Dental Caries Status, Socio-Economic, Behavioral and Biological Variables among 12- Year-Old Palestinian School Children

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There are currently inadequate data regarding the prevalence of dental caries and its associated variables, among Palestinian children. **Aim***: To determine the current prevalence of dental caries and related variables, among Palestinian children in East Jerusalem.* **Study design***: A stratified sample of 286 East Jerusalem Palestinian children was selected, employing randomly chosen sixth grade clusters from three pre-selected socio-economic school groups. Dental caries was recorded according to WHO recommendations. Salivary flow, pH, buffer capacity and microbial parameters, were recorded according to previously employed methodologies.* **Results***: The mean level of caries experience, by DMFT, was 1.98 ± 2.05. This level was higher than those found among Israeli children, but lower than several other Middle Eastern countries. In uni-variate analysis, significant associations were revealed between caries and school categories, which indicated lower, middle and higher socio-economic position(SEP), mothers' employment, home densities, dental visits, tooth brushing, Streptococci mutans (SM), Lactobacilli (LB), and saliva pH.* **Conclusion***: According to a linear logistic regression model, children learning in lower SEP schools, with higher SM levels and more acidic saliva, had a higher chance of experiencing dental caries. These findings should be considered in the planning of services and dental health care programs for Palestinian children.*

Key words: dental caries, socio-economic position, health behavior.

INTRODUCTION

Dental caries remains one of the major medical and dental diseases among all populations at all ages [1]. A wide range of factors contributing to this disease has been described in the literature, including not only direct biological determinants, but a wider range of socio-economic, cultural, political, behavioral, governmental, health care system and many other factors [1,2]. Recent research has emphasized the need to study and relate to the wider social determinants of health, as described by Marmot *et al* [3].

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Dental research has emphasized the need to understand and relate to the complex web of associations both within developed and developing populations. The continuing efforts of oral health promotion are based on collecting and applying appropriate knowledge.

The World Health Organization (WHO) and the International Dental Federation (FDI), back in the 1980's, as part of the goals for the year 2000, recognized the importance of creating a global oral health data based system [4]. This data bank has now been expanded and includes most countries of the world [5]. Minimal studies have been conducted, to date, among the Palestinian population, and only preliminary, inadequate information is available [6]. Data are required, similar to all communities, in order to optimally plan and implement dental public health programs.

The objectives of the present study were to establish the current prevalence level of dental caries among 12-13 year-old Palestinian children in East Jerusalem and the potential associations with socio-economic position (SEP), behavioral and biological variables.

MATERIALS AND METHOD

Study population. 286 sixth grade children were included from three groups of local schools: private non-governmental (NGO) schools (commonly recognized as higher SEP), governmental schools (moderate SEP), United Nations Relief and Works Agency (UNRWA, recognized as lower SEP). Study schools were randomly selected from each of these strata: two private schools (three classes), one government school (four classes) and two UNRWA schools (two

classes). This stratification has been employed in previous research [7]. All sixth grade children in all classes were included. The study was authorized by the local health and educational authorities and the principals of the designated schools. One parent of each child signed a consent form in Arabic. We encountered no refusals.

Dental caries was recorded according to WHO guidelines [8] and thereby determined by DMFT (D: untreated caries experience, M: missing teeth due to caries experience, F: filled or otherwise treated teeth due to caries experience). Examinations were conducted by one examiner (LE) in the classrooms, employing a WHO CPI probe, dental mirror and existing light. Pre-study training and calibration had been applied between the examiner and an experienced epidemiologist (HDSC). The level of agreement attained was over 85%.

Salivary sampling and microbial parameters: Saliva was collected in the classrooms during the first hour of the school day. Whole saliva samples were collected while chewing a paraffin stick and expectorating for five minutes.

Salivary flow: The amount of collected saliva was divided by five, thereby demonstrating amount per minute. The operational definition was: less than 5 ml/min = low; more than 5 ml/min = high.

Salivary pH: The colorpHast ® kit (Merck) was employed. Two drops of saliva were placed on the strips, which reveal, according to a color code, the range of pH from 0 till 14. The operational definition was: less than pH 8 = acidic; pH 8 or higher = non-acidic.

Salivary buffer capacity: The CRT® buffer kit (Ivoclar Vivadent) was employed. Two drops are placed on the strips which reveal, after five minutes, the buffering capacity, according to color codes: blue = high capacity; green = medium capacity; yellow = low capacity.

