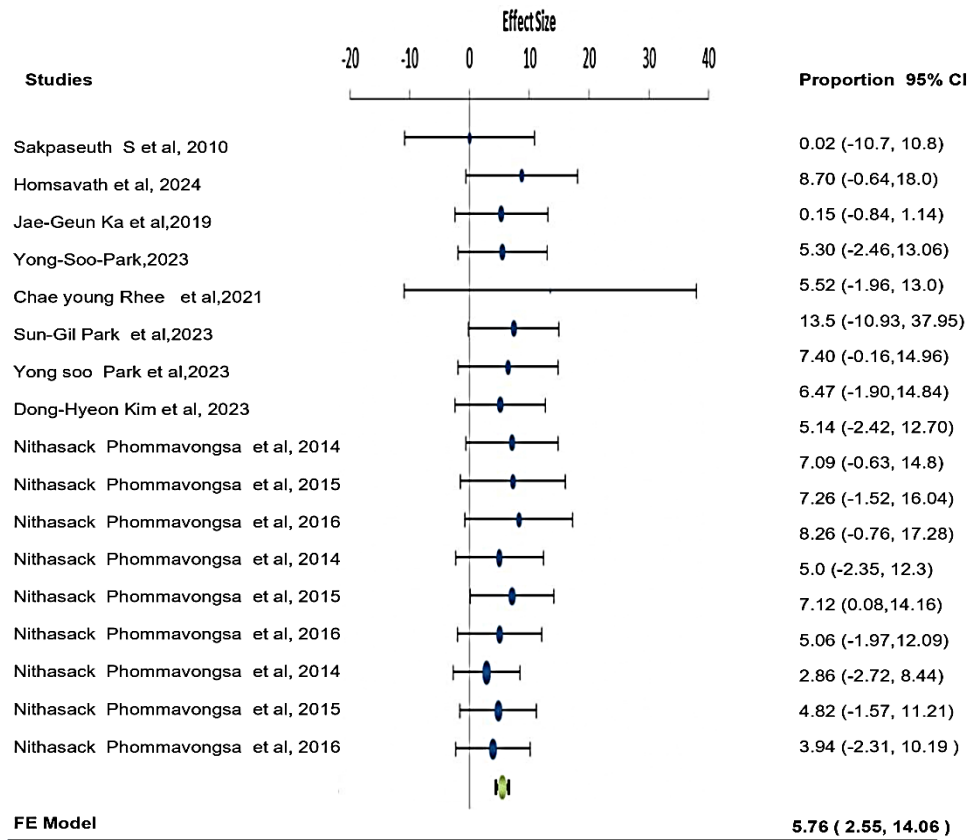


Fig. 2. Effect estimates for caries prevalence in primary teeth

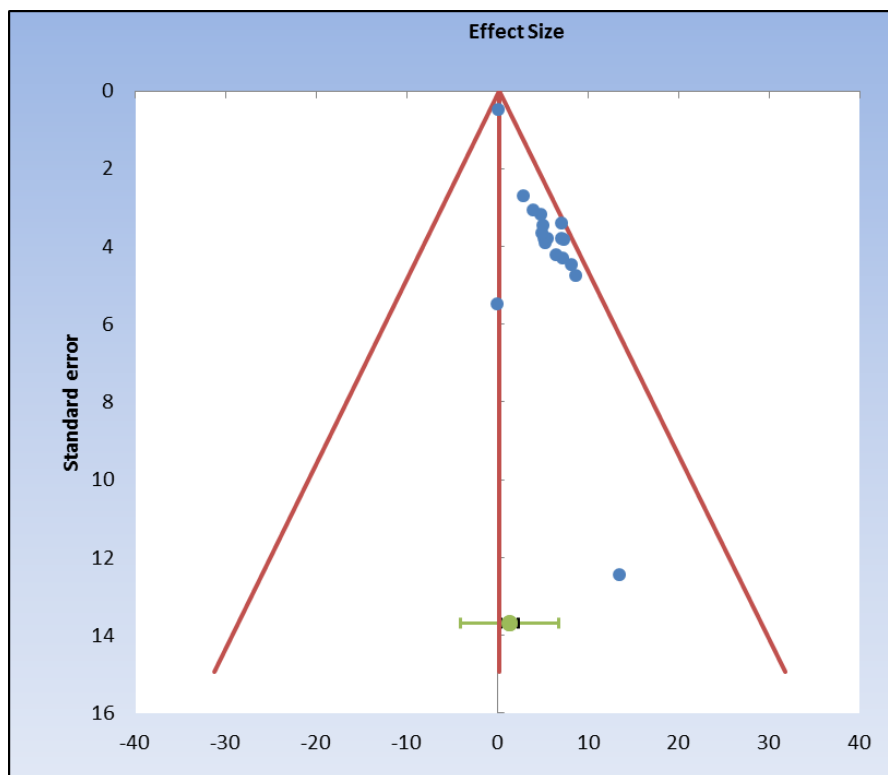


Fig. 3. Funnel plot showing the prevalence of dental caries as proportion of primary teeth

