DENTAL CARIES: EXPERIENCE IN RELATION TO WASTING AND STUNTED GROWTH AMONG SCHOOLBOYS IN ABHA, SAUDI ARABIA

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Background: The aim of this study was to assess the dental health status of Saudi schoolboys in an urban city in the southwestern region of Saudi Arabia, and to investigate the association of dental caries with wasting and stunted growth.

Patients and Methods: A two-stage stratified random sample of 959 schoolboys representative of the 6 to 13 year-old school population in Abha were subjected to dental examination. Using the WHO criteria, decayed, missing and filled teeth were determined, and the prevalence of caries for each age group was determined by means of decayed and filled primary teeth (dft), and decayed, missing and filled permanent teeth (DMFT) epidemiological indices. The children were also subjected to weight and height measurements and their values were compared with the local growth standards.

Results: The total prevalence of caries-free children was 14.6%. The mean dft values at ages 6, 9 and 12 years were 6.53, 3.97 and 1.07, respectively ($P<0.001$), while the mean DMFT values were 0.16, 0.83 and 1.23 for such ages ($P<0.001$). After adjusting for age and social class, the wasted children were found to have a higher caries prevalence in the primary dentition than the well-nourished children ($P<0.01$), while children with stunted growth exhibited lower caries prevalence in the permanent teeth ($P<0.05$).

Conclusion: Comparisons with international goals for oral health by the year 2000 show that the goal for 12-year-olds with respect to the status of the permanent dentition has been attained, but not the goal for 5-6 year-olds with respect to caries-free primary teeth. It is likely that nutritional status may have different effects on susceptibility to caries of deciduous and permanent teeth.

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Key Words: Dental caries, wasting, stunted growth.

Animal studies have shown that early malnutrition affects tooth structure, delays tooth eruption, and results in increased dental caries.[1] In humans, however, there has been much controversy regarding the negative association between the nutritional status and the prevalence of caries.[2,3] Decrease in caries in the developed countries of the world in the past 20 years is well documented, and some investigators have looked critically at the role of diet and nutrition in this decline,[4] but have noticed no direct evidence that the decrease in caries rates is related to an increase in nutritional status. The aim of this study was to estimate the prevalence of dental caries among schoolboys in Abha, the capital of the Asir Region in southwestern Saudi Arabia, and to establish whether there is a significant association between wasting and stunted growth and dental caries.

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Materials and Methods

A two-stage stratified sample of 975 boys from six out of 17 primary schools in Abha was randomly selected for the study. The sample constituted approximately 15% of the school population of 5537 children in all the schools. In the first sampling stage, all 17 primary schools were classified into three groups according to geographical location and socioeconomic level (roughly categorized into high, middle and low social classes). Then, using the equal allocation method of sampling, two schools were randomly selected from each of the three groups.

In the second sampling stage, six classes were selected randomly from each of the selected schools to represent the different grades. Thus, a total of 36 classes were included in the sample. Each class was considered to be a cluster, and all boys in the selected classes constituted the target

group of the present study. Children above the age of 13 years

TABLE 1. *Distribution of decayed, filled and missing primary and permanent teeth among 959 Saudi schoolboys in Abha City.*

	Primary Teeth		Permanent teeth		Total	
Number of teeth affected	No.	%	No.	%	No.	%
0 (caries free)	206	21.5	631	65.8	140	14.6
1-4	429	44.7	318	33.2	413	43.1
5-8	241	25.1	9	0.9	285	29.7
9-16	83	8.7	1	0.1	121	12.6
Total	959	100.0	959	100.0	959	100.0
Mean±SD	3.59±3.11		0.79±1.34		4.38±3.27	
Decayed: filled ratio	2.26		1.71		2.15	

TABLE 2. *Caries experience of 959 Saudi schoolboys in Abha City according to age.*

		Caries				Caries Free			
		dft		DMFT		dft=0		DMFT=0	
Age (year)	No.	X	SD	X	SD	No.	%	No.	%
6	45	6.53	3.68	0.16	0.47	3	6.7	40	88.9
7	169	5.59	3.65	0.13	0.47	19	11.2	155	91.7
8	131	4.86	2.87	0.56	1.09	10	7.6	96	73.3
9	145	3.97	2.50	0.83	1.36	18	12.4	94	64.8
10	165	2.95	2.25	0.92	1.34	31	18.8	98	59.4
11	158	2.30	2.20	1.14	1.44	47	29.7	77	48.7
12	111	1.07	1.40	1.23	1.63	56	50.5	58	52.3
13	35	0.74	1.20	1.86	2.07	22	62.9	13	37.1
Total	959	3.54	3.12	0.80	1.40	206	21.5	631	65.8
P-value		<0.001*		<0.001*		<0.001**		<0.001**	

dft=decayed, filled primary teeth; DMFT= decayed, missing and filled permanent teeth (0 denotes caries-free); *one-way ANOVA was applied; **chi-square test for linear trend was applied.

