

DENTAL CARIES AND ITS ASSOCIATION WITH DIET AMONG FEMALE PRIMARY SCHOOL CHILDREN IN RIYADH CITY

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ABSTRACT

The purpose of the present study was to determine dental caries experience of 8-10-year-old schoolgirls in Riyadh city, and to assess the relationship between dental caries & dietary practices. This cross sectional study involved 522 third and fourth grade primary school girls attending 24 primary schools (12 public and 12 private) in Riyadh city. The selected girls were examined at schools by two calibrated examiners who were trained & calibrated prior to the study using the WHO criteria for the diagnosis of dental caries. Each selected schoolgirl was interviewed after the parents completed a 3-day dietary diary. Of the 522 schoolgirls examined, four hundred and fifty girls (86.2%) had dental caries, and only 72 (13.8%) were caries free. The mean dmft was 4.96 (± 3.03) for the primary teeth, with more than half (51.7%) of the girls with caries had 5-8 decayed primary teeth. Only one-third of the carious primary teeth had restorations. The mean DMFT of the permanent molars was 2.44 (± 1.69). More than three-quarter (76.4%) of schoolgirls had dental caries in one or more of the permanent molars. Almost two thirds (59.2%) of the girls with caries had 3 to 4 of the permanent molars affected by caries. Out of the 399 schoolgirls who had one or more decayed permanent molar, only 41 (10.3%) had a restoration in one or more of their permanent molars. The 3-day dietary diary showed that the majority of schoolgirls in this study consume sugar on moderate to high frequency basis. More than one-fourth (27.4%) of the sample brushed their teeth daily. About one-third of schoolgirls (N=161; 30.8%) did not visit a dentist at all. In conclusion; the dental caries prevalence was high in schoolgirls aged 8-10 years in Riyadh city. The dental caries was found to be associated with frequency of sugar consumption.

Key words: Dental caries, prevalence, dietary diary, schoolgirls

INTRODUCTION

The early work of Kite et al (1950)² in rats demonstrated that the presence of food in the mouth is the cause of dental caries.¹ Since then, enormous amount of experimental research has been published linking fermentable carbohydrate (sugar) with dental caries. Worldwide, dental caries prevalence has increased in many countries especially in children.³ Several researchers have reported a high prevalence of dental caries among primary school children in Saudi Arabia,⁴⁻⁹ and since last decade, the prevalence has risen from 68%⁴ to 96%.⁹ Akpata et al¹⁰ in 1992, found a significant relationship between decayed and filled surfaces of teeth and the frequency of sugar consumption in 12-13-year-old Saudi children. Since then, there has been limited information regarding dietary intake and caries experience of school children in Riyadh city. With the rapid economic development in the Kingdom

of Saudi Arabia during past few decades and changes in life style of citizens, it is worthwhile to study the current status of caries experience in school children in relation to their dietary practices.

The aim of this study therefore, was to determine the prevalence of dental caries in 8-10-year-old primary school girls in Riyadh city, and to correlate their dental caries experience with dietary practices

METHODOLOGY

Initially five hundred and ninety primary school girls aged 8-10 years were randomly selected for the study. A total of 24 primary schools (12 public and 12 private) were randomly selected from a list of girls' primary schools provided by the Saudi Ministry of Training and Education. The selected sample represented the five regions of the Riyadh city: Eastern, Western Northern, Southern, and Central. Efforts

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were made to include all socioeconomic strata of Riyadh city by selecting 3-5 schools from each region. At the time of study, each school had around 80-100 school girls attending the third and fourth grade, the headmistresses randomly selected the girls for the dental examination.

Following approval of the research protocol by the Ethics Committee of King Saud University College of Dentistry Research Center and the Ministry of Training and Education, letters were sent to the selected schools about the study. Parental consent of the selected children was also obtained prior to the study.

Dental examination of the selected students was conducted in schools by two calibrated examiners who were trained and calibrated prior to the study. The dental examination for dental caries was carried out on pre-adjusted semi-reclined chair under portable source of light (halogen 40 W Lamp) utilizing the WHO criteria for the diagnosis of dental caries.³² The dental caries were diagnosed predominantly by visual method augmented by the gentle use of a probe to remove dental plaque. The probe was also utilized to confirm presence or absence of proximal caries surfaces especially where a definite break in enamel was not detected visually. DMFT/dmft (decayed, missing and filled) scores were used to calculate caries experience.

