

Dental Hygiene for Children: Conducting a Scoping Review for Assessing the Prevalence of Dental Caries in Primary Schools

Najat Abdrabbo Alyafei*

Department of Oral Public Health- Operations-Primary Health Care Corporation (PHCC); Doha, Qatar.

ABSTRACT

Introduction: The most prevalent chronic disease among children worldwide is tooth decay, more popularly known as dental caries. The main aim of the current study is to understand contextual factors that influence the effectiveness of school based oral health

Methods: The scoping review approach was used in the study to provide a conceptual framework and theoretical background. Evidence from previous literature was utilized to guide the work and present a critical argument regarding the general prevalent behaviour of Qatari primary school children towards dental hygiene.

Results: The factors that enhance the school oral health programme effectiveness were identified in the existing study, which includes regular programmes, school-based oral health policy, active participation of teachers, parents, and students, and sample periodic monitoring or follow-ups.

Conclusion: The study recommends further exploration of the impact of involving parents, teachers, and dentists on partnership approach within oral health education.

Keywords: Primary school; Dental caries; Primary pupils; Oral or dental hygiene; Oral health programme

INTRODUCTION

Dental caries is initiated by environmental and biological interaction and social factors [1] and are known as a multifactorial disease. It occurs by a complicated interaction of food, germs, and susceptibility of the host. It starts with the dental plaque development that is the result of poor feeding habits like insignificant oral cleanliness, correlated with irregular tooth brushing with kinds of toothpaste having fluorides, and greater amount of fermentable sugars intake [24]. Children are more susceptible to dental caries because of the relative width of dentine and enamel in deciduous dentine rather than permanent ones.

Dental caries and their associated problems affect not only the children but also society [5]. An affected child may feel discomfort together with pain and thus might need a doctor's help for dental filling or extraction that may involve admission to the hospital [6]. Such conditions are much depressing to the children as well as to their parents. They pose an extensive financial burden on healthcare as dental care is expensive and requires lifelong care

with increasing complications [7].

Dental caries has affected around 60% to 90% of the school-going children worldwide and world health organization suggests that school-based oral hygiene interventions are key to controlling it. Diseases related to dental health are chronic disorders in humankind, impacting the life quality, oral functions, a person's self-esteem, and the whole health of the individual is affected [8]. Health inequalities can further worsen financial stress since many people's insurance does not cover everything [9]. Dental caries is one of the most frequent diseases resulting in time lost, dropout from school as well as daily activities' disruptions in children [10-14].

Despite being preventable, dental caries is still considered a significant problem to public health [5]. Primary strategies to prevent dental caries comprise promoting oral health *via* interaction of various factors of aetiological including supportive environment building, promotion of oral health, community action strengthening, health services reorientation, and personal

* **Correspondence to:** Dr Najat Abdrabbo Alyafei, Head of Oral Public Health-Operations-Primary Health Care Corporation (PHCC); E-mail: n_alsalahi@hotmail.com

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skills development [15].

Oral health behavioural preventive strategies empower school children against dental caries [16]. To implement oral health among children, schools provide potential chance to implement different programmes, including healthy food choices, sponsored on-site dental services [17]. The research suggests that kids' oral health can be improved by these programmes even though the evidence-based is varied [18]. Oral health issues are also evidently prevalent in Qatar.

In several developed countries, dental caries is more frequent in older children. The disease is also highly prevailing in Qatar children even though their schooling system is with interventions of oral health [19-23]. Qatar's national oral health survey surveyed the prevalence of caries within Qatar as 72% in six-year-old and 54% among twelve-year children. Recently it was found to be 82.4% among primary school kids. Thus, the current study tried to find the existing caries pattern in primary schools of Qatar to enhance the programs of oral health within schools.

The burden of oral health in Qatar

Literature of Qatar about caries highlights a high cost and health stress [24-28]. Although, there is deprivation of the latest data on the dental caries among children in Qatar, only three papers were available on dental caries among adolescents and children within Qatar. The Ministry of Health in Qatar is the source of national oral health survey information. The methodology utilised within this survey is adopted from the oral health survey that focuses on three main phases of childhood, including children aged 6, 12, and 15 years. This provides the data on dental fluorosis and dental caries. National oral health survey gives its first data stating that 72% of deciduous and 54% and 55% of permanent in 12 and 15 years old respectively were affected by dental caries. Girls of all ages in Qatar from a background of low socioeconomic and public schools were expressively more affected. Data analysis of secondary nature [29] on national oral health survey data showed a total of 4.2 DMFT. The study's outcome showed that girls were more affected than boys as 73.8% and 68.9% respectively as well as children of Qatar were 3.8 times more affected than non-Qatari. Regardless of being a country with a high income, there is still a prevalence of unattended dental decay among the children of Qatar.

