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Original Article

The Role of Oral Hygiene Practices in Managing Dental Caries Risk Among Adolescents

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ABSTRACT

It is widely recognized that practicing oral hygiene is crucial for reducing the risk of oral cavities. To evaluate the risk factors for dental caries, such as gender and oral hygiene habits including using mouthwash, fluoride toothpaste, and brushing your teeth regularly. Three hundred people from a clinic of dental in Jeddah, Saudi Arabia, participated in this cross-sectional and comparative study. A questionnaire was utilized to evaluate oral hygiene habits and demographic data. Tests were performed to evaluate erosion scores, plaque indices, Streptococcus mutans (MS) counts, lactobacilli levels, buffering capacities, and salivary secretion rates. Gender was linked to erosion scores, plaque index, MS count, and buffering capacity. The high buffering capacity prevalence and MS counts were significantly greater among boys than girls. Furthermore, the average plaque index for boys was greater than that of girls. It is advised to implement oral hygiene health education programs designed to decrease the prevalence of dental caries among adolescents because oral hygiene behaviors can affect the likelihood of dental cavities. Regular tooth brushing and mouthwash use were linked to the rates of salivary secretion, and people who used non-fluoridated toothpaste had a higher development of lactobacilli than those who used fluoridated toothpaste.

Keywords: Dental caries, Risk factors, Saudi Arabia, Oral hygiene

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Introduction

Dental caries are characterized by the gradual deterioration of tooth enamel. This can be partially ascribed to bacteria located on the teeth that break down fermentable carbs. This process creates an acidic setting conducive to tooth decay [1-3]. Even though tooth decay can be prevented, it remains the most prevalent chronic disease among children and teenagers. Among those aged 12–19 years, its 4 fold more prevalent than bronchial asthma [4]. in individuals aged 2 to 19, the prevalence of dental caries was found to be 45.8% in primary teeth and 13% in permanent teeth [5]. Furthermore, as per the global burden of disease 2017 report, the most prevalent health condition is untreated tooth decay in permanent teeth [6]. Even in high-income countries, the costs of dental treatment are considerable, comprising five percent of overall health expenditure and twenty percent of out-of-pocket health expenses [7]. The treatment of dental cavity according to current guidelines involves reducing cariogenic bacteria, remineralizing lesions, and employing restorative treatments. A recent change has occurred in caries management, moving away from a solely surgical approach toward more preventive methods [8]. cavity resistance development is influenced by a factors variety, including lifestyle choices, socioeconomic

status, and dietary habits [9]. Dental caries are mainly caused by unhealthy habits, including inadequate oral hygiene and a bad diet [10].

Maintaining good oral hygiene is important for dental health, which in turn influences systemic health and life quality [11]. The primary indicator of tooth decay in school-age children is poor oral hygiene [12]. Additionally, the prevalence of dental caries in kids aged 12 is significantly influenced by their oral hygiene condition [13]. When children acquire Streptococcus mutans (MS) during their formative years, the chances of them developing dental caries rise considerably; however, maintaining effective oral hygiene and following a diet low in cariogenic substances can help reduce the risk to some extent. These measures assist in managing plaque, which can counteract the effects of early bacterial exposure and ultimately lower the incidence of caries [14]. Moreover, the development of caries was linked to advancing age, the percentage of teeth showing visible plaque, and the MS presence [15]. The goal was to evaluate the risk factors influencing dental caries, which include gender and oral hygiene practices like regular tooth brushing, using fluoride toothpaste, and using mouthwash. There is little research on the connection between dental caries and oral hygiene practices in Saudi Arabian adolescents.

Materials and Methods

This comparative cross-sectional study included 300 adolescence aged 15-18 from a dental clinic in Jeddah, Saudi Arabia. An electronic database was performed using PubMed and Google Scholar to gather background information and data related to the research question and determine the knowledge gap. A questionnaire was used to assess demographic data and oral hygiene habits. In addition, tests were conducted to measure salivary secretion rates, buffering capacities, lactobacilli levels, MS counts, plaque indices, and erosion scores.