Prior to the dental examination, parents of the selected students completed at home a 3-day dietary diary for their child. Written instructions were attached to the diary aiming to encourage parents to record for their daughters' everything eaten or drunk over a 3-day period (including a weekend day), together with the time of eating. The forms were collected in the classroom and a dietary interview carried out to facilitate the clarifications of uncertainties in the dietary diary. In addition, each student was asked ten questions; questions 1-7 were related to frequency of taking common snack food or drinks (confectionery, sticky sweets, carbonated soft drinks, flavored milk with chocolate and strawberry, potato chips, citric fruits, savory food like cheese sandwiches). The questions #8 and #9 were related to frequency of visiting a dentist and tooth brushing. The question #10 was related to what the students consumed (foods or drinks) daily specifically at school. From the dietary diary data obtained, the schoolgirls were categorized into three categories depending upon their frequency of sugar consumption.¹⁰

- Low sugar consumption; frequency not more than once a day.
- Medium sugar consumption; frequency 2-3 times a day.
- High-sugar consumption; frequency 4-5 times or more a day.

Data Analysis

All data were entered into an SPSS program (Version #14). Both descriptive and analytic statistics were used to analyze the data. Inter and intra-examiner reproducibility of caries diagnosis was determined using Cohen's Kappa statistics. The association between age and sugar consumption, and caries experience were tested using Chi square test and Kruskal-Wallis test with consideration of p-value of equal or less than 0.05 to be statistically significant.

RESULTS

Inter-examiner reliability for the presence or absence of dental caries was 0.85; and was 0.97 for both examiners' intra-examiner reproducibility. Out of 590 schoolgirls who were selected, only 522 were included in the study. The sixty eight girls were excluded for the following reasons: 56 girls failed to bring their parents' consent and dietary diary forms from home, the other 12 girls brought incomplete dietary forms.

The selections of girls from different regions of Riyadh were as follows: one hundred (19.2%) each from East and West regions; 50 (9.6%) from the North; 149 (28.5%) from the South and 123 (23.6%) from the Central region, in accordance with the city population's distribution.

Dental Caries

Three hundred and seventy six (72%) girls were from public elementary schools and 146 (28%) from private schools with 343 (91.2%) girls out of 376 from public schools experiencing dental caries, and 132 (90.4%) out of 146 from private schools had dental caries. There was no significant difference ($p > 0.05$) in caries experience between schoolgirls from public and private schools.

The mean (SD) age of the sample was 9.3 (0.8) years with age ranging from 8-10 years. Of the 522 schoolgirls examined, four hundred and fifty girls (86.2%) had dental caries, and only 72 (13.8%) of the schoolgirls were caries free (Table 1). The mean dmft score of the sample was 4.96 (± 3.03), with decayed "d" component of 3.85 (± 2.70), missing "m" component of 0.45 (± 0.96) and

filled “F” component of 0.66 (± 1.41) [Table 2]. The decayed teeth formed the major component of dmft scores in all age groups.

Table 3 shows frequency of dental caries and restorations in the primary teeth in relation to age. More than half (51.7%) of the sample with dental caries had 5-8 decayed primary teeth. Nearly one-third (28.7%) of these girls had restorations done.

More than three-quarters (76.4%) of the sample had dental caries in one or more of their permanent molars with mean score of decayed permanent molars slightly higher in ten year old girls [2.73 (± 1.63)] as compared to 8 years old girls [2.45 (± 1.44)] [Tables 4 & 5].

The mean DMFT score of the sample was 2.44 (± 1.69) with decayed “D” component of 2.23 (± 1.63), missing “M” component of 0.05 (± 0.27) & filled “F” component of 0.16 (± 0.62). The mean decayed compo-

nent permanent also formed the major component of DMFT [Table 5].

Table 6 shows frequency of decayed and restored permanent first molars in relation to age; 59.2% of the girls with dental caries had 3 or 4 permanent molars affected by caries. Those who had decayed permanent molars, only 10.3% had a restoration done in one or more of their permanent molars. About three out of every four (75.6%) of the schoolgirls with restored permanent molars were nine year old (Table 6).

Oral Hygiene and Dietary Practices

Oral hygiene practices in relation to mean dmft/DMFT scores are presented in Table 7; the higher the frequency of tooth brushing the lower was the mean of dmft and DMFT scores. Cross-tabulation of dmft/DMFT scores with oral hygiene practices showed significant

TABLE 1: CARIES PREVALENCE AND SEVERITY FOR PRIMARY TEETH IN RELATION TO AGE

Age(yrs)	Schoolgirls		Schoolgirls Caries free		School girls With caries		Mean dmft (SD)
	No.	%	No.	%	No.	%	
8	110	(21)	12	(10.9)	98	(89.1)	5.24 (2.94)
9	371	(71.1)	52	(14)	319	(86)	4.87 (3.04)
10	41	(7.9)	8	(19.5)	33	(80.5)	5.05 (3.16)
Total	522	(100)	72	(13.8)	450	(86.2)	4.96 (3.03)

