

Short Communication

Changing dental caries levels in the 1980's, 1990's and 2005 among children of a Jerusalem region.

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Objective To study caries levels and related variables among first grade and fourth grade schoolchildren in one Jerusalem geographic region in 2005, and possible changes in caries levels over three decades: the 1980s, 1990s and finally in 2005. **Methods** Dental caries was examined, within schools, employing the DMFS and defs indices, for permanent and deciduous teeth respectively. **Results** Data indicate a consistent decline in disease: a reduction from 1.64 to 0.32 to 0.16 for DMFS, and 13.95 to 8.09 to 5.07 for defs (1983, 1992, 2005, respectively), among first grade children; and from 3.50 to 2.50 to 1.07 for DMFS, and 13.88 to 7.26 to 4.16 for defs, (1983, 1992, 2005, respectively), among fourth grade children. **Conclusions** A consistent decrease in caries has been detected over three decades. Specific causal factors were not ascertained.

Key words: Caries prevalence, defs, DMFS, Israel, schoolchildren

Introduction

Dental caries levels (by DMF averages) have consistently declined in western countries since the 1970's (Marthaler, 2004). In Israel, a national review reported decreasing caries levels since the 1980s (Sgan-Cohen *et al.* 2000). A study in one Jerusalem region, described a decrease since the 1980s (Sgan-Cohen *et al.* 1997). A national study, among 12-year-old Israeli children, demonstrated a low caries level, as compared with previous data (Zusman *et al.* 2005).

The present study objectives were to investigate caries levels and associated variables in 2005, among first and fourth grade schoolchildren, and to compare caries levels with data from the 1980s and 90s.

Methods

The clinical examinations were conducted in south-western Jerusalem, which according to municipality records generally represents the lower middle class. The area and sample framework was the same as described in a previous survey (Sgan-Cohen *et al.* 1997). The social fabric of Israel has been modified over time, but this region has demonstrated minimal infra-structural changes and the socio-economic ranking remains similar. Among three schools a random cluster sample of classes was selected. Comparisons for first graders were conducted between 1983 (n=158), 1992 (n=132) and 2005 (n=100), and for fourth graders between 1986 (n=116), 1992 (n=108) and 2005 (n=85). Caries was evaluated in well illuminated school nurses' rooms, after tooth cleaning with gauze, utilizing the DMFS and defs indices, for permanent and deciduous teeth, according to the 1977 recommendations of WHO, employing blunt, unsharpened sickle shaped

explorers (WHO,1977). Children were examined after receiving informed consent signed by parents.

Socio-economic level, by parents' occupations (Kark, 1974), parents' education and country of origin, were determined according to school records. In each decade one examiner had conducted the survey after training and calibration with one experienced dentist-epidemiologist (HSC), who had participated throughout the three study periods. All agreement levels had been above 85%.

In statistical analysis, Levene's test for equality of variances was employed for testing possible associations between 2005 caries levels and independent variables. For comparisons between years of examinations, Student's t test was employed.

Results

The 2005 study included 185 children, equally distributed by gender, with a consent level of 74%. According to the 2005 study, caries levels among first graders for permanent teeth was DMFS=0.16+0.49, and for deciduous teeth, defs=5.07+ 8.56 The caries levels among fourth graders for permanent teeth, was DMFS=1.07+1.8 and for deciduous teeth, defs=4.16+5.94.

In analysis of associations, data of first and fourth grade children were combined. No significant associations were found for parents' occupations. Children of fathers born in Israel had significantly more permanent caries (DMFS=1.40) than of immigrants (DMFS=0.84, p=0.005). These differences were almost identically associated with mothers' origin (p=0.009).

Children of fathers with 9-12 years of education had significantly more permanent caries (DMFS=1.42) than of fathers with more than 12 years of education (DMFS=0.29, p=0.002). Results for mothers were similar

but not statistically significant. For parents' origin and education, no significant differences were detected for deciduous teeth caries.

Population samples in the 1983-6, 1992 and 2005 studies were compared by gender, parents' occupations, education, and origin. Gender distribution was similar in all three decades. Distribution of father's occupation was similar throughout. Mother's occupation had slightly changed - an increase in academic and higher managerial positions from the 1980s to 1992 and then a decrease in 2005. Fathers' and mothers' higher education (more than 12 years) was similar in the 1980s and 90s, but had decreased by 2005. Between the 1980s and 90s, there was an increase of proportion of parents born in Israel, however, by 2005 there was a reverse in this trend.

