

Risk factors for dental erosion in 5–6 year old and 12–14 year old boys in Saudi Arabia

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Abstract – Material and methods: Dental examinations were carried out on 354 boys aged 5–6 years, and 862 boys aged 12–14 years, attending 40 schools in Riyadh. The prevalence of dental erosion was assessed using diagnostic criteria similar to those employed in the 1993 UK National Survey of Child Dental Health.

Results: Pronounced dental erosion (into dentine or dentine and pulp) was observed in 34% of 5–6 year olds and 26% of 12–14 year olds. Information on food and drink consumed and dietary habits was obtained by means of a questionnaire. Parents reported that 65% of 5–6 year old boys took a drink to bed. Water was the commonest drink consumed (37%) followed by carbonated soft drinks (21%). One third of parents reported that their son had something to eat in bed or during the night and 60% of this was sweet food or confectionery. Seventy per cent of 12–14 year old boys reported consuming drinks at night; these were mainly water (30%), carbonated soft drinks (27%) and tea or coffee, with sugar (18%). Forty-six per cent of the 12–14 year olds reported that they ate in bed at least once a week and 54% of this was sweet food or confectionery. When the dental examination and questionnaire results were correlated, a statistically significant relationship was found between the number of primary maxillary incisors with pronounced erosion of their palatal surfaces and the consumption of carbonated soft drinks at night ($P=0.015$). A significant relationship was also found between the number of permanent maxillary incisors with pronounced erosion on their palatal surfaces and the frequency of drinks at night ($P=0.020$), as well as the duration of drinks retained in the mouth ($P=0.038$). **Conclusion:** It is concluded that dental erosion is more common in the primary and permanent dentitions of Saudi Arabian boys compared with results for similar age groups from the United Kingdom.

Key words: Dental Erosion; risk factors; Saudi Arabia; Prevalence; boys (children)

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Dental erosion can be defined as the progressive loss of hard dental tissues by a chemical process not involving bacterial action (1, 2). Such tissue loss is insidious in nature and may not be apparent until the patient reports symptoms of sensitivity or the fracture of thinned incisal edges (3). Millward and co-workers (4) considered tooth wear in young children to be dental erosion except when it occurred on the incisal edges of anterior teeth and occlusal surfaces of posterior teeth. Although tooth surface abrasion in children is uncommon, attrition of incisal edges in the primary dentition is very common at the time of

exfoliation, and it is extremely difficult to separate erosion from attrition in the late stages of the primary dentition (4, 5).

Dental erosion was included in UK's 1993 National Survey of Child Dental Health (6). A total of 17061 children aged 5–15 years were examined using a modification of the Smith & Knight index (7). The survey results showed 52% of five and six-year-old children were found to have one or more eroded primary incisors and in 24% of children of these ages, erosion had progressed into dentine or pulp. In the permanent dentition, 25% of the children over eleven years of age were found to have

dental erosion on the palatal surfaces of maxillary incisors and approximately 12% of children aged 12–15 years had erosion on the buccal surfaces. In only 2% of children aged over 13 years had the erosion progressed into dentine or pulp.

The UK National Diet and Nutrition Survey (8) of children aged $1\frac{1}{2}$ to $4\frac{1}{2}$ years was conducted using the same diagnostic criteria for dental erosion as the 1993 National Survey of Child Dental Health. The results showed 19% of children had erosion affecting the palatal surfaces and 10% of children had erosion of the buccal surfaces of their maxillary incisors. Erosion involved dentine or the pulp palatally in 8% and buccally in 2%. The survey showed a weak relationship between the frequent consumption of sweetened drinks and carbonated soft drinks and dental erosion, with the timing of consumption (bedtime) of these drinks more closely associated with the frequency of dental erosion.

Sales of soft drinks in the temperate climate of the UK have increased dramatically over the past 40 years to 178 litres per capita in 1996 with adolescents accounting for up to 65% of these purchases (9). Since the consumption of soft drinks has been widely implicated as a major factor in the aetiology of dental erosion (10), in the hotter climates of developing countries there is increasing concern for the dental health of consumers since daily fluid consumption is high and soft drinks, particularly carbonated soft drinks, are increasingly available at reasonable cost.