Buffer capacity was expressed as 1 for high, 2 for medium, and 3 for low, while MS count and lactobacilli were expressed as 1 for very low, 2 for low, 3 for medium, and 4 for high.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 25. Results were analyzed using the chi-square test, Monto Carlo test, Fisher exact test, and Student's t-test. All tests were two-tailed, and a p-value of <0.05 was considered statistically significant.

Results and Discussion

Fifty percent (150) of the three hundred individuals were female. While 191 (63.7%) of their fathers earned college and second degree degrees, 129 (43%) of their mothers had either university or postgraduate education **(Table 1)**.

Table 1. Demographic specifications of the sample (n = 300)

	N (%)
Gender	
Boys	150 (50.0)
Girls	150 (50.0)
Age	
13 years	1 (.3)
14 years	75 (25.0)
15 years	224 (74.7)
What is your mother's education level?	
University and postgraduate	129 (43.0)
Secondary and preparatory	50 (16.7)
Others	121 (40.3)
What is your father's education level?	
University and postgraduate	191 (63.7)
Secondary and preparatory	21 (7.0)
Others	88 (29.3)

Note. All variables are reported as numbers and %.

In terms of oral hygiene practices, girls showed higher rates compared to boys for engaging in bruxism, regularly using mouthwash, using fluoride toothpaste, and brushing teeth twice a day (13.3% vs. 6.7%, 55.3% vs. 39.9%, 70.7% vs. 28.2%, and 58.7% vs. 29.3%, respectively), with these differences being statistically

remarkable (P <0.001, P < 0.008, P <0.001, and P <0.001, respectively). Indeed, males were more likely than females to clench and bite on hard objects (45.3% vs. 34.7% and 18.7% vs. 5.3%, respectively), and these differences were statistically remarkable (p<0.001) **(Table 2)**.

Table 2. Habits of Oral Hygiene based on gender

	Boys	girls	P-value
	N (%)	N (%)	
3. How often do you use a toothbrush?			
Never	2 (1.3%)	0 (0.0%)	<0.001[a]
Few times or once a week	21 (14.0%)	3 (2.0%)	
Once a day	62 (41.3%)	21 (14.0%)	
Twice a day	44 (29.3%)	88 (58.7%)	
More than twice a day	16 (10.7%)	33 (22.0%)	
Other	5 (3.3%)	5 (3.3%)	
6. Do you use toothpaste when brushing your teeth?			
Yes	146 (97.3%)	139 (92.7%)	0.064[b]
No	4 (2.7%)	11 (7.3%)	
7. What type of toothpaste do you usually use?			
Fluoridated	42 (28.2%)	106 (70.7%)	<0.001 [a]
Non-fluoridated	5 (3.4%)	0 (0.0%)	
Do not know	102 (68.5%)	44 (29.3%)	
8. Do you utilize mouthwash regularly?			
Yes	59 (39.9%)	83 (55.3%)	0.008 [b]
No	89 (60.1%)	67 (44.7%)	
9. Which of the following oral habits do you have?			
Bruxism	10 (6.7%)	20 (13.3%)	<0.001 [b]
Clenching	28 (18.7%)	8 (5.3%)	
Biting on a hard object	68 (5.3%)	52 (34.7%)	
Other	44 (29.3%)	70 (46.7%)	

Note. All variables are reported as number and %
The significance test was done at a 0.05 level
[a] Test of Monto Carlo was utilized
[b] Test of Chi-Square was utilized
Significant findings are in bold

In the comparison of boys' and girls' dental histories, it was found that the attendance rate for dental visits was slightly greater among girls (98%) than boys (96%), though this difference was not statistically remarkable (p=0.501). However, six month referrals to dental practice were significantly more frequent in boys (p = 0.013) **(Table 3)**.

