

## Effect of Oral Health Educational Program on Oral Hygiene Status in a Group of Egyptian School Children: A Before and After Study

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OHI-S; Interactive Oral health educational program; School visit; Oral Hygiene.

### Abstract

**Background:** This study aimed to assess the efficacy of an oral health educational program on oral hygiene among a group of schoolchildren in Egypt.

**Methods:** A before-and-after study was conducted among children aged 9–12 years. A total of 155 Egyptian schoolchildren (90 females and 65 males) participated in the study. An interactive health education program was specially designed and delivered, incorporating a PowerPoint presentation, videos, flyers, and posters with basic information about oral health, as well as simple instructions on proper tooth-brushing techniques and gum care. Oral hygiene was assessed using the Oral Hygiene Index Simplified (OHI-S) at baseline (T0) and six months after the intervention (T1).

**Results:** Statistical analysis showed a marked overall reduction in the percentage of debris and calculus by the end of the study. A highly significant decrease in debris levels was observed from T0 (=1.92) to T1 (= 0.09). Similarly, calculus levels significantly decreased from T0 (= 1.35) to T1 (= 0.02). Although the difference between males and females was not statistically significant (93.5% and 96.4%, respectively), a marked improvement in OHI-S scores was observed. The percentage of participants with OHI-S scores between 0.0 and 1.2, indicating good oral hygiene, increased markedly from 20% at T0 to 100% at T1.

**Conclusion:** The oral health education program effectively improved the oral hygiene of schoolchildren, as shown by significant decreases in OHI-S scores.

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## 1 Introduction

Maintaining good oral health supports everyday life-it helps people enjoy their meals, express themselves clearly, and interact with others without the burden of pain or embarrassment. Dental caries and periodontal diseases are still substantial problems for public health, particularly affecting children and adolescents<sup>1</sup>. Poor oral hygiene in school-aged kids has been linked to a higher rate of oral health problems, which can cause pain, infection, and a lower quality of life.

The World Health Organization (WHO) reported that the majority of kids around the world have periodontal problems<sup>2</sup>. A study conducted in Egypt in collaboration with the WHO found that 80% of examined children suffered from some form of periodontal disease<sup>3</sup>. This highlights the urgent need for effective public health interventions.

There are many challenges to overcome in order to promote oral health, where there is an urgent need to internationally strengthen public health programs by

deploying effective oral health care strategies<sup>4</sup>. Tooth brushing is one of the most crucial oral health behaviors that should be a habit in young children<sup>5</sup>.

Early interventions during primary school years are crucial in shaping lifelong health behaviors<sup>6</sup>. The age group between 6 and 12 years old and adolescents are frequently at high risk for periodontal problems. The World Health Organization (WHO) and the FDI-World Dental Federation jointly defined oral health goals to reduce the risk of oral diseases for young school children as they are the group of choice<sup>7</sup>. School-based oral health education programs have shown promise in improving oral hygiene habits, reducing caries incidence, and fostering positive long-term behaviours<sup>8</sup>.

Introducing health-related education at an early age plays a significant role in shaping healthy habits, including those related to dental care. Schools serve as an ideal setting to promote oral hygiene among young learners, reaching them during a critical period of behavioral development. Embedding oral health instruction, preventive approaches, and supportive environments into both academic programs and daily routines can help instill habits that last into adulthood<sup>9</sup>.

Despite the common focus of oral health education programs on disadvantaged or underserved populations, children from high socioeconomic backgrounds have received limited attention in this context<sup>10,11</sup>. This study targeted group comprised schoolchildren enrolled in a high socioeconomic international Egyptian school. Although this demographic is often assumed to have better access to dental care and oral hygiene products, they are not immune to oral health issues. The socioeconomic status is not the only factor that determines a person's attitude towards oral hygiene<sup>12</sup>. This reveals a gap in current health promotion strategies, as most school-based oral health interventions have historically focused on low-income socioeconomic status.

This study aimed to evaluate the effectiveness of an interactive oral health educational program in enhancing oral hygiene among children in an international Egyptian school. Therefore, this study addresses an underexplored population, seeking to assess the effectiveness of interactive oral health education in improving hygiene practices among children with higher socioeconomic status.

Permission was also taken from the Nile Egyptian International Schools (NEIS) authorities. The choice of school was based on the lack of structured educational programs tailored for higher-socioeconomic school settings that has left a critical void in preventive oral health efforts. Informed consent was obtained from parents or legal guardians of the study participants. The study duration was over six months, from October 2023 to April 2024.