Saudi Arabia is fast developing country with a population of approximately 19 million (11). The nation's economy increased almost 40 fold from 1960 to the late 1980s (12). Changes to the diet have included substantial increases in the consumption of carbonated beverages and acidic drinks (13). A high prevalence of tooth wear among Saudi Arabian adults has been reported (14, 15), but no epidemiological study of dental erosion in Saudi Arabian children has so far been carried out.

Objectives

- To carry out an epidemiological study to determine the prevalence of dental erosion in the primary dentition of 5–6 year old boys and the permanent dentition of 12–14 year old boys in Riyadh City.
- By means of a questionnaire, to obtain information on dietary habits in 5–6 year old and 12–14 year old boys.
- To investigate whether there are any specific risk factors for dental erosion that can be identified in the Saudi Arabian population, by correlating the results of the clinical examination and questionnaire data.

Material and methods

Riyadh City is a very good example of a Saudi Arabian urban area with a complex structure of population of different origins. As such it was an appropriate site to study the prevalence, aetiology, predisposing factors and treatment needs for dental erosion in children in Saudi Arabia. The system of schooling in the Kingdom of Saudi Arabia provides females with their own schools and entire female staff. During school hours males are not allowed to enter the female schools. Due to the school rules in Saudi Arabia, which separate genders in all levels of education, boys only were included in this school-based study.

At the time of the study the total number of schoolboys aged 5–15 years in Riyadh City was 148 625. These boys were studying at 341 elementary schools and 146 intermediate schools. A table of random allocation (16) was used to produce a list of 40 schools. It was planned that approximately 30 boys would be examined in each school, giving a predicted sample of 1200 boys.

Clinical method

Preparation for the study took place in the UK from October 1996 until December 1996. During this stage the study protocol was produced, the first author was trained and the examination form and questionnaire were designed. In Saudi Arabia the official permissions were sought and materials needed for the study implementation were prepared in January 1997. The fieldwork for the study was carried out from February 1997 to July 1997.

Children were examined in a room usually adjacent to the classroom, with the student lying on a semi-reclined preadjusted mattress chair with a headrest. A portable source of light (halogen 40w lamp) was used for dental examination together with individually wrapped and sterilised mouth mirrors and gloves. Once cotton rolls had been used to dry the tooth surfaces, dental mirrors were used to visually inspect the teeth and dental erosion was recorded, for the labial and palatal surfaces of all primary maxillary incisors and the occlusal surfaces of first primary molars in 5–6 year

olds. In the 12–14 year olds, dental erosion was recorded for the labial and palatal surfaces of all permanent maxillary incisors and the occlusal surfaces of first permanent molars. These surfaces were examined for loss of surface enamel characteristics, and/or exposure of dentine or pulp without involving the incisal edge, and the depth of loss of tooth tissue for each surface was examined according to the following criteria:

Code 0 Normal

Code 1 Enamel only -loss of surface characterisation

Code 2 Enamel and dentine—loss of enamel, exposing dentine

Code 3 Enamel, dentine and pulp—loss of enamel and dentine resulting in pulpal exposure

Code 9 Assessment could not be made; when the tooth was either missing or had a large restoration.

All coded readings were dictated to a scribe during the dental examination for entry onto an examination sheet. All collected data were checked for accurate coding and correct data entry onto examination sheets.

The collected data were entered into computer data file and then verified by the Data Preparation Service at the University of Newcastle upon Tyne. Once the data had been entered into a data set an SPSS statistical programme (version 8.0) was used for statistical analysis.

Questionnaire

A questionnaire was designed, similar to that used in the National Diet and Nutrition Survey (8). It was then translated to Arabic and then processed, printed and copied according to the expected number of students to be examined in each of the selected schools.

At a preparatory visit, one week prior to the dental examination, each student's school record was reviewed to obtain basic information about each expected participant. For the 5–6 year old boys, questionnaires were distributed for completion by parents to determine their knowledge of oral hygiene and dietary habits of the child and the family. Boys aged 12–14 years of age were allowed to complete the questionnaires themselves in their classrooms under supervision. Completed questionnaires were collected on the day of the examination. In the case of non-returned questionnaires, that particular school was revisited after requesting further co-operation from

the school administration in questionnaire collection.