A survey for the decay of teeth within 4-5 years old children can be considered as another source of data on a population level for dental caries in Qatar. The study's outcome showed that around 89% of 4 to 5 years' children of preschool have tooth decay in their primary teeth and around 73% critical dental caries among children. The mean number of teeth decay was 7.6, nearly doubling within the national oral health survey. The cross-sectional survey states that over 61% of preschool children mothers were suffering from dental or gum issues. Further, many of the children suffering from the problem were not treated, which shows fewer visits for dental check before age 6, since only 51% of this age group had ever visited a dentist. Caries within the 20 teeth of the primary one follows a typical pattern that involves upper incisors and entire molar teeth. Dental caries among young children may be due to poor feeding behaviour. A study showed a prevalence of 85% of dental caries in children of 12 to 14 years old that gives an average of 4.6 to 5.5 of tooth decay among 12, 13, and 14 years old. Therefore, the occurrence of caries in children of 12 years was found to be 1.5 times more than national oral health survey reported. Once again, most of the caries cases were untreated, and approximately

2/3 of the caries were present on the permanent molar teeth. Approximately half of the untreated dental caries were present on the first molar teeth and were thus more likely to be subjected to extraction or restoration. This represents that preventive measures must be applied to school-going children on their first permanent molars while in adolescents on second permanent molars. The prevalence of caries in the children who visited the primary health care centres within Qatar as a population-based study among 6 to 15 years old 19 were around 73% of dental caries affect permanent dentition with an average of 4.5 DMFT value. It is also reported that about 69% of the caries were not treated. It also identifies that gender, health state, obesity, reduced attendance in schools, and high earnings were independent risk factors. However, the key preventive method against caries was brushing the tooth over once a day. The children that take Vitamin-D-fortified milk, seafood, and liver oil below once a week were found to be without dental caries and were significantly higher in number than those with dental caries.

MATERIALS AND METHODS

A case study approach was used to extract the present article with internationally done studies on behavioural prevention of dental caries that is school-based programme and a review was made by utilising scoping review approach [30,31]. A description was given on the familiar approach of scoping review used to review the studies and providing evidence on health as well as better ground to elucidate and improve the theoretical framework, which aids in the consistency support to the findings which other researchers have reported. In the present study, the scoping review approach is thus utilised as a methodological framework to review the research evidence that gives health problems. This method was used as a mapping tool in which evidence was concise to give the breadth and depth of the study problem that is being studied. The conceptual review is the main aim of the scoping review of the evidence within the international research that will guide the work of empirical case study nature. The present research's main scoping review is to 'drill down' the literature that is particular to the primary school, both private and public, to survey the research question on oral health behaviours. Thus, to review the school-based dental caries behavioural prevention programme in international literature, scoping review approach is used.

Relevant and reputable databases were explored to search the literature. These databases include global health, medline, PsycINFO, Health Management Information Consortium (HMIC) through OVID interface, CINAHL via EBSCOhost interface, and EMBASE. The searching of ProQuest, as well as PubMed, was also done. The search strategy is adopted from a review on dental caries prevention that is primary school-based. The terms related to randomised controlled trials were excluded, including trial, randomly, group, placebo, and clinical trial. This omits results in the broadening of review scope by considering non-experimental studies, providing further and deep insights into the behavioural prevention program of dental caries of school based.

Several papers have been selected for this review. Majority of the papers included here were related to the primary studies with different study designs including, cohort study, cross-sectional study, quasi-experimental study, and randomised controlled trial. In comparison, few included a systematic review on behavioural interventions that promote twice daily tooth brushing and reduced snacking on sugary foods among school children aged 4-12 years. The last study was on the review of behavioural interventions for

childhood caries at an individual, family, and community level, including school-based programmes [32]. The studies included here were all primary studies conducted in different countries of the world in Asia, Europe, Africa, and America as well as few traditional literature reviews, and another was a systematic review of literature

Within this scoping review, a method adopted here is the thematic analysis used to analyse, identify, and report the data patterns. This type of analysis is mostly used to explore a particular data set containing specific themes and patterns. Within this analysis, the main focus was to identify new patterns and develop new themes. This approach also helps in reviewing and organizing current literature and providing a complete data set description, and aids in interpreting the data meaning [33,34]. Six steps were recommended to conduct thematic analysis [35]: data familiarization, initial code generation, searching for the themes, reviewing themes, defining and naming themes, and finally producing a report.