As is demonstrated in Table 1, DMFS among first graders decreased from 1.64 in 1983 to 0.32 in 1992 (a reduction of 80%, $p<0.001$), and then to 0.16 in 2005 (a further reduction of 50%, $p=0.07$). The defs values also decreased from 13.95 to 8.09 (a reduction of 42%, $p<0.001$) and then to 5.07 in 2005 (a further reduction of 42%, $p=0.01$).

As is demonstrated in Table 2, DMFS among fourth graders decreased from 3.57 in 1986 to 2.50 in 1992 (a

reduction of 28%, $p<0.005$), and then to 1.07 in 2005 (a further reduction of 57%, $p<0.001$). The defs values decreased from 13.87 in 1986 to 7.22 in 1992 (a reduction of 47%, $p<0.001$) and then to 4.16 in 2005 (a further reduction of 42%, $p=0.001$).

Discussion

The present survey is a descriptive study of change conducted over three decades. Generally, the profile of parents over time remained similar, despite certain differences. Fathers' occupation levels had not changed; mothers' occupational levels had increased and then decreased; parents' higher education levels had decreased; proportion of Israeli born parents had increased in the 1990s and then decreased by 2005. This trend was assumed to be attributed to the large immigration of parents from the previous USSR in the early 1990s.

A significant association was found between permanent teeth caries and parents' place of birth in the 2005 data. Children of Israeli born parents had significantly higher caries levels compared to children of immigrant parents. There had been a decrease (since 1992) in the proportion of parents born in Israel and therefore this

Table 1. Dental caries levels among first grade children by year of examination.

Index	1983 n=158		1992 n=132		p*	2005 n=100		p**
	mean	SD	mean	SD		mean	SD	
DMFS	1.64	2.39	0.32	0.85	<0.001	0.16	0.49	0.07‡
DS	0.94	1.69	0.23	0.66	<0.001	0.14	0.47	NS
MS	0	0	0	0	NS	0.01	0.1	NS
FS	0.70	1.88	0.09	0.49	<0.001	0.01	0.1	0.07‡
defs	13.95	11.94	8.09	8.72	<0.001	5.07	8.56	0.01
ds	3.73	6.19	3.02	4.55	NS	2.26	6.28	NS
es	2.05	4.86	1.17	3.17	NS	0.12	0.78	<0.001
fs	8.18	9.16	3.90	6.13	<0.001	2.67	5.94	NS

NS=not statistically significant

*difference between 1983 and 1992, according to Student's t test

** difference between 1992 and 2005, according to Student's t test

‡ "tendency" towards significance

Table 2. Dental caries levels among fourth grade children by year of examination.

Index	1983 n=116		1992 n=108		p*	2005 n=85		p**
	mean	SD	mean	SD		mean	SD	
DMFS	3.57	3.08	2.50	2.65	<0.005	1.07	1.80	<0.001
DS	0.72	1.37	0.88	1.27	NS	0.58	1.33	NS
MS	0	0	0.05	0.05	NS	0	0	NS
FS	2.85	2.96	1.57	2.24	<0.005	0.49	1.30	<0.001
defs	13.87	8.64	7.26	7.22	<0.001	4.16	5.94	0.001
ds	0.96	1.88	1.67	2.68	<0.02	1.20	3.34	NS
es	0.90	3.27	1.24	3.20	NS	0.04	0.24	<0.001
fs	12.01	8.62	4.35	5.95	<0.001	2.93	4.82	0.07‡

NS=not statistically significant

*difference between 1983 and 1992, according to Student's t test

** difference between 1992 and 2005, according to Student's t test

‡ "tendency" towards significance

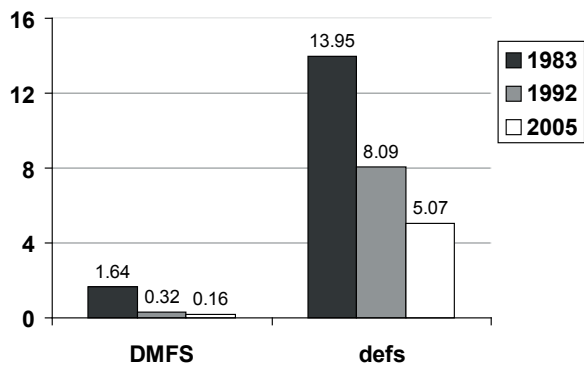


Figure 1. Caries prevalence levels by DMFS and defs among first-grade school children in 1983, 1992 and 2005.