Reproducibility of diagnosis

To assess the reproducibility of the application of diagnostic criteria, approximately 10% of the subjects were re-examined. In each dental examination session the scribe selected 3–5 students for re-examination, without informing the examiner, and a further clinical examination was undertaken for the selected students at that same school visit. The scribe was instructed to allow a time difference (not very specific but usually near the end of the examination session) between the first and second examination.

Statistical analysis

To enable a correlation between the examination study and the questionnaire survey to be undertaken, the dental examination data file was merged with the questionnaire data file for each of the two age groups to produce two merged data files. Only those subjects who attended the examination session and returned a completed questionnaire were included in the correlation analysis. Pearson's correlation co-efficient and linear regression analysis were used to analyse the degree of association between the erosion variables and the erosion-related questionnaire variables. A linear regression analysis model was formulated with each statistically significant erosion-related questionnaire variable (independent) and a grouped erosion variable e.g. erosion of all palatal surfaces of incisors (dependent). Following this, the other clinical independent variables were adjusted to the model and tested for statistical significance.

Results

Clinical data—primary dentition

Three hundred and fifty four boys, aged 5–6 years, from 15 elementary schools in Riyadh, were examined. Of these boys, 95% exhibited evidence of dental erosion in one or more maxillary primary incisors or first primary molars, 34% exhibited pronounced dental erosion of clinical significance (erosion into dentine or erosion into pulp). (Table 1) The prevalence of dental erosion in one or more maxillary primary incisors was 82%; 16% exhibited pronounced dental erosion (erosion into dentine or erosion into pulp) in one or more maxillary primary incisors. The severity of erosion is given in Table 1. Overall, 1026 palatal surfaces of maxillary

Table 1. Prevalence and severity of dental erosion on the palatal and labial surfaces of primary maxillary incisors in 354 boys aged 5–6 years

	Right lateral (52) No. (%)	Right central (51) No. (%)	Left central (61) No. (%)	Left lateral (62) No. (%)	All primary maxillary incisors No. (%) ^a
Labial Surfaces					
No. of surfaces assessed	338	313	322	332	1305 ^b
No. of eroded surfaces	278 (82)	221 (71)	231 (72)	273 (82)	1003 (77)
Enamel only	276 (99)	217 (98)	227 (98)	271 (99)	991 (99)
Enamel and dentine	2 (1)	3 (2)	3 (2)	2 (1)	10 (1)
Enamel, dentine and pulp	0 (0)	1 (1)	1 (1)	0 (0)	2 (0)
Palatal Surfaces					
No. of surfaces assessed	339	315	323	332	1309 ^c
No. of eroded surfaces	282 (83)	228 (72)	238 (74)	278 (84)	1026 (78)
Enamel only	250 (88)	183 (80)	192 (81)	244 (88)	869 (85)
Enamel and dentine	27 (10)	35 (15)	36 (15)	29 (10)	127 (12)
Enamel, dentine and pulp	5 (2)	10 (5)	10 (4)	5 (2)	30 (3)
Occlusal Surfaces					
	Upper right (54) No. (%)	Upper left (64) No. (%)	Lower left (74) No. (%)	Lower right (84) No. (%)	All occlusal Surfaces No. (%) ^a
No. of surfaces assessed	295	307	258	258	1118 ^{d,e}
No. of eroded surfaces	289 (98)	302 (95)	254 (98)	254 (98)	1099 (98)
Enamel only	263 (91)	260 (86)	197 (78)	198 (78)	918 (84)
Enamel and dentine	25 (9)	41 (14)	57 (22)	56 (22)	179 (16)
Enamel, dentine and pulp	1 (0)	1 (0)	0 (0)	0 (0)	2 (0)

^a Percentages rounded to nearest whole number.^b 47 surfaces excluded because of exfoliation, extractions or large restorations.^c 43 surfaces excluded because of exfoliation, extraction or large restorations.^d 73 teeth excluded because of exfoliation or extraction.^e 225 teeth excluded because of large restorations or cariously involved surfaces.

primary incisors (78%) had evidence of erosion, mainly erosion of enamel. Palatal erosion into dentine occurred on 71 central incisors, and 56 lateral incisors with 20 central incisors and 10 lateral incisors showing erosion into the pulp. Of the 1305 labial surfaces assessed, 99% of the surfaces with erosion involved enamel only. Erosion into dentine was twice as prevalent in mandibular first primary molars (22%) compared with maxillary first primary molars (11%).