RESULTS AND DISCUSSION

School-based oral health prevention strategy effectiveness determinants

Behavioural prevention strategy choice: School-based oral health programme's effectiveness was suggested by several literatures that it was manipulated by the kind of prevention strategy. It is more reported that Motivational Interview (MI) showed more effectiveness on prevention of dental caries than the classical oral health education and other strategies for behavioural prevention [36,37]. In a community trial study, it has come to know that pupils who took the motivational interview and oral health education along with their parents showed reduced plaque index as compared to those pupils who attended these without a parent ($p < 0.001$). Likewise, those mothers of the pupils who took initial traditional oral health education as well as subsequently motivational interview periodically showed higher plaques reduction (34.3 vs. 20.6; $t = -3.12$, $p = 0.002$) as matched to those mothers of the pupil within a randomised controlled trial who took only initial traditional oral health education. MI was also identified within this literature review for the prevention of dental caries as the most effective behavioral interventions. There may be some other factors that affect the MI effectiveness on the health promotion among the children in the school. MI was first tailored to meet the need of the individual for oral health educational intervention by the personalised intervention and secondly, motivational interviews for parents of school children were also contained therein. Lastly, periodic reinforcement was exposed to the MI groups.

Among other researches, it was also seen that oral health education involving digital media and EL is more effective as compared with traditional health education. Different kind of strategies' effectiveness can be affected by contextual factors of specific nature like children's active participation. Thus, it is clear that rather than the strategy type, contextual factors greatly affect the promotion of school oral health outcomes. As far as MI were effective, traditional oral health education might be as effective if it is well-planned with regular involvement of the parents [38-42]. The contextual factors will subsequently be discussed within the relevant themes affecting the effectiveness level of behavioural prevention programmes of dental caries. A study noticed that educational interventions' effectiveness was proved by the IES messages utilisation that helps to enhance the oral health behaviors [43]. It's presented a different strategy as compared with the other researchers doing the same

study of supporting either traditional or experiential lecturing. However, it was proposed that behavioural changes occurred only when behavioural intervention were done, but still it didn't successfully indicate the lowering of DMFT. A study revealed that educational motivation is far more effective in oral health education than lecture method [44].

Involvement of parents and teachers: In order to enhance the oral health education within the school, parent's involvement has been described, within community trial, in Iran where pupils' parents obtain leaflet of oral health education along with brushing diary to supervise their child in tooth brushing, as more suitable oral hygiene showing reduced plaque as compared to those children who solve puzzles under the health behaviors supervision only at school [45-49]. In another study within Indian community, children brushing under parent's supervision as well as with oral health education showed reduced plaque (better oral hygiene) as compared with those children who received only oral health education without the parent's involvement. Some of the oral health cleaning products used within the rural area of Arnala, India comprises of neem, twigs or babool as tooth brushes and charcoal and burnt cow dung powder as toothpaste. Parental supervision could be cultivated on the basis of spreading awareness or sensitizing the parents about oral health hygiene.

Iranian pupils showed significant enhancement in behavior of oral health in a cluster-randomized trial within which parents and teachers were provided with booklet of oral health as compared with those pupils whose teachers and parents were not involved. Since parents were responsible for healthy behaviours for oral hygiene and other practices therefore parent's involvement had a vital impact while teachers serve as a role model to their students. Thus, the outcome of the study showed more positive effect and cognitive variables with the involvement of parents and teacher as compared to those in which only parents were involved. One more study on oral health promotion programme in school conducted in Denmark regarding oral health education showed that tooth brushing supervised by teacher and oral hygiene aid supplies results in more reduction in the dental caries as compared with pupils who received no intervention (16.8% v/s 12.6%). A study showed that a successful teacher involvement for the implementation of oral health education to school pupils [50].

A conducted research within two groups as control group and educator-led group. Control group that received no treatment showed less improvement unlike educator-led [51]. Strategies that is teacher-led showed more effectiveness as compared to interventions that is dentist-led. A study showed that students didn't stick to the oral health improvement practices when parents were not involved [52].