Bacteria: Levels of of mutans streptococci (MS) and Lactobacilli (LB) were assessed employing CRT® kits (Ivoclar Vivadent). Each slide is composed of two selective agar media for MS and LB. Collected saliva was spread over the kits, excess saliva was discarded and then closed kits were transferred to the laboratory, where they were incubated at 37°C for 48 hours. Enumeration of bacteria was then calculated, according to the manufacturer's key, to a semi-quantitative rank from 1-4 : 1=<104, 2=104-105, 3=105-106, 4=>106 CFU/ml. The manufacturer defines score 1 as low, 2 as low-medium, 3 as medium high, 4 as high caries risk. This methodology has been employed in previous research [9,10]. This methodology had been employed in a previous study of the same population [11].

Socio-demographic variables: Self administered questionnaires were explained and applied in the classroom. Questions included: gender, school category (private, government, UNRWA), education of parents (elementary school, high school, academic), employment of parents (unemployed, employed), home density (five or less persons per home, more than five persons at home).

Oral health behavior: According to the same questionnaire: last dental visit (once or more a year, less than once a year) , frequency of tooth brushing (twice a day or more, once a day, less than once a day), use of dental floss (yes/no), mouth rinse (yes/no).

Statistical analysis: Employing the SPSS 19.0 package, ANOVA and independent t-test were used to examine uni-variate analyses. Linear logistic regression was used in multi-variate analysis, with the aim of isolating the independent effects of the independent variables. In all analyses DMFT served as the dependent variable.

RESULTS

The present study data present a level of 1.98 ± 2.05 DMFT caries experience at age 12 years among 286 sixth grade Palestinian school children in East Jerusalem.

Socio-demographic variables

Table 1 demonstrates the association between socio-demographic and caries experience (by DMFT). No significant associations were found for gender, fathers' education and employment and mothers' education. Children attending private schools (higher SEP) had the lowest caries levels (DMFT=1.71) as compared to those attending UNRWA (lowest SEP) schools (DMFT=3.40). These differences were statistically significant (p<0.001). Children of employed mothers had less caries (DMFT=1.35) than unemployed mothers (DMFT=2.09). This difference was statistically significant (p=0.036). Home density was also significantly associated (p=0.019) with caries experience. Children living with four or less persons at home had less caries (DMFT=1.51) than children living with more than four other persons at home (DMFT=2.17).

Oral health behavior variables

Table 2 demonstrates the associations between oral health behavior and caries experience. Last dental visit was significantly (p=0.002) associated. Unexpectedly, children who had visited the dentist during the last year (more frequently) had more caries experience (DMFT=2.22) than children who visited the dentist less frequently (DMFT=1.37). A significant (p=0.002) and consistent association was revealed between tooth brushing frequency and caries experience: DMFT levels were 2.32 for children brushing twice a day, 2.05 for children brushing once a day and 1.15 for children brushing less than once a day. Very few children were found to be using mouth rinses and/or dental floss and these were not found to be associated with caries experience.

Salivary and microbial variables

Table 3 shows that higher levels of SM (p<0.001), LB (p=0.038) and acidic salivary pH (p=0.013) were significantly associated with caries experience. Borderline significance was found for salivary buffer capacity (p=0.059) and no association for salivary flow.

Multivariate analysis

Table 4 presents multivariate linear logistic regression analysis of all previous variables included in the uni-variate analyses which had been found as statistically significant or with a tendency towards statistical significance. As is revealed, after controlling for all other variables, the three variables which were significantly and independently related with caries experience were: school category (p=0.001), level of mutans streptococci (p=0.001) and salivary pH (p=0.001).

DISCUSSION

The present caries experience level of 1.98 ± 2.05 DMFT among Palestinian children in East Jerusalem, was higher than recent reports among Israeli children [12], but lower than prevalence levels reported from several surrounding Middle Eastern countries [13-16].

This study investigated a wide range of biological (salivary and oral microbiology parameters), socio-demographic and health behavior variables. The recent "Call to Action" of the International

Table 1. Caries experience, by DMFT, among Palestinian schoolchildren, by socio-demographic variables.

Socio-demographic variables		N	%	DMFT		p
				Mean	SD	
School category	Government	137	51.9	1.80	1.91	
	UNRWA	35	13.3	3.40	2.45	<0.001
	Private	92	34.8	1.71	1.87	
Gender	Male	75	28.4	1.73	2.09	
	Female	189	71.6	2.07	2.02	0.223
Father's education	Elementary school	90	35.7	2.23	2.23	
	High school	99	39.3	1.83	1.82	0.403
	Academic	63	25.0	2.00	2.16	
Father's employment	No	55	21.1	1.60	1.99	
	Yes	206	78.9	2.09	2.06	0.114
Mother's education	Elementary school	95	36.4	2.04	2.10	
	High school	105	40.2	2.12	2.06	0.373
	Academic	61	23.4	1.67	1.95	
Mother's employment	No	223	84.8	2.09	2.09	
	Yes	40	15.2	1.35	1.67	0.036
Home density	5 or less	71	27.3	1.51	1.98	
	More than 5	189	72.7	2.17	2.05	0.019
Total		264		1.98	2.05	

Table 2. Caries experience, by DMFT, among Palestinian schoolchildren, by oral health behavior variables.