Clinical data—permanent dentition

Of the 862 boys aged 12–14 years examined, 95% exhibited some dental erosion in one or more maxillary permanent incisors or first permanent molars; with 26% exhibiting pronounced dental erosion (erosion into dentine or erosion into pulp).

Restricting the analysis only to the 3420 permanent maxillary incisors assessed, 72% had evidence

of some dental erosion; 12% were found to have pronounced dental erosion (erosion into dentine or erosion into pulp).

The prevalence of dental erosion on palatal surfaces of maxillary incisors was 66% (Table 2), with 317 palatal surfaces showing erosion into dentine (14% of affected teeth). Ten teeth (0.3% of the 3420 teeth assessed) had suffered erosion into the pulp.

The frequency of dental erosion on labial surfaces was evenly distributed among the maxillary permanent incisors, being found in 59% of the labial surfaces of 3420 teeth assessed. Erosion into dentine affected only 0.1% of the 3420 labial surfaces assessed; only two maxillary incisors were pulpally involved due to labial erosion. Virtually all occlusal surfaces of first permanent molars showed some evidence of erosion. Erosion into dentine occurred more frequently in mandibular molars, (18%) than maxillary molars, (6%) (Table 2).

Table 2 Prevalence and severity of dental erosion on the palatal and labial surfaces of permanent maxillary incisors in 862 boys aged 12–14 years

	right lateral (12) No. (%)	right central (11) No. (%)	left central (21) No. (%)	left lateral (22) No. (%)	all permanent maxillary incisors No. (%) ^a
Labial Surfaces					
No. of surfaces assessed	859	851	854	856	3420 ^b
No. of surfaces eroded	511 (59)	497 (58)	501 (59)	507 (59)	2016 (59)
Enamel only	505 (99)	491 (99)	494 (99)	500 (99)	1990 (99)
Enamel and dentine	6 (1)	6 (1)	6 (1)	6 (1)	24 (1)
Enamel, dentine and pulp	0 (0)	0 (0)	1 (0)	1 (0)	2 (0)
Palatal Surfaces					
No. of surfaces assessed	859	851	854	856	3420 ^b
No. of surfaces eroded	556 (65)	567 (67)	571 (67)	557 (65)	2251 (66)
Enamel only	482 (87)	482 (85)	482 (84)	478 (86)	1924 (85)
Enamel and dentine	71 (13)	82 (15)	86 (15)	78 (14)	317 (14)
Enamel, dentine and pulp	3 (0)	3 (0)	3 (0)	1 (0)	10 (0)
	Upper right (16) No. (%)	Upper left (26) No. (%)	Lower left (96) No. (%)	Lower right (46) No. (%)	All occlusal surfaces No. (%) ^a
Occlusal Surfaces					
No. of surfaces assessed	731	758	651	638	2778 ^{c,d}
No. of eroded surfaces	666 (91)	702 (93)	589 (90)	573 (90)	2530 (91)
Enamel only	623 (94)	659 (94)	484 (82)	471 (82)	2237 (88)
Enamel and dentine	43 (7)	43 (6)	105 (18)	102 (18)	293 (12)
Enamel, dentine and pulp	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

^a Percentages rounded to nearest whole number.^b 28 teeth excluded because of extraction, avulsion or large restoration.^c 150 teeth excluded because of extraction.^d 520 teeth excluded because of large restorations.

Reproducibility of diagnosis

Duplicate examinations were carried out on 49 5–6 year old boys. Diagnostic reproducibility was assessed by considering the palatal surfaces of primary incisors. Cohen's Kappa was calculated at 0.913 representing good agreement for reproducibility of erosion.

Duplicate examinations were also carried out on 100 12–14 year old boys. Variation in diagnosis on the palatal surfaces of maxillary permanent incisors was used as a marker of diagnostic reproducibility. Cohen's Kappa was calculated at 0.889. The high Kappa values should be considered with some caution because of the very high prevalence of erosion into enamel.