Therefore, the teacher's commitment and support plays a prominent role that determines the success or failure of the study [53]. Accordingly, various aspects must be considered by the researcher including the teachers within the interventions of behavioural oral health. Furthermore, parent's involvement within the development of motivation strategy for school-based oral hygiene would increase the success rate due to continuous supervision of the pupils.

Children's engagement and their active participation: Children's active participation and engagement within the school-based oral health programme would affect the success enhancement. A comparative study was conducted between Experiential Learning (EL) traditional oral health education through extramural visits

and oral health projects that displayed significant improvement ($P < 0.001$) within both 6 and 18 months' group post intervention. 6 months represents significant improvement towards their oral health attitude ($P < 0.05$) and behaviour ($P < 0.001$) while 18 months' group didn't show any positive behaviour. Furthermore, frequencies of dental caries and plaque significantly drops ($P < 0.05$) during post intervention in EL of 18 months' group. It is also observed by the authors that those students who receive traditional oral health education showed less improvement as compared to the students obtaining EL. The outcome of the study supports the idea of children's engagement and their active participation for sustainable as well as effective oral health programme towards the enhancement behaviour, attitude, hygiene and oral health knowledge. Also pointed out the essentiality of oral health behaviour assessment and the education of children to improve the habits of poor oral hygiene practices to reduce deficiencies [54].

The children engagement impacted positively the success rate as well as effectiveness of oral health behavioural interventions. It is also noted that continuous motivation of children is required for sustainable habits of oral health hygiene. The idea of children engagement within education programme to enhance the success of implemented intervention. Within this the participants were prompted to sustainable adherence to the oral hygiene practices by being monitoring and evaluated after certain period. Thus, children engagement must be considered by the researcher for better and sustainable oral health hygiene.

Teaching aids usage: Victorious programmes of school-based oral health education have been reported through the aids of audio-visual usage [55]. Noteworthy knowledge enhancement along with decrease in the dental plaque was observed in children of primary school through the use of audio-visual aids film on oral health education, videos, coloured photograph albums as well as anatomical models for the practical demo of use of toothbrush [56-58] within oral health education programmes. Thus, among children engagement, comprehension and concentration enhancement results in the improvements of oral health hygiene through the usage of teaching aid such as anatomical models, audio-visual like films or videos in their native languages.

Intervention's combination: Combination of interventions in any programmes for prevention of dental caries might decide the success of the programme. Within China, a cluster randomized controlled trial observed significant decrease in mean plaque and DMFS in Yichang City after the application of school-based health promotion for three years [45]. They use a combination of interventions within their research, including student and mother regular education of oral health, poster presentation and contest on oral hygiene. Moreover, students were also adopted for regular tooth brushing at least twice a day, dentist visits, and toothpastes having fluorides.

It is found more effective when oral hygiene aids such as toothpaste or toothbrush were provided too along with oral health education [59]. Thus, it can be interpreted that combined interventions lead to better implementation of behavioural prevention programmes on oral diseases. When children were interested in all aspects that surround the oral health, thus resulting in the better enhancement of dental health.

For better enhancement and control over the plaque and gingival health, the lecturing method, and practical illustration on oral hygiene in children, hands-on training on regular rinsing, flossing,

and brushing within the oral health education programmes act as motivational tool in promoting oral health activities.

Likewise, positive connection was observed between the prevalence of dental caries and oral behaviour among children in the environment where dental health programmers have been employed [60,61]. The researchers also noted that fewer caries was suffered by the children whose schools had low sweets in their meals compared to those whose schools provide higher sugary treats to their students. When behavioural-change and educational methods were implemented in oral health education, improvements of the participants towards their oral health knowledge, behaviour, and positive attitude towards their dental health were noted. Thus, interventions of behavioural nature and other interventions were needed to be implemented within regular school-based education programmes among children to better develop oral health.

Periodic or regular oral education programme: An evidence from the literature that proposed that either regular or periodic school oral health programmes were habitually successful. Regular reinforcement is required for the sustained impact of any oral health education programme. Conducted research among elementary school children about the implementation of dental caries prevention programme in Senegal on 1st to 6th grade, which is periodic. The outcome was satisfactory, but this programme didn't encompass the students after elementary school. The lack of interest to adhere to good oral health behaviour which is important for long-term dental caries prevention were not well monitored.