Table 3. History of dental based on gender

	boys	Girls	P-value
	N (%)	N (%)	
10. Have you ever used a dentist?			
Yes	144 (96.0%)	147 (98.0%)	0.501[c]
No	6 (4.0%)	3 (2.0%)	
11. If yes, how many times have you used the dentist?			
Every 6 months	35 (23.3%)	23 (15.3%)	0.013[a]

Every year	3 (2.0%)	10 (6.7%)
Irregularly	29 (19.3%)	19 (12.7%)
Only when in pain	66 (44.0%)	66 (44.0%)
Other	17 (11.3%)	30 (20.0%)

Note. All variables are reported as number and %
The significance test was done at a 0.05 level
[a]Monto Carlo was utilized
[c] Test of Fisher exact was utilized
Significant findings are in bold

The descriptive statistics for our sample's lactobacilli level, MS count, buffering capacity, plaque index, and saliva flow frequency are provided in **Table 4**.

Table 4. Plaque index, Lactobacilli, MS count, Buffer capacity, and Saliva secretion rate descriptive statistics.

	Mean (SD)	**Median**
Rate of saliva secretion	1.48 (1.04)	1.30
Index of plaque	4.00 (3.10)	4.00
	%	
Capacity of buffer Yellow (low) / green (medium) / blue (high)	9%/ 35.7%/ 37%	
Count of MS High / medium/ low/ very low	27%/ 13%/ 22%/ 38%/	
Lactobacilli High / medium/ low/ very low	13.3%/ 26.3%/ 25.7%/ 34.7%	

Note. All variables are reported as mean, standard deviation, and median.
Capacity of Buffer (high (1)-medium (2)- low (3)).
Lactobacilli and MS count (very low (1)- low (2)- medium (3)- high (4))

Die hohe Pufferkapazität trat bei Jungen häufiger auf als bei Mädchen (48 % gegenüber 27 %, jeweils; p=0.001), whereas the median was the same for both boys and girls (2, which is the medium). Moreover, Boys were more likely than females to have a high MS count (35% vs. 19%, respectively; $p \leq 0.001$)). The index of plaque was higher in boys compared to girls (4.69 [3.49] vs. 3.31 [2.48] and 2.55 [1.21] vs. 2.03 [1.19]), with considerable disparities (p<0.001 and p<0.001, respectively). Furthermore, boys had higher median values for plaque index and MS count compared to girls (5 vs. 3 and 2 vs. 1.5, respectively) **(Table 5)**.

Table 5. Erosion score, Plaque index, Lactobacilli, MS count, Buffer capacity, and saliva secretion rate based on gender.

	Mean (SD)	**Median**	**P-value**
	Rate of saliva secretion		
Boys	1.59 (0.85)	1.50	0.073[a]
Girls	1.37 (1.20)	1.00	
	Index of plaque		
Boys	4.69 (3.49)	5.00	<0.001[a]
Girls	3.31 (2.48)	3.00	
	%	**Median**	**P-value**
	Capacity of buffer		
Boys Yellow (low) / green (medium) / blue (high)	8%/ 44%/ 48%	2.00	0.001[b]
Girls Yellow (low) / green (medium) / blue (high)	10%/ 63%/ 27%	2.00	
	Count of MS		

Boys High / medium/ low/ very low	35%/ 11%/ 28%/ 26%	2.00	<0.001[b]
Girls High / medium/ low/ very low	19%/ 15%/ 16%/ 50%	1.50	
Lactobacilli			
Boys High / medium/ low/ very low	35%/ 11%/ 28%/ 26%	2.00	0.129[b]
Girls High / medium/ low/ very low	17%/ 21%/ 27%/ 35%	2.00	

Note. All variables are reported as mean, standard deviation, and median.
The significance test was done at a 0.05 level
[a] Student T-test was utilized
[b] Test of chi-square was utilized
Significant findings are in bold
Capacity of buffer (high (1)-medium (2)- low (3))
lactobacilli and MS count (very low (1)- low (2)- medium (3)- high (4))

Those who maintained a regular tooth-brushing routine exhibited a greater saliva secretion rate (1.52 [1.09] compared to 1.18 [0.56]), and this variation was statistically remarkable (p=0.004). Die anderen Indizes wiesen jedoch darauf hin, dass es keine wesentlichen Unterschiede in Bezug auf die Häufigkeit des Zähneputzens gab **(Table 6)**.