TABLE 3. *Caries experience of Saudi schoolboys in Abha City according to social class.*

	Social class							
	Low (n=123)		Moderate (n=665)		High (n=107)		Statistical difference	
Caries	X	SD	X	SD	X	SD	F*	*P*-value
dft	2.59	2.79	3.80	3.13	3.43	2.92	8.16	0.0003
DMFT	0.80	1.41	0.82	1.35	0.62	1.24	1.02	0.36
Caries-free	No.	%	No.	%	No.	%	χ^2**	*P*-value
dft = 0	44	23.3	123	65.1	22	11.6	9.05	0.003
DMFT = 0	80	13.6	431	73.3	77	13.1	1.09	0.30

*F=value for one-way ANOVA; **chi-square for linear trend.

TABLE 4. *Caries experience of 959 Saudi schoolboys in Abha City according to weight/height and height/age nutritional indicators.*

	Centile	No.	dft		DMFT	
Nutritional indicator			Mean	SD	Mean	SD
Weight/Height	$<5^{th}$	93	4.95	3.34	0.70	1.28
	$\geq5^{th}$	865	3.45	3.05	0.80	1.34
	Difference		t=4.45 (*P*=.0000)		t=-0.68 (*P*=0.50)	
Height/Age	$<5^{th}$	66	4.27	3.18	0.47	1.04
	$\geq5^{th}$	892	3.54	3.10	0.81	1.35
	Difference		t=1.84 (*P*=0.07)		t=–2.01 (*P*=0.045)	

Weight/Height = weight-for-height "wasting"; height/age = height-for-age "stunting."

were considered as extreme outliers, and were removed from the analyses to avoid their having undue influence on the results. The analysis was then performed on the sample of 959 schoolboys aged 6 to 13 years.

Procedure

Dental examination was conducted for all children of the target group, using the methods of diagnosis described by the World Health Organization.[5] This was done in the dental clinic of the main school health unit in Abha, by only one dentist for consistency. The number of decayed and filled primary teeth (dft) and the number of decayed, missing and filled permanent teeth (DMFT) were recorded for all children in the selected sample. Scores were recorded on specially designed forms and subsequently coded for data analysis.

Children were measured by a male nurse using a fixed wall ruler with a spirit level as a bar and a beam balance to obtain height and weight. For height, children were measured without shoes. Traction was applied to the mastoid process and measurement recorded to the nearest 0.25 cm. Weight measurements were recorded with light clothes to the nearest 0.1 kg. Comparison with local growth standards[6] was made possible by delivering values corrected for age, in the form of centile bands. A computed program placed each value in one of the two centile bands: <5th centile and >5th centile. Children whose height-for-age was less than the 5th centile were classified as stunted, and those whose weight for height was less than the 5th centile were classified as wasted. Stunting is a measure of past or chronic malnutrition, whereas wasting indicates current or acute malnutrition.

A questionnaire regarding social data on the child and family was sent to parents for completion. The socioeconomic status of children was assessed using a scoring system,[7] with some modification, based on the type of houses, number of livestock, crowding index, father's and mother's education and work. The maximum score was 20. The mean±score for the entire group was 10.0±3.0. The socioeconomic status was classified as follows: score <10=low; 10-15=moderate; and 16-20=high social class.

Data were analyzed using Pearson's chi-squared test, Student's *t*-test, and simple factorial ANOVA test at a 5% level of significance. Multiple regression analysis was applied upon weight-for-height, height-for-age and social class variables, with the dft and DMFT values as the dependent variables. The statistics were calculated using the SPSS software package.[8]

Results

Among the 959 Saudi schoolboys, 206 children (21.5%) were caries-free in their primary teeth, 631 (65.8%) in their permanent teeth, and 140 (14.6%) in both primary and permanent teeth. The mean number of decayed and filled primary teeth (dft) was 3.59±3.11. In the permanent teeth, the mean number of decayed, missing and filled permanent teeth (DMFT) was 0.79±2.84.

Children with high numbers of caries in the primary teeth (dft≥5) accounted for 33.8% of all children, while those with high numbers of caries in the permanent teeth (DMFT≥5) accounted for only 1% (Table 1).

TABLE 5. *Effects of age, social class, weight/age and height/age on dft and DMFT values among 959 Saudi schoolboys in Abha City using multiple regression analysis.*

Category	Constant	Age	Social class	Weight/Height	Height/Age	F-values	Significance	R^2
dft	11.20*	–0.87*	–0.4	1.13*	0.02	99.93	*P*<0.001	0.31
	(0.59)	(0.05)	(0.03)	(0.34)	(0.38)			
DMFT	–1.35*	0.24	–0.01	0.17	–0.42**	30.23	*P*<0.001	0.12
	(0.29)	(0.02)	(0.01)	(0.17)	(0.19)			

Beta coefficients and their standard errors (SE) estimated using linear regression, age (in years), social class (in social score), weight/height (<5th centile=1), and height/age (<5th centile=1); **P*<0.01; ***P*<0.05.

