



Association between Oral Health Promoting School Activities and Oral Health Literacy, Oral Health Behavior and Oral Health Outcome

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Abstract

Bureau of dental health had implemented oral health promoting school program since 2008, activities cover; 1) build supportive oral health policy 2) improve children oral health skills 3) create supportive environment 4) set an oral health surveillance system and 5) engage of all stakeholders. This study aimed to find the association between the oral health promoting school activities and oral health literacy (OHL), oral health behavior and oral health status among school children.

This study was conducted in 3,671 primary-school-children grade 5-6 from 70 schools. Sampling was done by using the stratified two-stages sampling technique. Data were drawn from 1) school oral health activities questionnaires, 2) OHL questionnaires, and 3) oral health behavior questionnaires. Caries experience (DMF) of the children was derived from the Ministry of Public Health's database. The Chi-square test and Logistic regression analysis were used in data analysis.

The result showed that the average mean of OHL among children was 21.6 (Adequate OHL= 21). Only 10.0% of Children brushed their teeth followed the key messages 222 (brush twice daily, at least 2 minutes and avoid eating 2 hrs. after brushed). Moreover, 10.5%, 14.9%, and 28.6% of children consumed carbonated soft drinks, sugary drinks, and snacks more than 2 times per day, respectively. A statistically significant association between schools implemented oral health

activities and oral health literacy ($p < 0.001$), oral health behavior ($p < 0.05$), and oral health status ($p < 0.05$) were observed. Oral health promoting school should be scaled up as they related to good oral health behavior.

Keywords: Oral health promotion, Oral health in school, Oral health literacy, Oral health evaluation, Oral health promoting school

What was Known

- Implementation of oral health promoting schools was recommended aimed to encourage students to have good oral health behaviors and good oral health outcome.
- There was limited of evidence to support for effective health promotion activities.

What's New and Next

- Schools implemented oral health promoting activities had children with the better oral health outcome.
- Oral health promoting school program can be communicated and scaled up over the country.
- Future research of cost effectiveness may need in terms of develop the policy to encourage and scale up the implementation of oral health promoting school program.

Introduction

School plays a key role in initiate goodness, knowledge, and behavior among children, while health is a fundamental factor crucial for child development. The Ottawa charter for health promotion activities cover dimensions of building healthy public policies, creating supportive environments, strengthening community actions, developing personal skills, and reorienting health services toward prevention and promotion of health. The World Health Organization¹ stated in the WHO's global school health initiative in health promoting school emphasized on implementation of activities in school as the starting point for instilling good health behaviors in children. And schools are also the initiate of connecting health issues to parents and communities.

The Department of Health, Thailand had implemented health promoting school since 1998, and oral health was part of it. Bureau of dental health has been operating oral health promoting schools program network since 2008. The objective was to build oral health promoting school network in terms of promoting good oral health among children for better oral health outcomes through the engagement of all stakeholders. Encourage schools implemented activities in 5 key aspects; 1) build a supportive healthy public policy for good oral health 2) improve children oral health skills through the integration of oral health promotion to the curriculum and the learning process. 3) create a supportive environment to good oral health 4) set an oral health surveillance system for early detection and referring for early treatment, and monitoring the oral health status of students and 5) engage of parents and communities in promoting oral health in children. Until now, there was limited evidence to support the effectiveness of oral health promotion activities. This study aimed to evaluate the oral health promoting school program; by exploring and examining the relationship between oral health activities in school and oral health literacy, oral health behavior and oral health status among school children. This study's findings would help to improve the oral health promoting school program, which would have further implications to improve the oral health outcome of the children

Materials and Methods

Study design and sample procedures

A cross-sectional survey was conducted in February–March 2020. Surveyed areas were in 12 provinces from Area Health Regions 1–12. Sampling was done by using the stratified two-stages sampling technique. Stage 1: random sampling was used to select 1 province from each of the 12 Area Health Region. Stage 2: in each province, the authors categorized schools into urban and rural areas, then selected schools from oral health promoting school program network by systematic sampling in the urban and then selected nearby schools for non-oral health promoting School Program Network, and likewise in the rural area. (Urban and rural are designated 1:1). In each school selected the primary school children grade 5 and 6 according to calculated size, by quota sampling, equally for gender. The calculated sample size for this survey was 3,648. The protocol was approved by the Ethical Committee of the Department of Health Thailand. The approval was issued on 31st January 2020, approval no. 381.