Table 6. Erosion score, Plaque index, Lactobacilli, MS count, Buffer capacity, and saliva secretion rate based on regular toothbrushing.

	Mean (SD)	**Median**	**P-value**
Rate of saliva secretion			
Regular toothbrushing	1.52 (1.09)	1.33	0.004[a]
Nonregular toothbrushing	1.18 (0.56)	1.00	
Index of plaque			
Regular tooth brushing	3.90 (3.00)	4.00	0.137[a]
Non-regular toothbrushing	4.72 (3.76)	4.50	
	%	**Median**	**P-value**
Capacity of buffer			
Regular toothbrushing Yellow (low) / green (medium) / blue (high)	9%/ 53%/ 37%	2.00	0.743[b]
Nonregular toothbrushing Yellow (low) / green (medium) / blue (high)	6%/ 56%/ 39%	2.00	
MS count			
Regular toothbrushing High / medium/ low/ very low	27%/ 13%/ 22%/ 38%	2.00	0.945[b]
Nonregular toothbrushing High / medium/ low/ very low	31%/ 14%/ 19%/ 36%	2.00	
Lactobacilli			
Regular toothbrushing High / medium/ low/ very low	13%/ 26%/ 26%/ 35%	2.00	0.920[b]
Nonregular toothbrushing High / medium/ low/ very low	14%/ 31%/ 22%/ 33%	2.00	

Note. All variables are reported as mean, standard deviation, and median.
The significance test was done at a 0.05 level
[a] Student T-test was utilized
[b] Test of chi-square was utilized
Significant findings are in bold
Capacity of buffer (high (1)-medium (2)- low (3))
Lactobacilli and MS count (very low (1)- low (2)- medium (3)- high (4))

The prevalence of high lactobacilli was greater among individuals by employing no fluoride containing

toothpaste compared in comparison to who use fluoridated toothpaste (40% vs. 12%, respectively), with a statistically significant difference (p = 0.040). Additionally, the lactobacilli median was greater for users of non-fluoridated toothpaste than for those employong fluoride containing toothpaste (3 vs. 2). The other statistics, however, indicated that the differences in relation to the use of fluoridated toothpaste were not significant **(Table 7)**.

Table 7. Erosion score, Plaque index, Lactobacilli, MS count, Buffer capacity, and saliva secretion rate based on using fluoridated toothpaste.

	Mean (SD)	**Median**	**P-value**
Rate of saliva secretion			
Using fluoridated toothpaste	1.45 (1.18)	1.00	0.540[a]
Using non-fluoridated toothpaste	1.77 (0.37)	1.80	
Index of plaque			
Using fluoridated toothpaste	3.57 (3.02)	3.00	0.082[a]
Using non-fluoridated toothpaste	6.00 (4.18)	5.00	
	%	**Median**	**P-value**
Capacity of buffer			
Using fluoridated toothpaste Yellow (low) / green (medium) / blue (high)	13%/ 55%/ 32%	2.00	0.220[b]
Using non-fluoridated toothpaste Yellow (low) / green (medium) / blue (high)	40%/ 40%/ 20%	2.00	
Count of MS			
Using fluoridated toothpaste High / medium/ low/ very low	26%/ 10%/ 20%/ 43%	2.00	0.684[b]
Using non-fluoridated toothpaste High / medium/ low/ very low	20%/ 0%/ 40%/ 40%	2.00	
Lactobacilli			
Using fluoridated toothpaste High / medium/ low/ very low	12%/ 22%/ 30%/ 35%	2.00	0.040[b]
Using non-fluoridated toothpaste High / medium/ low/ very low	40%/ 40%/ 20%/ 0%	3.00	