TABLE 2: MEAN DMFT SCORES AND ITS COMPONENTS IN RELATION TO AGE

Age (yrs)	Decayed (SD)	Missing (SD)	Filled (SD)	Mean dmft (SD)
8	3.95 (2.54)	0.39 (0.79)	0.89 (1.62)	5.24 (2.94)
9	3.84 (2.68)	0.43 (0.92)	0.61 (1.35)	4.87 (3.04)
10	3.73 (3.30)	0.83 (1.51)	0.49 (1.29)	5.05 (3.16)
Total	3.85 (2.70)	0.45 (0.96)	0.66 (1.41)	4.96 (3.03)

TABLE 3: FREQUENCY OF DECAYED AND RESTORED PRIMARY TEETH IN RELATION TO AGE

Age (yrs)		No. of decayed teeth			Total decayed	No. of restored teeth			Total restored	Total
		1-4	5-8	>8		1-4	5-8	>8		
8	No.	27	34	4	65	28	5	0	33	98
	%	41.5%	52.3%	6.2%	100%	84.8%	15.2%	0%	100%	
		27.5%	34.7 %	4.1%	66.3%	28.6%	5.1%	0%	33.7%	100%
9	No.	97	121	12	230	77	11	1	89	319
	%	42.2%	52.6%	5.2%	100%	86.5%	12.4%	1.1%	100%	
		30.4%	37.9%	3.8%	72.1%	24.1%	3.5%	0.3%	27.9%	100%
10	No.	12	11	3	26	6	1	0	7	33
	%	46.2%	42.3%	11.5%	100%	85.7%	14.3%	0%	100%	
		36.4%	33.3%	9.1%	78.8%	18.2%	3%	0%	21.2%	100%
Total	No.	136	166	19	321	111	17	1	129	450
	%	42.4%	51.7%	5.9%	100%	86%	13.2%	0.8%	100%	
		30.2%	36.9%	4.2%	71.3%	24.7%	3.8%	0.2%	28.7%	100%

TABLE 4: CARIES PREVALENCE AND SEVERITY FOR PERMANENT TEETH IN RELATION TO AGE

Mean DMFT (SD)	Girls with caries %	Girls with caries No.	Girls caries free %	Girls caries free No.	Girls No.	Age
2.67 (1.49)	86.4	95	13.6	15	110	8
2.33 (1.71)	73.3	272	26.7	99	371	9
2.90 (2.90)	78	32	22	9	41	10
2.44 (1.69)	76.4	399	23.6	123	522	Total

TABLE 5: MEAN DMFT SCORES & ITS COMPONENTS IN RELATION TO AGE

Mean DMFT (SD)	Filled (SD)	Missing (SD)	Decayed (SD)	Age
2.67 (1.49)	0.11(0.41)	0.11(0.41)	2.45 (1.44)	8
2.33 (1.71)	0.17(0.77)	0.03(0.23)	2.12 (1.62)	9
2.90 (2.90)	0.17(0.77)	0.00	2.73 (2.02)	10
2.44 (1.69)	0.16(0.62)	0.05(0.27)	2.23 (1.63)	Total

TABLE 6: FREQUENCY OF DECAYED AND RESTORED PERMANENT MOLARS IN RELATION TO AGE

Age (yrs)	No. of decayed permanent molars				Total decayed	No. of restored permanent molars				Total restored	Total
	1	2	3	4		1	2	3	4		
8	No. 11	20	18	38	87	4	4	0	0	8	95
	% 12.6%	23%	20.7%	43.7%	100%	50%	50%	0%	0%	100%	
		11.6%	21.1%	18.9%	40%	916%	4.2%	4.2%	0%	0%	8.4%
9	No. 24	59	51	107	241	15	9	4	3	31	272
	% 9.9%	24.5%	21.2%	44.4%	100%	48.4%	29%	12.9%	9.7%	100%	
		8.8%	21.7%	18.8%	39.3%	88.6%	5.5%	3.3%	1.5%	1.1%	11.4%
10	No. 5	3	2	20	30	0	0%	1	1	2	32
	% 16.7%	10%	6.7%	66.6%	100%	0%		50%	50%	100%	
		15.6%	9.4%	6.3%	62.5%	93.8%	0%	0%	3.1%	3.1%	6.2%
Total	No. 40	82	71	165	358	19	13	5	4	41	399
	% 11.2%	23%	19.8%	46%	100%	46.3%	31.7%	12.2%	9.8%	100%	
		10%	20.5%	17.8%	41.4%	89.7%	4.8%	3.3%	1.2%	1%	10.3%