Therefore, for successful and enhanced oral health programme, it is important to integrate oral health education into daily timetable of schools to access oral health education on regular basis. The study comprises of five stages, first stage encompasses the evaluation after the end of first education session, second stage involves assessment after six months, third stage involves evaluation done after three months and in fourth stage evaluation is done after six months. Thus, the authors observed that for better implementation of intervention, repetitions, sustainability and reinforcements of the education provided are needed. Studied emphasized the reinforcing of education provided on oral health and identifies where the programme would be effective or not. It supported the idea of regular reinforcement of education since human behaviour takes time to adapt to any new behaviour that requires to be followed. A short period of time was implemented in certain studies [62], but no sustainable behaviour was observed. Thus, research suggests that for better implementation (Figure 1) of oral health behavioral prevention programme, regular with the long-term period programme must be incorporated within the

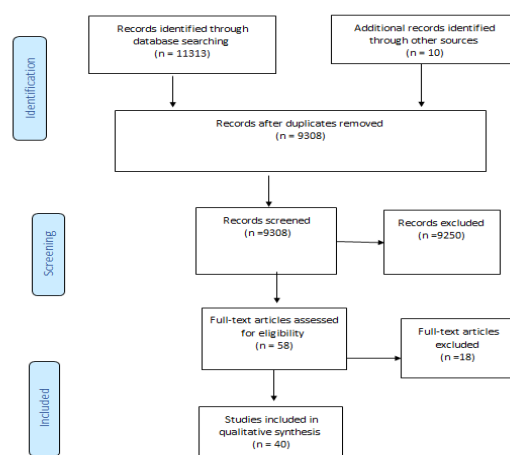


Figure 1: The PRISMA flow diagram.

daily education activities by the schools.

DISCUSSION

Numerous kinds of behavioral prevention strategies were narrated in school-based health literature within this literature review that includes a motivational interview, traditional oral health education, oral health puzzles, oral health education with digital media, supervised oral hygiene [63,64] experiential learning and supply of oral health aids. It is identified from the review of various researches that an individual is responsible for their oral health behavior and *via* effective and evidence-based self-care, dental health can be achieved. To boost the knowledge and understanding about the dental health practice and oral health diseases is crucial for implementing education on dental health hygiene and public policy. To sustain oral health, the scoping

review of prevailing researches demonstrated that it is entirely dependent on the dental flossing as well as tooth brushing for the avoidance of plaques, dental caries, gingivitis and periodontitis. The researches that reported the behavioral prevention strategies effectiveness furthermore were based on the subsequent results: Dental Caries Prevention (DMFT), behavior towards oral health, oral health practices (such as dental visits, healthy eating, dental flossing, tooth brushing), plaques control and knowledge of oral health. In the end, effectiveness of oral Behavioural Prevention Strategy's few possible elements was identified in the review: active participation and engagement of students and parents, the

Table 1: Summary of study included.

S/N	Authors	Country	Methods	Summary of findings and comments
1	Angelopoulou et al. [42]	Greece	Traditional one-off lecture on oral health issues compared to 3-month education by teachers.	Oral health behaviour and attitude improved at 6 months but not significantly in both groups.
2	Daouda et al. [43]	Senegal	A cohort of public school children followed up from with periodic education, and primary care.	Mean DMFT was not statistically different between first and sixth grade.
3	Cooper et al. [18]	Different countries	Systematic review	Some evidence of positive impact on children's knowledge.
4	Yekaninejad et al. [47]	Singapore	Group randomised trial	Improved tooth brushing and flossing on including parents.
5	Mohamadkhah et al. [40]	Iran	Quasi-experimental study	Oral health knowledge and tooth brushing improved.
6	Shenoy et al. [38]	India	A comparative study.	3-week education was more effective.
7	Damle et al. [48]	India	A comparative study.	Intervention group had reduction in mean plaque score.
8	Hebbal et al. [39]	India	A cluster-randomised controlled trial	Knowledge score in the audio-visual group increased and plaque score reduced.
9	Naidu et al. [50]	India	An intervention study with health education.	Knowledge and oral health improved.
10	Gonzalez-Del-Castillo-McGrath et al. [37]	Mexico	Randomised controlled trial	Motivational interviewing of parents was more effective.
11	Haleem et al. [51]	Pakistan	Cluster randomised control trial	All strategies were effective.
12	D'Cruz et al. [44]	India	A double-blind intervention study.	Oral hygiene practices improved in the intervention group.
13	Angelopoulou et al. [41]	Greece	A comparative study	Experiential learning was more effective.
14	Bhardwaj et al. [52]	India	A longitudinal study.	Overall mean plaque score and gingival score decreased.
15	Mohammadi et al. [36]	Iran	A comparative study.	Motivational interview was more effective.