Questionnaire data—primary dentition

The 271 responses from parents of 5–6 year old boys represented a response rate of 75.7%. Of the parents responding, 65% reported that their child took a drink to bed for consumption before sleep

or during the night (Table 3) with 41% reporting use of drinks 1–3 nights per week, and 16% having drinks every night. Water was the most common drink consumed (37%), followed by carbonated soft drinks (21%) and then milk (19%). Fruit juice and tea were equally selected (8%). Of the 186 parents who answered the question regarding

Table 3. Frequency of night drinks intake in 271 5–6 year old boys and 851 12–14 year old boys.

Drinks intake	5–6-year-olds		12–14-year-olds	
	Number	%	Number	%
Never	93	35	249	30
1–3 nights per week	106	41	307	37
4–6 nights per week	20	8	88	11
Every night	42	16	188	22
Total	263 ^a		832 ^b	

^a 8 parents did not answer this question^b 19 boys did not answer this question

Table 4. Foods eaten at night by 110 boys aged 5–6 years and 386 boys aged 12–14 years

Drinks intake	5–6-year-olds		12–14-year-olds	
	Number	%	Number	%
Fruit	15	14	118	19
Crisps or savoury snacks	19	17	110	18
Confectionery and sweet snacks	21	19	93	15
Cakes	12	11	83	14
Toast/sweet sandwiches	9	8	70	12
Cereal-sweetened	12	11	49	8
Cereals-unsweetened	3	3	14	2
Biscuits-sweetened	12	11	28	5
Biscuits-unsweetened	3	3	27	4
Other	5	5	16	3
Total	111 ^a		608 ^b	

^a Parents of one 5–6 year old boy selected more than one kind of food taken at night.

^b 222 boys aged 12–14 years selected more than one kind of food taken at night.

sugars content of night drinks, 140 parents (75%) responded that their son had added sugar in his drinks or consumed drinks containing sugars at night.

One third of parents reported that their son had something to eat in bed or during the night (other than the evening meal); 17% of boys ate in bed or during the night less than once a week, 10% ate from one to three nights per week, and 6% ate

every night. A total of 111 selections of different kinds of foods were made by 110 parents of the boys who ate at night. Of these selections, 60% was sweet food, 14% fruit, and 17% crisps or a savoury snack (Table 4).

Questionnaire data—permanent dentition

The 851 completed questionnaires from 12–14 year olds represented a response rate of 97.9%. Over two thirds (70%) of boys aged 12–14 years reported having night drinks: 37% had drinks 1–3 nights per week, 22% had drinks every night. (Table 3) A total of 696 selections of different kinds of drinks taken at night were made by 636 boys aged 12–14 years. These were mainly water (30%), carbonated soft drinks (27%), and tea or coffee (18%). Sixty per cent of the boys were taking night drinks to which they had added sugars or which contained sugars.

Forty six per cent of the 12–14 year old boys reported that they ate in bed, at least once a week; 9 per cent ate in bed every night. A total of 608 selections of different kinds of food were made by the 386 boys who ate at night. Fruit was the most selected food (19%) followed by crisps or savoury snacks (18%), with sweet food and confectionery constituting 54% of foods eaten at night (Table 4).

Correlation and regression analysis

The total number of 5–6 year old subjects included in the merged data file was 268; of these 43 had

Table 5. Linear regression analysis model for pronounced dental erosion of palatal surfaces of primary maxillary incisors in 46 5–6 year old boys (Significance; * $P < 0.05$)

Model	Unstandardised coefficients		
	B	SE	P value
Kinds of drinks taken at night (0=none or non carbonated, 1=carbonated drinks)	0.271	0.094	0.015*
Frequency of food intakes at night (0=never, 1=One to 3 nights/ week, 2=4–6 nights/week, and 3=every night/week)	0.274	0.306	0.390
Erosive potential of food taken at night ^a (1=low, 2=moderate, 3=high)	0.338	0.427	0.445
Frequency of brushing (1=<1/day, 2=1/day, 3=2/day, 4=3/day, 5=>3/day)	–0.284	0.545	0.612
Frequency of drinks taken at night (0=never, 1=1–3 nights/ week, 2=4–6 nights/week, and 3=every night)	–0.361	0.984	0.720
Frequency of drinks taken at night (0=never, 1= \geq one night/week)	0.140	1.977	0.945

^aLow=unsweetened cereals or unsweetened biscuits, crisps or savoury snacks.