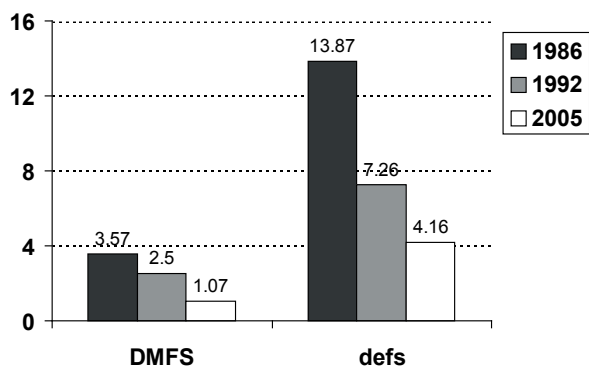


Figure 2. Caries prevalence levels by DMFS and defs among fourth grade school children in 1986, 1992 and 2005.

could possibly be considered as an explanation for the decrease in caries. Further examination of the impact of immigration was beyond the limits of this research.

A significant association was also found between permanent teeth caries and fathers with higher education (more than 12 years). Children of these fathers demonstrated lower caries levels. There had been a decrease (since 1992) in the proportion of fathers with higher education and therefore this variable could not be considered as a possible explanation for the decrease in caries.

As is demonstrated in Tables 1 and 2, the predominant components of the DMFS and defs indices are the "FS" and "fs" components, which indicate caries treatment. The association between low caries levels and high fathers' education found in this study is consistent with previous research which has revealed significant associations between caries treatment and socio-economic variables (Sgan-Cohen *et al.* 2000). The association between high caries levels and Israeli born parents, found in this study, might be explained by the emerging influence of "westernized fast-food" culture among Israelis.

Caution needs to be employed when comparing data collected over time. Different examiners collected the data, and might have applied their diagnoses differently. However one examiner had been present throughout and had calibrated all examiners.

Another potential problem might be the changing diagnosis of caries, as illustrated by modified WHO criteria of recording DMF. The latest guidelines recommend using a CPI probe (WHO,1997). However, in order to avoid this potential bias, the 2005 survey employed the same criteria and instruments as had been employed in the 1980's and 90s. Blunt, unsharpened sickle shaped explorers were employed in all three examinations and were not firmly pressed into fissures. It should be noted that a system, excluding radiographs, might be inadequately sensitive in an era of low caries levels.

Consent rates can influence results via participation bias. In the previous two surveys the response rate had been over 90%. Non-invasive examinations had previously been routinely conducted in Jerusalem, as part of the municipal health services. At the present time, consent issues are more stringent and the local Israeli Research Board demand individually signed informed consent from each child's parent. The present examination consent level was 73%. Despite all attempts, it was not possible to achieve the previous higher levels.

A final potential difficulty in data interpretation derives from the fact that these surveys were conducted in one Jerusalem region. One orthodox religious and one very low socio-economic school were excluded (in all three studies). The sample therefore might not ideally represent the whole city. The municipality is aware of the relatively poor oral health of these sectors.

Data from the 2005 study cannot ascertain the causal factors for caries reduction. It is, however, proposed that the improved dental health levels were associated with water fluoridation (initiated in Jerusalem in the late 1980's) and a municipal preventive dental program, with emphasis on sealants, which had started in 1992. We assumed that children were brought up in the areas of study, although these data were not documented.

In conclusion, the magnitude of dental caries reduction revealed in this study, for two age groups, for both permanent and deciduous dentitions, and over a period spanning three decades, cannot be disregarded. Our data are consistent with results from most western countries (Marthaler, 2004) and with other studies in Israel (Sgan-Cohen *et al.* 1997, 2000, Zusman *et al.* 2005).

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