A total of 155 Primary Egyptian school children aged 9 to 12 years, enrolled in an international school located in 6th of October City, Giza, Egypt. The estimated sample size (n) was 140 participants. The actual sample size attained was augmented by around 5% (about 7 participants) for the dropouts (147 participants), using a power analysis that considered an effect size of 0.27, a significance level (alpha) of 0.05, and a statistical power of 95%<sup>13</sup>. Children between the ages of 9 and 12, regardless of gender, were eligible to take part in the study. Participants were excluded if they were undergoing treatment with fixed orthodontic appliances, had any medical condition, or if parental consent for participation was not obtained.

The oral hygiene of the study participants was evaluated using the Oral Hygiene Index Simplified (OHI-S), originally introduced by Greene and Vermillion in 1964. This index offers a simple and practical method for measuring levels of dental plaque and calculus by two main key components: the debris index and the calculus index. The OHI-S evaluation is based on examining six designated tooth surfaces, including the buccal surfaces of the upper right and left first molars, the labial surface of the upper right central incisor, the lingual surfaces of the lower left and right first molars, and the labial surface of the lower left central incisors. In this system, higher scores indicate a greater accumulation of debris and calculus, which signifies poorer oral hygiene<sup>14</sup>.

In the initial phase of data collection (T0), an oral examination was conducted to determine the level of oral cleanliness, recording scores that showed the presence of debris and calculus. A diagnostic dental chart outlining each child's oral health was sent to the parents of each child to assist with follow-up care. The chart included recommendations for any necessary referrals or additional dental care, such as restorations or scaling (**Fig. 1**).

## 2 Materials and Methods

An interventional educational (before and after) study was designed to assess the impact of an oral health educational program. Official ethical approval was obtained from the ethical committee of the Military Medical Academy (MMA) under No. (49-2023).

### Dental Evaluation chart for children

Student name: ..... Class: .....

Permanent Teeth

Primary Teeth

Dear parent, please check our evaluation and visit your dentist for any required treatment, considering poor oral hygiene and caries as a serious condition.

Oral hygiene	good	fair	poor
Caries	Simple (S)	need immediate treatment (T)	Extraction (E)
Any other comment .....			
.....			
Signature .....			

**Figure 1.** Dental diagnostic chart for necessary referrals.

Following the examination, an interactive educational health program was provided to the children at the school theatre. The intervention aimed to enhance oral health awareness and improve oral hygiene behaviors among participants through an interactive educational health program. A comprehensive, multi-method strategy was implemented to guarantee engagement, promote active participation, and improve knowledge retention. The necessary information regarding oral health was provided through a PowerPoint presentation that included interactive graphics and videos, from the FDI's "Mouth Heroes" campaign.

The importance of good tooth-brushing practices and dietary habits that affect kids' oral hygiene was highlighted in the presentation. Posters were positioned strategically to reinforce the program's main points. Flyers were distributed along with toothbrushes and toothpaste as visual reminders of important oral hygiene practices.

Students had the opportunity to participate in hands-on training using toothbrushes and toothpaste provided during the session. A demonstration of the modified Bass brushing technique was conducted, allowing students to learn appropriate brushing methods under supervision. This hands-on approach helped them acquire effective brushing techniques<sup>15</sup>.

Six months after the program (T1), the same participants were reassessed using the OHI-S index to evaluate changes in their oral hygiene over time. None of the participants withdrew from the study. By utilizing the same method as before, the results remained consistent and comparable. A statistical analysis was conducted to compare pre- and post-intervention OHI-S scores, allowing for an objective evaluation of the effectiveness of the intervention in improving oral hygiene.

All data were calculated, tabulated, and analysed using SPSS v26.0 (IBM Corp, NY), with statistical significance set at  $P < 0.05$ . Descriptive statistics were reported as Mean  $\pm$  SD, while categorical data were presented as frequencies (n) and percentages (%).

## 3 Results

The 155 children participated in the study (58.1% females and 41.9% males), with no dropouts. The mean age of the participants was 10.01 with a standard deviation of  $\pm 0.98$  years, indicating a relatively homogeneous age distribution within the study sample.