TABLE 7: ORAL HYGIENE PRACTICES IN RELATION TO DMFT & DMFT SCORES

Oral Hygiene practices	School girls No.	%	dmft (SD)	DMFT (SD)
Not brushing	57	10.9	5.53(3.2)	2.70(1.4)
Once / month	104	19.9	5.98(2.4)	3.24(1.5)
Once / week	218	41.8	5.22(3.2)	2.53(1.6)
Once / day	86	16.5	3.66(2.6)	1.92(1.9)
Twice / day	57	10.9	3.51(2.9)	1.25(1.5)
Total	522	100	4.96(3.0)	2.45(1.7)

p=0.006

association (p=0.006). Six in ten (61.7%) schoolgirls were brushing either once a week or once a month only. In addition, one in every ten (10.9%) girls was not brushing her teeth at all.

About one third (30.8%) of the sample did not visit a dentist, about one-fourth (25.5%) visited a dentist

once an year and 43.7% of the sample reported irregular dental visits.

The 3-day dietary diary summarized in Table 8 shows the frequency of using seven common foods and drinks. Four hundred and seven (78%) school-girls ate confectionery once or more daily (high), 112

TABLE 8: FREQUENCY OF COMMONLY USED FOODS AND DRINKS

Food/Drink		High	Moderate	Low D None	Total
Confectionery	No. %	407(78%)	112(21.5%)	3(0.5%)	522(100%)
Sweet sticky food	No. %	345(61.1%)	128(24.5%)	49(9.4%)	522(100%)
Soft drinks	No. %	205(39.3%)	141(27%)	176(33.7%)	522(100%)
Flavored milk	No. %	360(69%)	96(18.4)	66(12.6%)	522(100%)
Crisps	No. %	172(33%)	179(34.3%)	171(32.7%)	522(100%)
Sweetened fresh juice	No. %	345(66.1%)	148(28.4%)	29(5.5%)	522(100%)
Cheese sandwich	No. %	454(87%)	53(10.2%)	15(2.8%)	522(100%)

TABLE 9: MEAN DMFT (SD) SCORES IN RELATION TO FREQUENCY OF SUGARY FOOD CONSUMPTION

Dietary diary	Frequency of Sugar Consumption		
	Low	Moderate	High
First day			
No. of schoolgirls	55	277	190
%	10.5%	53.1%	36.4%
Mean dmft (SD)	4.93 (2.87)	5.06 (3.19)	4.83 (2.83)
Second day			
No. of schoolgirls	49	293	180
%	9.4%	56.1%	34.5%
Mean dmft (SD)	5.94 (3.93)	4.69 (3.08)	5.14 (2.59)
Third day			
No. of schoolgirls	81	326	115
%	15.5%	62.5%	22%
Mean dmft (SD)	5.80 (3.64)	4.57 (2.95)	5.49 (2.59)

p<0.01

TABLE 10: MEAN DMFT (SD) SCORES IN RELATION TO FREQUENCY OF SUGARY FOOD CONSUMPTION

Dietary diary	Frequency of Sugar Consumption		
	Low	Moderate	High
First day			
No. of schoolgirls	55	277	190
%	10.5%	53.1%	36.4%
Mean dmft (SD)	2.89 (1.57)	2.45 (1.78)	2.32 (1.57)
Second day			
No. of schoolgirls	49	293	180
%	9.4%	56.1%	34.5%
Mean dmft (SD)	2.41 (1.91)	2.35 (1.67)	2.61 (1.66)
Third day			
No. of schoolgirls	81	326	115
%	15.5%	62.5%	22%
Mean dmft (SD)	2.53 (1.64)	2.43 (1.9)	2.45 (1.74)

p<0.05

(21.5%) girls ate once or more weekly (moderate) and 3 (0.5%) reported eating confectionery once a month (low). Regarding sticky foods and soft drinks; 345 (61.1%) and 205 (36.6%) girls were in high consumption categories respectively. Flavored milk (sweetened) and cheese sandwiches (87%) were also highly consumed.

The majority (90.6%) of schoolgirls in this study consumed sugary foods in moderate to high frequency (Tables 9 & 10). There was a strong association between the frequency of sugar consumption and mean dmft scores (p<0.009).