Data collection

Four aspects of data were collected; 1) oral health promoting activities in school 2) oral health literacy among children 3) oral health behavior among children and 4) school environment. Data were drawn from 4 forms; first, oral health promoting activities questionnaires, composed of 2 parts; part 1: general information of school, part 2: activities implemented in school based on oral health promoting school criteria in 5 aspects; a) build a supportive healthy public policy for good oral health b) improve children oral health skill c) create a supportive environment to good oral health d) set up an oral health surveillance system and e) engagement of parents and communities in promoting oral health in children. Second form, Oral health literacy questionnaires (Test of Functional Health Literacy in Dentistry for Primary School Children: P-TOFHLiD)², composed of 4 parts; a) oral health knowledge b) dental caries c) oral hygiene and d) cariogenic foods/drinks consumption. A cut point of the score greater or equal to 21 points is an adequate functional oral health literacy. Third form, oral health behavior questionnaires covered; tooth brushing behavior, frequency of cariogenic foods/drinks consumption and received oral health services. And forth, environmental observation form, composed of 2 parts; part 1 general information of school and part 2 checklist of supportive environment for good oral health. Caries experience (DMF) of the children were derived from the Ministry of Public Health database

(HDC). The descriptive data were presented as frequency and percentage. The association between school oral health activities and oral health literacy, oral health behavior, oral health status among school children was analyzed by Chi-square test and Logistic regression with the significant level of $p < 0.05$.

Results

A total of data was drawn from 70 primary schools, with 51.4% of the oral health promoting school network (Table 1), and 3,671 primary school children grade 5 and 6. The students were in oral health promoting schools 49.1% (1,801), they were in grade 5, 49.1% (1,804) and grade 6, 50.9% (1,867) and were male and female 49.5% (1,816) and 50.5 (1,855) respectively (Table 2).

School Activities and environment

Results showed oral health activities implemented in schools according to the 5 key aspects of oral health promoting school are as followed 1) build a supportive healthy public policy for good oral health; 85.7% of schools engaged all stakeholders in participation for policy-making, 84.3% had a policy to ban of soft-drink, 62.9% had a healthy between meal menu policy, 70% had the policy to ban of snacks, 78.5% had the policy to grow vegetables in school. 2) improve children oral health skills; 87.1% had activities improving brushing skills among children, 85.7% of schools integrated oral health into their curriculum, 87.1% integrated knowledge and good attitudes towards oral health care, 85.7% had activities improving food literacy in chosen healthy snacks, food and drink, 48.6% had learning activities through a project-based or active learning, 64.3% had an activity to train student's oral health leaders. 3) create a supportive environment to good oral health, 92.9% of schools had after lunch tooth-brushing activities, 72.9% provided adequate hygienic tooth-brushing sites, 74.3% had after lunch tooth brushing activities systems (oral health leader, check cleanliness), 84.3% provided adequate toothbrush and toothpaste, but only 57.1% of schools had organized activities or programs to control the frequency of cariogenic foods/drinks consumption, and 70.0% had activities to control of unhealthy food and drink 4) set an oral health surveillance system, the result found that 98.6% of schools had an activity of oral health examination by teachers/ health personnel at least 1 time per semester, 78.6% analyzed oral health problems based on oral health data and had a project to solved with the problems, 91.4% had a referral system for oral

health service. 5) engagement of parents and communities in promoting oral health in children, it was found that 74.3% of schools had activities to raise awareness among parents, families and communities about oral health care, 68.6% had activities to promote healthy eating behavior of children at home and community, 82.9% promoted the consumption of fruit and vegetable and 51.4% of schools raised awareness of the impact of unhealthy diet among shops and stores (Table 1).