16	Pakpour	Iran	Cluster-randomized controlled trial.	Adolescents who received loss-framed message reported improved oral health.
17	Jain et al. [8]	India	Before and after study that assessed effectiveness of oral health training of teachers.	Significant improvement in oral health knowledge and practices was noted.
18	Doichinova et al. [54]	Belgium	Oral hygiene education and motivation of 30 children aged 6-12.	The tooth brushing skills and oral hygiene index improved after the intervention.
19	Lai	Taiwan	Prospective cohort study.	Long-term effectiveness on oral health practices.
20	Mohamadkhah	India	Quasi-experimental study.	Knowledge and oral hygiene behaviours improved.
21	Olubunmi et al. [55]	Nigeria	An interventional study.	Oral hygiene improved.
22	Chandrashekar et al. [59]	India	An intervention study comparing oral health education by teacher, dentist and teacher.	Supply of oral hygiene aids contributed to behavioural change among the children.
23	Gupta	USA	Programme evaluation of oral health education component of school sealant programme.	The programme led to increased oral health knowledge among the children.
24	Macnab et al. [63]	Canada	Before and after study on oral health education.	Oral hygiene practice improved.
25	Saied-Moallemi et al. [46]	Finland	Comparison of class based oral health puzzles to parent-led no intervention among 9-year olds	Parent-led interventions were more effective.
26	Petersen et al. [24]	Thailand	An intervention study	Plaques and Dental caries incidence reduced.
27	Tai et al. [45]	China	Cluster randomised control trial.	More children in the intervention schools adopted regular oral health behavioural practices.
28	Takeuchi	Tonga	Evaluation of oral health programme.	Improvement in oral hygiene behaviour (tooth brushing).
29	Tarvonen et al. [61]	Korea	Longitudinal study	Decreased prevalence of dental caries.
30	Chachra et al. [58]	India	A comparative study.	Improvement in knowledge and practice of oral hygiene.
31	Albino et al. [32]	Different countries	A literature review of behavioural interventions.	Most interventions that utilized motivational interviewing were successful
32	Macpherson	UK	Evaluation of National Supervised Tooth brushing Programme in Scotland.	Uptake of the programme correlated with decrease in dental caries.
33	De Farias et al. [62]	Brazil	Randomised control trial.	Lower plaques and higher oral health knowledge.
34	Halawany et al.[56]	Saudi Arabia	Before and after study.	Improvement in knowledge and self-reported behaviour
35	Habbu et al. [60]	Different countries	Systematic review	Improvement in oral hygiene and gingival health, dental caries, oral health knowledge, attitude and behaviour in few studies
36	Gambhir et al. [17]	Different countries	Systematic review of ten papers	Knowledge, attitude and oral hygiene could be significantly improved through dental health education.
37	Lai	Taiwan	Prospective cohort study	Better overall plaque score in the intervention group, and better dental health and practices.

38	Kaewkamnerdpong et al. [53]	Thailand	Survey	Better brushing habits and low sweets intake.
39	Alsumait et al.	Kuwait	A cross-sectional study	Low carries cases were noted.
40	Gasoyan et al. [49]	Armenia	Before and after study and a cross-sectional research.	Lower level of caries among the children.

regularity of intervention, significant others involvement, teaching aids usage, and a combination of interventions. The effectiveness of Behavioural prevention strategy's elements established was based on the case study on theoretical propositions (Table 1).

CONCLUSION

1. The review displayed successful implementation of oral health education that improves dental health when these programmes involve both teachers and parents, together with the visual aid's utilization. The study recommends further exploration of the impact of involving parents, teachers, and dentists on partnership approach within oral health education.

2. Policy makers' perceptions and views should be addressed and explored towards dental health and school-based oral health programmes within Qatar, as well as the challenges and how these challenges will be addressed and how the alteration in children oral health will be sustained in Qatar state.

3. The present study is aimed at the school-based oral health programmes conducted within Qatar. Therefore, the upcoming study should compare the school-based oral health programmes conducted in Qatar with those conducted in other countries such as adjacent countries or countries in other continents.

4. The current study collected the opinions of students, parents and teachers related to school-based oral health programmes as a qualitative study *via* scoping review. The upcoming research should collect the opinions from stakeholders like dental assistants, management of education facilities, dental hygienists and dentists related to oral health within schools *via* qualitative approach.

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