A significant improvement in OHI-S debris scores was observed across all assessed tooth surfaces. As shown in **Table 1**, the proportion of participants with a debris score of 0 (indicating clean teeth) increased dramatically from 5.3% at baseline (T0) to 91.6% following the intervention (T1) ( $P < 0.001$ ). This highlights the effectiveness of the educational program in enhancing oral hygiene practices among participants, as illustrated in **Fig. 2**. Furthermore, post-intervention, 98.5% of participants had no calculus, compared to only 26.5% at baseline ( $P < 0.001$ ), as shown in **Table 2**.

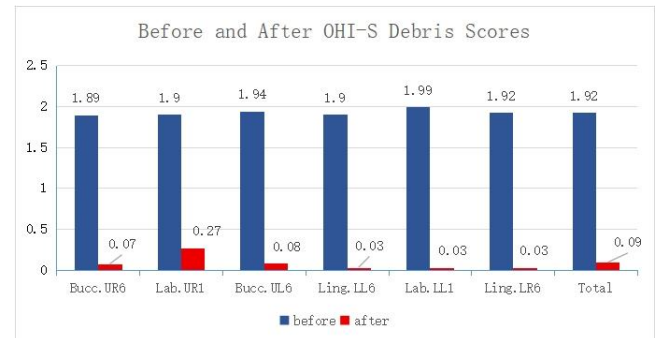
**Table 3** shows the OHI-S scores before the intervention, which were as follows 31 children (20%) had scores ranging from 0.0 to 1.2, indicating good oral hygiene. Additionally, 45 children (29%) had scores ranging from 1.3 to 3.0, representing fair oral hygiene, while 79 children (51%) fell in the range of 3.1 to 6.0, indicating poor oral hygiene. After the program, the same table shows that all 155 participants (100%) achieved scores in the range of 0.0 to 1.2, categorizing them as having good oral hygiene.

**Table 1.** Comparison between before and after of OHI-S Debris scores.

	Before		After		% change	Wilcoxon Signed Ranks Test	P value
	Mean	SD	Mean	SD			
Bucc.UR6	1.89	0.87	0.07	0.26	96.3	10.52	<0.001**
Lab.UR1	1.90	0.86	0.27	0.45	85.8	10.18	<0.001**
Bucc.UL6	1.94	0.90	0.08	0.27	95.9	10.48	<0.001**
Ling.LL6	1.90	0.88	0.03	0.18	98.4	10.59	<0.001**
Lab.LL1	1.99	0.84	0.03	0.16	98.5	10.72	<0.001**
Ling.LR6	1.92	0.88	0.03	0.16	98.4	10.63	<0.001**
Total	1.92	0.82	0.09	0.17	95.3	10.64	<0.001**
**; means significant difference at P<0.01							

**Table 2.** Comparison between before and after of OHI-S Calculus scores.

	Before		After		% change	Wilcoxon Signed Ranks Test	P value
	Mean	SD	Mean	SD			
Bucc.UR6	1.34	1.08	0.00	0.00	100.0	9.37	<0.001**
Lab.UR1	1.35	1.06	0.00	0.00	100.0	9.46	<0.001**
Bucc.UL6	1.36	1.10	0.01	0.11	99.1	9.38	<0.001**
Ling.LL6	1.37	1.08	0.01	0.08	99.5	9.37	<0.001**
Lab.LL1	1.31	1.07	0.06	0.23	95.6	9.28	<0.001**
Ling.LR6	1.37	1.09	0.01	0.11	99.1	9.41	<0.001**
Total	1.35	1.05	0.02	0.06	98.7	9.35	<0.001**
**; means significant difference at P<0.01							

**Figure 2.** Comparison between before and after of OHI-S Debris scores.**Table 3.** Frequency distribution of Oral Hygiene Index Simplified before and after study

	Before		After		P value
	N	%	N	%	
Good (0.0-1.2)	31	20%	155	100 %	<0.001**
Fair (1.3-3.0)	45	29 %	-	-	
Poor (3.1-6.0)	79	51%	-	-	

\*\*; means significant difference at P<0.01  
 N: Number of children  
 %: Percentage of OHI-S scores

## 4 Discussion

The present study was a before-and-after study to evaluate the impact of an interactive oral health educational program on the oral hygiene status of schoolchildren. It employed the Oral Hygiene Index Simplified (OHI-S), a widely accepted and validated tool known for its simplicity, reliability, and adaptability to various demographic settings, particularly among school-aged children<sup>16</sup>.