Oral health literacy and oral health behavior

According to the study results, it was found that oral health literacy among children grade 5 and grade 6 had basic or functional health literacy scores on average of 21.6 from a total score of 26 (more than or equal to 21 points, is adequate basic oral health literacy). Findings revealed that 71.4% of students had adequate oral health literacy. For oral health behavior, 85.7% of children brushed their teeth in the morning every day, only 27.0% brushed their teeth after lunch every day, 59.8% brushed before bedtime. Children brushed their teeth twice daily (in the morning and before bed) 55.2%. Children brushed their teeth for 2 minutes only 26.1%. Moreover, 23.4% of children didn't eat for 2 hours after brushed, and children brushed their teeth followed key messages 222 (twice daily, 2 minutes and avoid eating 2 hrs. after brushed) only 6.0%. In access to oral health services aspect; 77.7% of children received oral health examination, 35.9% received topical fluoride, 20.5% received sealant and 28.7% received tooth filling. For frequency of cariogenic foods/drinks consumption, children who drank carbonated soft-drink, drank sugary drinks, and consumed snacks more than 2 times per day were 10.5%, 14.9%, and 28.6% respectively (Table 2).

Association

The result of the relationship between school activities and oral health literacy, oral health behavior, and received oral health services among school-aged children, found that school had a ban of soft-drink policy had children who drank soft-drinks more than 2 times/day less than schools that didn't have ($p < 0.01$). School integrated oral health knowledge through a project-based or active learning, had a higher percentage of children with adequate oral health literacy than schools that didn't have ($p < 0.01$). There was no difference of percentage of children brushing teeth after lunch between schools provided enough hygienic places for after lunch

tooth-brushing activities and schools that didn't, but there was more percentage of children brushed their teeth at least twice daily (morning & before bed) in school which had well-organized after lunch tooth-brushing activities than schools without, with a statistical significance ($p < 0.01$). In addition, schools provided oral health examination activities by teachers or dental personnel, had children received more oral health services than schools that didn't ($p < 0.01$). School participated with stakeholders to promote the consumption of fruit and vegetable at home and community had percentage of children consumed snacks > 2 times/day less than school without ($p < 0.01$)

(Table 3).

Result showed the association between oral health activities in schools and caries prevalence among school children. Out of 3,671 primary school children, there were only 2,506 children with oral health status in HDC, and the associations were measured. From five different oral health activities, and for each activity, the statistical significance of the association were observed, with p-values less than 0.05. After adjusted only 3 activities; School had ban of soft-drink policy, school provided oral health examination by teachers or health personnel 1 time/semester and school promoted consumption of fruit and vegetable at home and community, showed a significant association (Table 4).

Table 1 Oral health activities and create of supporting environmental for good oral health in school

Information	Number (n=70)	Percentage 100%
School type		
- Oral health promoting school	36	51.4
- Non- Oral health promoting school	34	48.6
Oral health activities in school		
1) Build supportive oral health policy		
- schools engaged of all stakeholders in policy-making	60	85.7
- had ban of soft-drink policy	59	84.3
- had healthy between meal menu policy	44	62.9
- had ban of snacks policy	49	70.0
- had a policy to grow vegetables	55	78.5