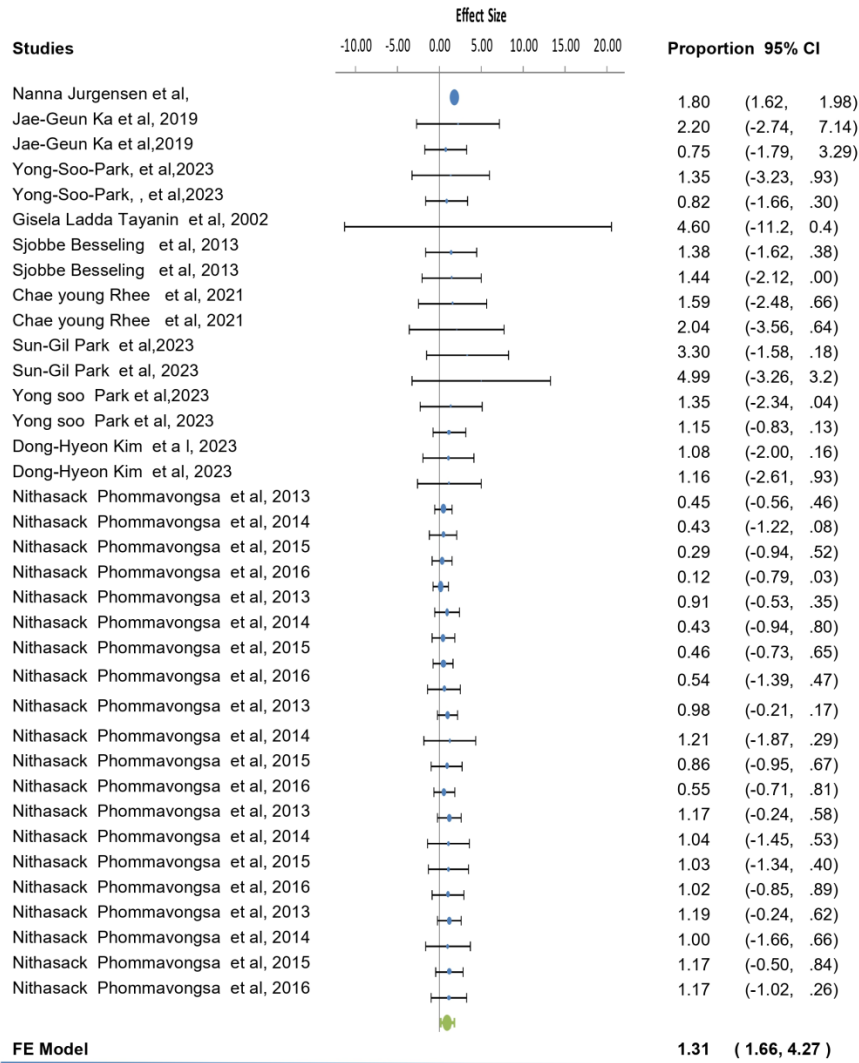


Fig. 4. Effect estimates for caries prevalence in permanent teeth

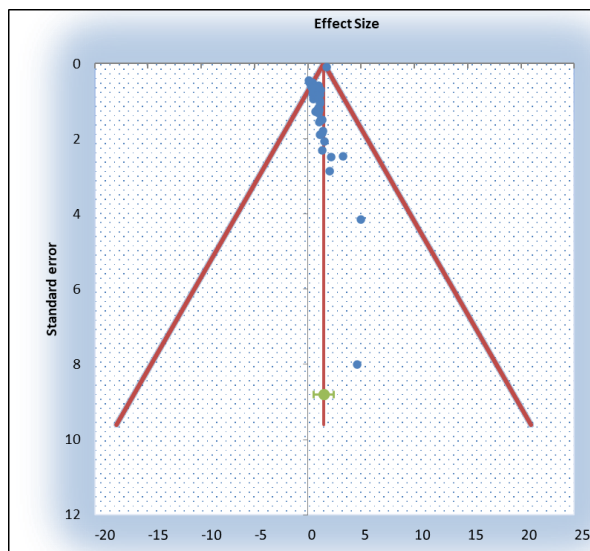


Fig. 5. Funnel plot showing the prevalence of dental caries as proportion of primary teeth

4. 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 [14], even though the oral health program such as toothbrush education, fluoride mouth rinsing program, fluoride topical application, and sealant in primary school were provide [15]. 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 [16], similarly in the India 2005 among children 5-7 years old [17], the decayed primary teeth index was 94.30%, and studied in 2014 among 12 and 15 year the prevalence of permanent teeth in 47.80 and 44%[18]. With high percentage of dental caries in children with untreated dental caries in primary dentition was significantly highest in underweight children [19]. The included of this present review showed of heterogeneity I² =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) [20].

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 [21-23].

5. 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.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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