This study demonstrated a significant improvement in oral hygiene following the interactive oral health educational program for children aged from 9 to 12 years old. Research indicates that tooth-brushing habits formed in childhood, above six years old, persist in adulthood, reinforcing the importance of early interventions<sup>7</sup>. Children at the age of nine experience significant development in fine motor skills and tactile sensation, which are crucial for tasks like holding a toothbrush<sup>17</sup>. Previous studies highlight that educational programs are highly effective in instilling proper oral hygiene habits among children<sup>4,18</sup>.

At the baseline assessments (T0), high debris scores indicated poor oral hygiene before the intervention. However, after the educational program, marked reductions in debris scores were observed across all measured tooth surfaces. The marked improvements were noted in the lingual surfaces of the lower molars (LL6 and LR6). This improvement could be attributed to the hands-on training and the distribution of toothbrushes and toothpaste, which enabled participants to practice proper brushing techniques.

The intervention also yielded significant reductions in calculus scores, with overall improvements reaching 98.6%. The most affected tooth surfaces were the buccal surfaces of the upper molars (UR6 and UL6) and the lingual surfaces of the lower molars (LL6 and LR6). The improvement in calculus scores would be directly linked to the referral diagnostic charts that were sent to each child's parents.

This study found that female participants improved their oral hygiene ratings slightly more than their male counterparts. Females showed a more dramatic reduction in debris and calculus scores after intervention. This is consistent with evidence indicating that females are more responsive to health education and comply better with dental hygiene recommendations<sup>19</sup>. Furthermore, another study found that girls are more likely than boys to engage in preventative health behaviors due to stronger parental reinforcement and social norms around personal cleanliness<sup>7</sup>.

The use of interactive educational methods combined with hands-on demonstrations has consistently been linked to better knowledge retention and improved behavioral outcomes. The current study demonstrated a significant improvement in Oral Hygiene Index Simplified (OHI-S) scores. The number of children achieving OHI-S scores that indicate good oral hygiene (ranging from 0.0 to 1.2) increased dramatically from 31 children (20%) at baseline to all 155 children (100%) after the program.

The findings in this study align with previous studies showing that interactive educational methods (videos, posters, and demonstrations) enhance knowledge retention and improve compliance with oral hygiene practices<sup>20,21,18</sup>. Similar to a study done by Abd Al-Azeem, et.al. (2025), which assessed the impact of an oral health educational program on the oral hygiene and dental caries status of orphaned children aged 7 to 17 in Egypt. Post-intervention results showed a statistically significant improvement in oral hygiene, with increases in good OHI-S scores and notable reductions in both debris and calculus scores<sup>22</sup>.

Furthermore, the findings in a study done by Zargar, et.al. (2025) emphasized the crucial influence of

schools, families, and oral health professionals in promoting oral-dental health among students<sup>23</sup>. The Community Dentistry Department of Karary University in Sudan launched a school-based oral health project targeting children in 2nd and 6th grades. With regular follow-ups, the initiative aims to promote oral health awareness, prevent dental problems, and provide critical care through a collaborative team of experts and dental students. The collected data confirmed the effectiveness of the project and supported its alignment with evidence-based practices, which was consistent with the findings of the current study<sup>24</sup>.

Hanafy and Abdelmoniem's (2022) study strongly correlates with our findings, as both showed that structured, interactive oral health education programs significantly enhance oral hygiene status among youngsters. Both programs included follow-up reinforcement, caregiver participation, and practical brushing procedures. Notably, Hanafy's study found a significant rise in children reaching good oral hygiene scores after intervention, which mirrors the changes shown in our participants. These similarities highlight how well engaging, instructive methods work to encourage long-lasting oral hygiene practices in a variety of young people<sup>25</sup>.

## Limitations

A limitation of the study is the limited frequency of follow-up visits, which would affect the long-term retention of oral hygiene behaviors among participants.

## 5 Conclusion

- Following the program, all participants demonstrated statistically significant improvements in oral hygiene.
- Prior to the intervention, the majority of children had low OHI-S scores; following the program, all had improved.
- Hands-on demonstrations and the interactive oral health educational program were key to the program's success.
- The findings are consistent with earlier research highlighting the relevance of early, participatory school-based interventions.

## Authors' Contributions

Sherien Atef Ahmed managed the methodology, Manuscript Writing.

Hala M. Abbas managed the Review & Editing, and Supervision.

Samaa S Hanafy managed the Review & Editing, and Supervision.

## Conflict of interest

The authors declare that they hold no competing interests.

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