Information	Number (n=70)	Percentage 100%
2) Improve children oral health skill		
- had activities to improve tooth brushing skill	61	87.1
- integrated oral health into their curriculum	60	85.7
- integrated knowledge and good attitudes towards oral health care	61	87.1
- had activities to develop skills in choosing healthy food and beverages	60	85.7
- integrate oral health knowledge through a project based or active learning	34	48.6
- had activities to train student oral health leader	45	64.3
3) Create supportive environment		
- organized after lunch tooth brushing every day	65	92.9
- provided adequate brushing sites and hygienic	51	72.9
- had after lunch tooth brushing activities systems (oral health leader, check cleanliness)	52	74.3
- provided adequate tooth brush and tooth paste	59	84.3
- control frequency of cariogenic food consumption	40	57.1
- control of unhealthy food and drink	49	70.0
4) Set an oral health surveillance system		
- provided oral health examination by teachers or health personnel 1 time/semester	69	98.6
- had project solving oral health problems among students	55	78.6
- had a referral system for oral health services	64	91.4
5) Engagement of all stakeholders		
- had activities to raise awareness of oral hygiene among parents, families and communities	52	74.3
- had activities to promote healthy diet of children at home and community	48	68.6
- promoted consumption of fruit and vegetable	58	82.9
- raised awareness of unhealthy diet among shops and stores	36	51.4

Table 2 Percentage of general information, oral health literacy and oral health behavior among children grade 5 and 6

Information	Number (n=3,671)	Percentage 100%
Type Area		
- Urban	1,901	51.8
- Rural	1,770	48.2
School type		
- Oral health promoting school	1,801	49.1
- Non- Oral health promoting school	1,870	50.9
Grade		
- Grade 5	1,804	49.1
- Grade 6	1,867	50.9
Gender		
- male	1,816	49.5
- female	1,855	50.5
Oral health literacy (OHL)		
- Adequate OHL (Score \geq 21 points)	2,621	71.4
Oral health behavior		
Tooth brushing		
Time		
- Morning	3,146	85.7
- After lunch	991	27.0
- Before bed	2,196	59.8
Brushing \geq 2 Times/day	2,026	55.2
Brushing duration \geq 2 minutes	958	26.1
Avoid of eating after brush 2 hrs.	859	23.4
Brushing teeth 222 (twice daily, 2 minutes and avoid of eating after brush 2 hrs.)	219	6.0
Received oral health services		
Oral health examination	2,854	77.7
Topical Fluoride	1,318	35.9
Sealant	753	20.5
Filling	1,051	28.6

Table 3 The association between school oral health activities and oral health literacy, tooth brushing and consumption of cariogenic foods/drinks among children

School activities	number of student	Drink soft-drink > 2 times/day		<i>p-value</i> ¹
		number	percentage	
School had ban of soft-drink policy				0.005
No policy	887	116	13.1	
Had policy	2,784	271	9.7	
School activities	number of student	Adequate oral health literacy		<i>p-value</i> ¹
Integrated oral health knowledge through project based or active learning				0.001
No activities	384	248	64.6	
Had activities	3,287	2,395	72.0	
School activities	number of student	Brushing teeth after lunch everyday		<i>p-value</i> ¹
		number	percentage	
Provided enough hygienic places for after lunch tooth brushing activities				0.72
No	563	148	26.3	
Yes	3,108	839	27.0	
School activities	number of student	Brushing teeth at least twice daily (morning & before bed)		<i>p-value</i> ¹
		number	percentage	
Had after lunch tooth brushing activities systems				0.003
No	947	485	51.2	
Yes	2,724	1,547	56.8	

School activities	number of student	Received topical fluoride		<i>p-value</i> ¹
		number	percentage	
Provided oral health examination by teachers or health personnel 1 time/semester				0.001
No	65	7	10.8	
Yes	3,606	1,310	36.3	
School activities	number of student	Consumed snacks > 2 times/day		<i>p-value</i> ¹
		number	percentage	
Promoted consumption of fruit and vegetable at home and community				0.005
No	733	240	32.7	
Yes	2,938	808	27.5	