Medium=sweetened cereals, sweetened biscuits, cakes, toast and sweet sandwiches.

High=confectionery, fruit (e.g. lemons).

Table 6. Linear regression analysis model for erosion into dentine/dentine and pulp of the palatal surfaces of maxillary permanent incisors in 95 12–14-year-old boys. (Significance, * $P < 0.05$)

Model	Un-standardised Coefficients		
	B	SE	P Value
Frequency of drinks taken at night (0=never, 1= ≥ 1 night/week)	1.656	0.659	0.020*
Duration of drinks in mouth (0=drinks straight away, 1=makes it last)	0.566	0.255	0.038*
Erosive potential of food taken at night ^a (1=low, 2=moderate, 3=high)	−0.870	0.306	0.010*
Frequency of foods taken at night (0=never, 1= ≥ 1 nights/week)	−1.233	0.449	0.012*
Frequency of vomiting in case of illness (1=other, 2=once a month, 3=once a week and more than once a week)	−0.834	0.343	0.024*
Illnesses related to dental erosion (1=low, 2=moderate, 3=high)	0.329	0.267	0.232
Family income (1=low, 2=moderate, 3=high)	−0.354	0.319	0.280
Father's education (1=lowest – 6=highest)	0.164	0.185	0.383
Frequency of brushing (<1 /day, 1/day, 2/day, 3/day, > 3 /day)	0.132	0.166	0.435

^a Low=unsweetened cereals or unsweetened biscuits, crisps or savoury snack.
Medium=sweetened cereals, sweetened biscuits, cakes, toast and sweet sandwiches.
High=confectionery, fruit (e.g. lemons).

pronounced dental erosion of palatal surfaces of primary maxillary incisors and were included in the analysis. The Pearson correlation coefficient for the relationship between dental erosion of the palatal surfaces of all maxillary incisors of the primary dentition and the erosion-related questionnaire variables showed no statistical significance. However, when the correlation was performed for pronounced (i.e. into dentine and/or pulp) erosion of the palatal surfaces of the maxillary lateral incisors, there was a significant relationship ($P=0.049$) for the “kinds of foods taken at night”. As Table 5 describes, linear regression analysis showed a statistically significant relationship between the number of palatal surfaces of primary maxillary incisors with pronounced erosion and carbonated drinks taken at night ($P=0.015$). with the risk of developing pronounced dental erosion on the palatal surface of one or more primary maxillary incisor being 1.29 times more likely (95% CI: 0.59, 2.87) when the child drank one or more carbonated soft drinks at night. However, the other independent erosion related questionnaire variables were found not to be statistically significant when adjusted to the linear regression model.

The merged data file for 12–14 year olds resulted in a total of 824 subjects. Ninety five boys had pronounced dental erosion of the palatal surfaces of permanent maxillary incisors and were included in the analysis. Using pronounced palatal erosion as the dependent variable, linear regression analysis

showed a statistically significant relationship between the number of permanent maxillary incisors with pronounced dental erosion of their palatal surfaces and two erosion-related questionnaire variables (Table 6); frequency of drinks at night ($P=0.020$) and the duration of drinks in the mouth ($P=0.038$).

The study showed a negative regression coefficient and significant relationship ($P=0.024$) between “frequency of vomiting in case of illness” and pronounced dental erosion. However, it was decided that the reliability of the respondents in reporting their medical history was questionable and this association was not considered further.

Discussion

In the UK Children's Dental Health Survey report (6), dentists found it difficult to agree on the diagnosis of the presence of erosion in enamel only. It was decided that the UK's 1993 Children's Dental Health Survey approach of highlighting the clinical importance of pronounced dental erosion (erosion into dentine, erosion into dentine and pulp) should be followed.

Although the dental erosion of one or more maxillary primary incisors in 5–6 years Saudi boys in this study was high (82%), pronounced dental erosion was 16%. This percentage is very close to the UK's levels of erosion into dentine or pulp (12–15%) of children aged 5–6 years, which was found

in Northern Ireland in 1993. The UK National Diet and Nutrition Survey (8) showed erosion into dentine or pulp in 13% of children aged 3½ to 4½, slightly lower than that found in the present study.