Note. All variables are reported as mean, standard deviation, and median.
The significance test was done at a 0.05 level
[a] Student T-test was utilized
[b] Test of chi-square was utilized
Significant findings are in bold
Capacity of buffer (high (1)-medium (2)- low (3))
Lactobacilli and MS count (very low (1)- low (2)- medium (3)- high (4))

Individuals that did not mention using mouthwash regularly had higher saliva secretion rates than as compared to individuals that used (1.62 [1.21] vs. 1.32 [0.8]), with a statistically significant difference (p=0.011). Nevertheless, other indices proved that there were no significant differences in regular mouthwash use.

Dental caries harms teeth, leading to cavities, abscesses, and the possibility of losing teeth [16]. Oral health problems mainly impact those who come from lower socioeconomic backgrounds [17]. This study, which was comparative and cross-sectional in design, involved 300 adolescents aged 15 to 18 years at a dental clinic. We aimed to evaluate the risk factors for dental caries in connection with oral hygiene practices. Plaque indices, MS numbers, and buffering capacity were significantly correlated with gender. On the other hand, salivary secretion rates were linked to regular mouthwash and dental brushing. The use of fluoride toothpaste was correlated with the levels of lactobacilli. As far as gender is concerned,

we identified significant disparities among males andf females in relation to brushing tow time every day, the use of fluoride containg toothpaste, frequent mouthwash usage, and teeth clenching; these were all more common among girls. On the other hand, boys exhibited higher rates of biting on hard objects and clenching. Therefore, it can be concluded that girls demonstrate a greater commitment to overall oral health, possibly because of concerns regarding the look

of their smile. This observation aligns with a study that found girls acquire superior oral health practices and dental knowledge compared to males [18]. Furthermore, a different study found that the prevalence of dental caries was higher among men [19]. In this study, boys were found to have a higher prevalence of MS counts and high buffering capacity compared to girls. In addition, boys had a higher average plaque index than girls. The results corroborate those of an earlier investigation that found a connection between dental caries and gender [20].

The saliva secretion rate was found to be consideable greater in individuals who brushed their teeth regularly, according to our findings. Scanty brushing was identified as a major contribiutor for tooth cavity due to its contribution to rapid plaque accumulation [21]. Additionally, the present research found that the amount of lactobacilli was significantly greater among individuals who used toothpaste lacking fluoride additives. Our results align with those from a study conducted by Stecksén-Blicks & Gustafsson, which found that fluoride containing-toothpaste use was linked with reductions in oral cavities and mean lactobacilli levels [22]. Fluoride intake that is not up to par was considered another risk factor for tooth caries, since fluoride aids in cavity prevention and can even remedy initial tooth damage [23]. Plaque indices, MS numbers, and buffering capacity were significantly correlated with gender. On the other hand, salivary secretion rates were linked to regular mouthwash and dental brushing [24].

This research confirmed risk factors influencing oral cavities, involving sex and oral hygiene initiatives such as frequent teeth cleaning, using fluoride-containing toothpaste, and using mouthwash regularly. Thus, we strongly advise the establishment of oral hygiene health education initiatives, particularly targeting young children and teenagers.

This study has limitations, including the introduction of bias through self-report questionnaires and the absence of clinical dental examinations.

Conclusion

Girls exhibited more positive attitudes toward oral hygiene. Gender was linked to buffering capacity, MS counts, and plaque indices. Higher salivary secretion rates were linked to regular tooth brushing and mouthwash use. Given that the use of toothpaste with fluoride affects lactobacilli levels, we strongly recommend introducing additional oral hygiene health education initiatives aimed at educating adolescents on the value of at-home dental careNot much research has been done on the connection between dental caries and oral hygiene habits among Saudi Arabian teenagers between the ages of 15 and 18. Therefore, more study is needed to investigate oral health issues using in-depth interviews and clinical examinations.

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