¹ *p-value* by Chi-square test

Table 4: The association between oral health activities in schools and caries prevalence among school children (n=2,506)

activities in schools	Caries prevalence	OR (95%CI)	<i>p-value</i> ¹	AOR (95%CI)	<i>p-value</i> ²
	number (percentage)				
School had ban of soft- drink policy (1,911)	504 (26.4%)	0.50 (0.41 – 0.61)	< 0.001*	0.55 (0.44 – 0.68)	< 0.001*
Integrated oral health into curriculum (1,859)	503 (27.1%)	0.59 (0.49 – 0.72)	< 0.001*	1.13 (0.91 – 1.34)	0.26
Had supervised after lunch tooth brushing (2,082)	547 (26.3%)	0.69 (0.58 – 0.82)	< 0.001*	1.33 (1.05 – 1.68)	0.02
oral health examination by teachers or health personnel 1 time/semester (2,384)	694 (29.1%)	0.47 (0.32 – 0.67)	< 0.001*	0.51 (0.34 – 0.75)	0.001*
Promoted consumed of fruit and vegetable at home and community (1,929)	491 (25.5%)	0.42 (0.34 – 0.50)	< 0.001*	0.42 (0.32 – 0.56)	< 0.001*

AOR, Adjusted Odds Ratio; CI, Confidence Interval

¹ *p-value* by Chi-square test

² *p-value* by Logistic regression

Discussion

In Thailand, data from the national oral health surveys in 2017 by the Bureau of Dental Health³ showed that oral health problems among 12 years old children were still high, half of the children (52%) had caries experience, and 66% had gingivitis. Oral health is fundamental to general health and well-being among children, and school plays an important role as a platform for promoting oral health. In Thailand, oral health promoting school was promoted by encourage schools implemented activities in five key aspects, our findings revealed that both oral health promoting schools' network and non-network schools had oral health promoting activities. This because all primary schools were introduced with the National health promoting school program. For oral health status of the children, it was found that oral health status derived from the database of the Ministry of Public Health (HDC), were only 2,506 that could be linked out of 3,671. The need for quality improvement of oral health data should be considerate.

For oral health promoting activities in school, the first aspect involves establishing a supportive, healthy public policy to encourage good oral health. Most schools engage all stakeholders in policy-making, implement policies to prohibit cariogenic foods and drinks, such as banning soft drinks, snacks, and sugary drinks. Many schools also have a healthy between-meal menu policy and promote vegetable cultivation on their premises. And it was found that children in schools with a soft-drink ban policy drink soft drinks less often than schools that did not have such a policy ($p < 0.01$). As we restrict the availability of unhealthy foods among children during the school period, children seem to consume less unhealthy foods and drinks. The study from Freeman⁴ found that the restriction of foods and drinks choices at school did not achieve its goals of promoting children's dental health or encouraging them to adopt healthier dietary habits both inside and outside school. While Bere⁵ found that providing free fruit or vegetable was an effective strategy to promote healthy eating in school. Moreover, evidence from Moyses⁶ showed schools with oral health policies as part of the health promoting schools' approach were found to have statistically significant of better oral health outcomes. To change behavior is long-term and be difficult to attribute to only one intervention⁷. Our study showed that schools not only implemented activities of restricting unhealthy food in school but also a combination of promoting fruits and vegetable consumption and also implemented activities outside school, by engagement of family and community.

The development of personal skills is crucial for fostering good oral health behavior. In this study, schools implemented activities, such as improving tooth-brushing skills, integrating oral health into their curriculum, promoting knowledge and positive attitudes towards oral health care, teaching skills for choosing healthy food and drinks, and training student oral health leaders. The study revealed that schools that integrated oral health knowledge through project-based or active learning had a higher percentage of children with adequate oral health literacy compared to those that did not. In describing the relationship between health education, health promotion, and health literacy, Watt and Fullter⁸ stated that health education alone is not sufficient to lead to good health. But effective health education processes in conjunction with health promotion through public health policy and create a supportive environment for good oral health will enhance health literacy and lead to well-being. Health literacy can be used as an outcome measure for health promotion intervention. This study revealed that the learning process through a project-based or active learning have better good result increased oral health literacy.

In this study, schools that had activities to train student oral health leaders showed good oral health behavior results. This supported from studies of primary school-aged children in Germany and Ireland, were also shown benefits with the use of peers^{9,10}. Chapman and Duncan¹¹ suggest that there is an ethical responsibility to provide oral health education and that access to information is one of the rights of individuals under the Ottawa Charter. They acknowledge that knowledge is often not sufficient for behavioral change, and that supportive environments are required.