The mouth prevalence of dental erosion of maxillary permanent incisors or permanent first molars in the present study was 95% in 12–14 year old Saudi boys; pronounced dental erosion was 26%. The high percentage (91%) of dental erosion on the occlusal surfaces of the 12–14 year old Saudi boys, found in the present study, is consistent with the high level of tooth wear found by Fareed and co-workers (14, 15) in adults aged 19–25 years.

The prevalence of pronounced dental erosion of permanent maxillary incisors in 12–14 year old Saudi boys was 12%, far higher than the findings of the UK's 1993 study of 2% for children aged 13 years using the same diagnostic criteria. The findings of the 1996 National Diet and Nutrition Survey of children aged 4–18 years in the United Kingdom have been presented recently (17). A similar pattern for erosion on the various surfaces examined was evident from both countries, but the prevalence and severity for every surface was higher in Saudi Arabia than in the UK.

The dietary dimension of dental erosion in this present study was evaluated using a questionnaire directed to parents of 5–6 year old boys. The main objectives of the questionnaire were to allow the respondent to recall as much information related to dental erosion as possible, including night drink frequencies, types of night drinks, night food frequencies, and types of night foods. Almost 23% of the 5–6 year old Saudi boys had high frequency of night drinks intakes (every night and 4–6 nights per week). In the present study 21.4% of the consumed night drinks was carbonated soft drinks, usually the cola type. Another acidic drink, fruit juice, constituted 7.5% of the night drinks of these children. This finding is important especially when it is known that fruit juices are served to children with no dilution in Saudi Arabia.

The questionnaire results showed a high consumption of carbonated soft drinks in Saudi boys aged 12–14 years; 60% reported adding sugars to tea or milk drinks. These dietary related factors in this study are in accordance with findings of Khan (18) and Johansson et al. (13) who reported that the high consumption of carbonated soft drinks and the frequent drinking of tea (with a lot of added sugar) were common practices among children and young adults in Saudi Arabia.

A significant relationship was found between the

number of primary maxillary incisors with pronounced erosion of their palatal surfaces and the use of carbonated soft drinks taken at night ($P=0.015$). A significant relationship was also found between the number of permanent incisors with pronounced erosion of their palatal surfaces and the frequency of drinks at night ($P=0.020$), as well as the duration of drinks retained in the mouth ($P=0.038$). Johansson et al. (19) showed a strong correlation between the presence of dental erosion and a high level of cola-type soft drinks in a group of young male Saudi military inductees aged 19–25 years. However the present study is the first to show a relationship between dental erosion and carbonated soft drink consumption in Saudi children.

A recent report showed that the production of soft drinks by industrial plants in Saudi Arabia had increased; in 1999 1.2 billion litres of soft drinks were produced (20). In view of this, the recent co-operation between the Ministry of Health and the Ministry of Education to apply a ban on the sale and consumption of carbonated soft drinks at schools and the replacement of these drinks with milk and juices is welcomed (21). This campaign is a step forward towards a healthier lifestyle, but it needs to be in conjunction with health awareness visits to schools in order to explain to the school-children the risk of food habits such as the frequent consumption of carbonated soft drinks to health in general, and oral health in particular.

Conclusions

- Thirty four per cent of 5–6 year old boys from Riyadh City, Saudi Arabia showed evidence of pronounced dental erosion of clinical significance (erosion into dentine or erosion into dentine and pulp) in one or more maxillary primary incisors or first primary molars.
- Twenty six per cent of 12–14 year old boys from Riyadh City showed evidence of pronounced dental erosion in one or more permanent maxillary incisors or permanent first molars.
- Twenty one per cent of 5–6 year old boys were said by their parents to consume carbonated soft drinks at night; 75% of parents reported that their children had added sugar in his drinks or consumed drinks containing sugar at night;.
- Sixty per cent of 12–14 year old boys reported taking night drinks to which they had added sugar or which contained sugar; 27 per cent reported consuming carbonated drinks at night

- The following risk factors for dental erosion were identified:
 - consumption of acidic drinks at night
 - consumption of drinks on one night or more per week
 - extended duration of drinks at night.

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