DISCUSSION

The current study assessed dental caries in 8-10-year-old primary school girls in Riyadh city, and determined association of the dental caries experience with dietary practices. The mean dmft score in the study sample was close to a study by Al-Amoudi et al¹², who reported a mean dmft score of 4.23 in 6-9 years old children in Jeddah, Saudi Arabia. Although the mean dmft score in the current study was lower than that reported previously [Wyne et al¹⁴ 2001 (mean dmft=6.5, Al Wazzan¹⁵ 2004 (mean dmft =7.3), Al Malik & Rehmini¹⁹ 2006 (mean dmft =8.1) and Wyne¹⁶ 2008 (mean dmft=6.1)], it still is very high when compared with the mean dmft scores from the developed countries (dmft below 2.0 in Denmark, Finland, Italy, Netherlands, Norway and England).¹⁷

The present study showed a dental caries prevalence of 86.2%; this high prevalence is in accordance with findings of previous studies in Saudi Arabia^{5, 8, 13, 14, 18} and in UAE¹⁹ which can be attributed to the cultural similarities and the direct effect of modernization with high consumption of sugary foods.¹⁹

The decayed component was the major part of the dmft, which indicates a high percentage of untreated caries and a major need for dental treatment. The above finding is in agreement with other previous Saudi studies.^{4, 9, 10, 18} This study showed that very few of the school girls with decayed permanent molars had restorations done. Such a low level of dental care can be attributed to inadequate dental awareness among parents as they tend to wait until the exfoliation of primary teeth to realize the presence of the permanent teeth in their children's mouths. The other possible reason is the relatively low number of dentists to serve increasing population in Saudi Arabia.⁹

In this study, less than one-third of the school girls with dental caries had restorations in their primary teeth. This can be attributed to the over stretched governmental dental services and that most of the pediatric dental services are devoted to emergency care only.²⁰

The mean DMFT in the sample was 2.44(±1.69) and more than three-quarters of the sample had dental caries in the first permanent molars. Taking into consideration that the prevalence of dental caries increases with age,²¹ dental caries is expected to reach a higher level as was reported (prevalence 94% and DMFT of 5.9) by Al-Sadhan²² in 12-14 year old Saudi children. It is much higher than the WHO target for

year 2010 (mean DMFT in 12-year-olds should not exceed 1.0).^{23, 24}

One of the predisposing factor for caries attack is the frequent sugar consumption.³³ In current study, the moderate to high frequency of sugary food intake was found to be associated with high caries experience, which is in accordance with reports by Akpata et al¹⁰ and Wyne et al.²⁵

The 3-day dietary diary is helpful in assessing the food or drinks consumed by children and its effect on oral and dental health.² Therefore, it is recommended to include the 3-day-dietary diary in all dental records for pediatric dental patients. Dentists need to know how to analyze the 3-day dietary diary and to give proper counseling to the parents.²⁶

The interview with the schoolgirls about the dietary diary obtained an excellent response and clarified the information obtained through the 3-day dietary diary. More than three-quarters of the schoolgirls consumed confectionery four or more times per day which could explain the high prevalence of dental caries in both primary and permanent teeth of this sample.¹¹ Such a high consumption of confectionery (more than 90% of the sample) regularly is higher than what had been reported earlier (Wyne et al 1995).²⁵

More than ninety percent of the girls consumed carbonated drinks which is higher than the findings of Grimm et.al²⁷ in USA in 8-13-year-old children. The schoolgirls consumed flavored (sweetened) milk more than the plain milk, which could be attributed to its easy availability both at home and school.²⁸

The result of this study showed a proportional relation between the mean DMFT score and the frequency of oral hygiene practices, schoolgirls who brushed regularly (twice/day) had the lowest mean DFT score. Whereas schoolgirls who neglected their oral hygiene had the highest mean DMFT score; which is consistent with the findings of Dummer et al.²⁹

Results of the present study showed that only few of schoolgirls visit a dentist regularly, mostly they do not visit a dentist at all or visit irregularly. This is in agreement with the report of Owusu et al³⁰ who showed almost the same dental attendance patterns of irregular visits to the dentist, and mostly for emergency in a Saudi population. Such a negative attitude towards visiting a dentist leads to inability to avail sound advice on preventive oral health practices and counseling, high prevalence of dental caries and delayed recognition and management of carious teeth.

According to WHO information series, a healthy school environment supports the adoption of healthy lifestyle. Canteens and vending machines providing healthy food and drinks lead to healthy life style and oral health throughout life.³¹ Effort should be made by the officials of the Ministry of Training and Education to maximize the control on sales of sweets and confectionery in schools, as it will promote healthy school environment which will eventually have a strong positive impact on the school children's oral health.

CONCLUSIONS

- The dental caries prevalence was high (86.2%) in schoolgirls aged 8-10 years living in Riyadh city.
- The dental caries was found to be associated with frequency of sugary food consumption.
- The dental caries was also found to be related with the oral hygiene practices.

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