To create a supportive environment for good oral health, this study revealed that schools implemented activities such as having after-lunch tooth-brushing activities, providing adequate brushing facilities and maintaining hygiene, establishing systems for after-lunch tooth-brushing activities (with oral health leaders ensuring cleanliness), supplying adequate toothbrushes and toothpaste, regulating the consumption frequency of cariogenic foods and drinks, and monitoring the availability of unhealthy food and drinks. These activities, when implemented in schools, promote good oral health behavior. In created environment supported for good oral hygiene habits such as tooth-brushing, the study from Jackson et al.¹² in London, England, found that teacher-supervised tooth-brushing with fluoride toothpaste (1,400 ppm), led to reductions in tooth decay. Moreover, the conclusion from a review of community-based

population-level interventions for promoting child oral health, revealed that interventions that combine oral health education with supervised tooth-brushing or professional preventive oral care can reduce dental caries in children¹³.

To establish an oral health surveillance system in schools, including the examination of oral health by teachers or health personnel at least once per semester, analysis of oral health problems based on oral health data, the implementation of projects to address oral health issues and the establishment of a referral system for oral health services, is also important in terms of access to care. Our study revealed that schools with the practice of oral health examinations by teachers or health personnel at least once per semester had a higher percentage of children accessing oral health care and a lower prevalence of caries. School health services should provide training, supply health materials, health education, oral healthcare, referral system, and regular monitoring system, as school may be the only place for children, who are at the highest risk of dental disease to gain access to oral health services.⁶

Engagement of parents and communities in promoting oral health in children was very crucial, our findings confirmed that schools with the engagement of parents and communities showed good children's oral health behavior and better oral health outcome. This was also found in Tehran, Iran, Saied-Moallemi et al.¹⁴ found that the home visit by a health counselor gave an oral health information leaflet and a diary to record children's brushing frequency had a statistically significant improvement on children's gum health. And also, in Australia, the Victorian Department of Health¹⁵ revealed that levels of fruit and vegetable consumption by children are higher when parents regularly eat fruit and vegetables, and they are available and accessible at home. The oral health promotion program initiated by the school, working with parents and communities can help promote the oral health of the families, other family members, and encourage them to become part of the school community through students. The interaction between school to home and community is critical, family and community members can be involved in the planning and decision-making process, in terms of building a supportive environment for good oral health.⁶

Conclusion

Oral health promoting school activities covered; 1) build a supportive healthy public policy for good oral health 2) improve children oral health skills through the integration of oral health promotion to the curriculum and the learning process 3) create a supportive environment for good oral health 4) set an oral health surveillance system for early detection and referring for early treatment and 5) engage of parents and communities in promoting oral health in children, can be communicated and scaled up over the country as they related to the better resulted in oral health literacy and oral health behavior among school children. Effectiveness in-terms of oral health outcome need more data and concrete evidence to support.

Ethical Approval Statement

This study was approved by the Ethical Committee of the Department of Health Thailand. The approval was issued on 31st January 2020, (Approval Number: 381).

Author Contributions

Chiraporn Khitdee, Piyada prasertsom and Kornkamol Niyomsilp designed the study and formulated the content of the intervention tools and knowledge questionnaire. Chiraporn Khitdee designed the intervention tools and knowledge questionnaire, with guidance from Piyada prasertsom and Kornkamol Niyomsilp. Chiraporn Khitdee, and Pattraporn Hasadisevi, conducted the study under the supervision of Piyada prasertsom and Kornkamol Niyomsilp. Chiraporn Khitdee carried out the initial statistical analysis of data, following advice from Piyada prasertsom and Kornkamol Niyomsilp. Chiraporn Khitdee, re-analyzed the data and wrote the manuscript. All authors read and approved the manuscript prior to submission for publication.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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