The decayed component of caries dominated, accounting for 69.4% of dft and 60.8% of DMFT, respectively, while the filling component accounted for only 30.6% and 35.4%, respectively, of these values (Table 1). Thus, the ratio of decayed to filled teeth was 2.26 for primary teeth and 1.71 for permanent teeth.

The prevalence of caries among schoolboys according to age is shown in Table 2. Table 3 shows that children of the lower social class had significantly lower mean dft value (2.59±2.79) than children of other social classes (F=8.16, *P*<0.001). Also, children of the lower social class showed a significantly higher proportion of caries-free primary teeth (dft=0) than did the children of other classes (23.3%, *P*<0.01). On the other hand, there was no significant difference among the different social classes either in the mean DMFT values (F=1.02, *P*>0.05) or in the proportion of caries-free permanent teeth (χ^2=1.09, *P*>0.05).

Table 4 shows the dft and DMFT values in children according to weight-for-height and height-for-age indicators of nutritional status. Wasted children (wt/ht <5th centile) had a significantly higher mean dft value (4.95±3.34) than did well-nourished children (3.45±3.05, t=4.45, *P*<0.01). In general, the wasted children had 1.5 times more deciduous teeth affected by caries than did the well-nourished children. On the other hand, children of stunted growth (ht/age <5th centile) had a significantly lower mean DMFT value (0.47±1.04) than did the well-nourished children (t=2.01, *P*<0.05).

The joint effect of the four significant variables—age, social class, wasting and stunting of growth—was examined by means of multiple regression analysis, with dft and DMFT values as the dependent variables (Table 5). They jointly showed a significant positive association with dft value (F=99.93, *P*<0.001), and with DMFT value (F=30.23, *P*<0.001). Both young age and wasting were significant predictors of caries in deciduous teeth (*P*<0.01 for each), while the absence of stunted growth was the only significant predictor of caries in permanent teeth (*P*<0.05).

Discussion

This study shows that the prevalence of dental caries among schoolboys in Abha falls into the category of high-caries level, and is similar to results reported in most developed countries,[9,10] but higher than other reported values in some parts of Saudi Arabia.[11-13] Children with caries had more decayed teeth than treated teeth. The ratio of treated teeth component was only 31.5%, while it was 77% for Japan[14] and about 50% in France,[15] a finding that indicates a relatively lower level of restorative care in Abha.

According to WHO/FDI global goals for oral health, by the year 2000,[16] 50% of children at the age of 5-6 years should be free of dental caries, and no more than three decayed, missing or filled teeth at the age of 12 years should be present (DMFT ≤3). The present study shows that the goal with respect to the status of the permanent dentition has been attained with the low DMFT value of 1.38. This finding is similar to what has been reported by others.[17] However, the goal for 5-6-year-olds with caries-free primary teeth has not yet been reached, with the figure at 7%.

It has been suggested that early malnutrition may produce defects in teeth during the period of development so that they are more susceptible to subsequent dental caries after eruption. Two cross-sectional studies and one longitudinal study conducted by Alvarez[2,18] in Peruvian children have provided direct evidence linking nutritional status, tooth eruption, and dental caries. In the present study, wasted children showed higher prevalences of caries in deciduous teeth (*P*<0.01) than did the well-nourished children. On the other hand, children with stunted growth exhibited a lower prevalence of caries in their permanent teeth. This might be attributed to the delay in tooth eruption due to such chronic malnutrition.[19] Such delays in tooth eruption might be associated with delays in caries development, because teeth that emerged at a later time are more likely to be exposed to the oral cavity environment for less time. However, height-for-age may not be the best indicator of nutritional status by itself, but may be indicative of a short stature. Weigh-for-height is more reliable as an indicator of short-term nutritional status than height-for-age is an indicator of chronic nutritional status. This may also explain why short stature is a negative indicator of dental caries.

Such an association between nutritional status and caries prevalence may be spurious, because it may result from inadequate control of confounding social factors. The results described above, however, persist after adjusting for

age and social class, where such an association between nutritional status and caries was evident among children of both higher and lower classes. In bivariate analysis, a positive association was found between the prevalence of dental caries in primary teeth and the socioeconomic status of the child. However, after adjusting for other factors by multiple regression analysis, the association disappeared.

Conclusion and Recommendations

The results of this study indicate that:

1. Dental caries prevalence among schoolboys in Abha falls into the category of high caries level. Therefore, an active and effective program of dental care is necessary for the child population. Comparisons with the international goals for oral health shows that the goals for 12-year-olds with respect to the status of permanent teeth has been achieved, but not the goal for 5-6-year-olds with caries-free primary teeth.
2. It is likely that nutritional status may have different effects on susceptibility to caries of deciduous and permanent teeth. However, further studies are recommended to confirm such assumptions.
3. The risk of dental caries appears to be associated with the preschool time frame and, therefore, the dental service should redirect its attention to preschool children and replace its restorative policy with a preventive policy through dental health education.

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