		N	%	DMFT		p
Oral health behavior variables				Mean	SD	
Tooth brushing frequency	More than a year	75	28.6	1.37	1.82	
	Twice per day or more	119	45.8	2.32	2.10	
	Once per day	88	33.8	2.05	2.09	0.002
	Less	53	20.4	1.15	1.61	
Mouth rinse use	No	202	76.5	1.92	2.04	
	Yes	62	23.5	2.16	2.08	0.419
Dental Floss use	No	237	90.8	2.07	2.10	
	Yes	24	9.2	1.29	1.27	0.077
TOTAL		264		1.98	2.05	

Association for Dental Research (IADR) has emphasized the need to "focus attention on the need: for better understanding of the full range of oral health determinants that include biological and environmental factors as well as behavioral and social determinants"[2].

We found, according to a linear logistic regression model, that the strongest predictors of dental caries experience were both socio-demographic and biological. Mutans streptococci and salivary pH levels have been clearly established as fundamental components of the etiology of dental caries[1]. These factors have been reiterated as essential contributors in the present study. At the same time, the category of schools (private, government or UNRWA) was found to serve as a central socio-demographic contributor, not weaker than the biological factors. Category of schools has served as a strong SEP proxy in many communities, including Israeli and Palestinian populations[7,17]. Frequency of tooth brushing was expectedly found as significantly associated with caries at a univariate level. However this association did not remain independently significant in the multiple regression model. Dental visit frequency was unexpectedly found to be positively associated with caries experience. This finding might be explained by the fact that caries was determined by the DMFT index, which includes treated teeth (the F component of DMFT). We might hypothesize that higher levels of dental visits might indicate more treatment, resulting in higher DMFT scores.

Table 3. Caries experience, by DMFT, among Palestinian schoolchildren, by salivary test variables.

Salivary tests		N	%	DMFT Mean	SD*	p
Streptococci mutans	low	14	5.4	1.07	2.53	<0.001
	Low-medium	33	12.6	0.73	1.23	
	medium-high	78	29.9	1.51	1.57	
	high	136	52.1	2.60	2.07	
Lactobacilli	low	60	26.0	2.00	2.24	0.038
	Low-medium	69	29.9	1.87	2.06	
	medium-high	73	31.6	2.25	1.70	
	high	29	12.5	3.10	1.88	
Buffer Capacity	High	152	62.8	1.72	1.87	0.059
	Med	70	28.9	2.40	2.05	
	Low	20	8.3	2.05	2.59	
pH	≤ 8	138	60.8	2.43	2.11	0.013
	8+	89	39.2	1.76	1.75	
Saliva Flow	≤ 5	148	64.1	2.13	1.95	0.652
	5+	83	35.9	2.25	2.12	

Table 4. Multiple linear regression model of caries experience, among Palestinian school children, by socio-demographic, behavioral and biological variables.

	Un-standardized Coefficients		Standardized Coefficients		95.0% Confidence Interval for B	
	B	Std. Error	Beta	*p*	Lower Bound	Upper Bound
Constant	3.165	1.561	---	0.044	0.086	6.244
Type of school	0.618	0.176	0.253	0.001	0.271	0.966
Father's employment status	0.218	0.341	0.043	0.525	-0.456	0.891
Mother's employment status	-0.291	0.462	-0.042	0.530	-1.202	0.621
Home density	0.081	0.368	0.015	0.827	-0.646	0.807
Last visit in dental clinic	-0.194	0.326	-0.041	0.552	-0.837	0.449
Tooth brushing frequency	0.171	0.181	0.061	0.345	-0.185	0.527
Dental Floss use	-0.662	0.508	-0.085	0.194	-1.664	0.340
Strep. Mutans	0.619	0.185	0.250	0.001	0.254	0.985
Lactobacilli	0.150	0.154	0.073	0.329	-0.153	0.453
Buffer Capacity	0.068	0.223	0.021	0.760	-0.371	0.508
pH	-0.567	0.161	-0.254	0.001	-0.885	-0.249

CONCLUSION

The present study was the first large research effort which included a representative sample of 286 Palestinian children (albeit only from East Jerusalem), a wide range of potential determinants: socio-demographic, biological and behavioral. Our results indicate the contribution of socio-economic together with biological factors to children's dental caries. Palestinian children learning in lower SEP schools, with higher SM levels and more acidic saliva had a higher chance of experiencing dental caries. The present findings should be considered and incorporated in any and all future community efforts, by the relevant Palestinian authorities, with the aim of promoting oral health in the present population.

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