

Dental caries and oral hygiene patterns in Afrikaans- and English-speaking white high school pupils from upper and lower socio-economic areas of Johannesburg and environs

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SUMMARY

An epidemiological survey of dental caries and oral hygiene of Afrikaans- and English-speaking pupils was undertaken in upper and lower socio-economic areas. Dental caries affected 99,7 per cent of the pupils (mean age 16,3 years). In general Afrikaans-speaking pupils had significantly higher mean and median DMFT scores than English-speaking pupils, although this is not clinically relevant. Individuals in the lower socio-economic areas had significantly higher DMFT values than those in upper socio-economic areas, which appear of clinical relevance. A modifying influence on DMFT of self-performed oral hygiene, determined by using OHI-D grouping, was evident but was less than had been expected and was in keeping with the report of Bellini et al (1981).

OPSOMMING

'n Epidemiologiese ondersoek na tandkaries en mondhygiëne onder Afrikaans- en Engels-sprekende leerlinge in hoër en laer sosio-ekonomiese areas is onderneem. Tandkaries het onder 99,7 persent van die leerlinge voorgekom (gemiddelde ouderdom 16,3 jaar). Oor die algemeen het Afrikaans-sprekende leerlinge aansienlik hoër gemiddelde en mediaan DMFT tellings gehad as die Engels-sprekende leerlinge, alhoewel dit nie klinies belangrik is nie. Persone in die laer sosio-ekonomiese areas het betekenisvol hoër DMFT waardes gehad as dié in die hoër sosio-ekonomiese areas. Dit word wel as klinies belangrik beskou. Self toegepaste mondhygiëne het 'n wysigende invloed op DMFT gehad soos deur die gebruik van OHI-D groepering bepaal is. Dit was egter minder as wat verwag is en is in ooreenstemming met die verslag van Bellini et al (1981).

INTRODUCTION

Self performed oral hygiene is a modifying factor in the development of dental caries but the effect on dental caries is less clear-cut than has been believed (Bellini, Arneberg and von der Fehr, 1981). Studies on the effect of self-performed oral hygiene on dental caries in high school pupils in South Africa is lacking.

The aims of the investigation were to determine dental caries patterns in Afrikaans- and English-speaking high school pupils from high and low socio-economic areas as well as the influence of oral hygiene on these patterns.

MATERIALS AND METHODS

The investigation was carried out in 1981. Schools were selected on the basis of a dissertation on school leavers by Coetzee (1977) who clearly demonstrated differences in the socio-economic strata of Afrikaans-speaking pupils attending Hoërskool Linden (higher socio-economic area) compared with Die Burger Hoërskool (lower socio-economic area) both situated in Johannesburg. These schools formed the nucleus of the study.

An English-speaking high school comparable to Linden High School selected for the investigation was Roosevelt High School, situated in the same higher socio-economic area. Western High School was the lower socio-econ-

omic English-speaking school and was situated in the same area as Die Burger Hoërskool. When a problem of insufficient numbers of pupils willing to be examined arose, additional schools were selected. Northcliff High and Malvern High (English-speaking) as well as Florida Hoërskool (Afrikaans-speaking) drawing children from similar areas to those schools originally selected were chosen. In all the schools studied no hostels are attached to which pupils from other areas might be drawn, thus all the pupils examined came from the areas surrounding the schools.

Authorization to undertake the investigation was obtained from the educational authorities and school principals while written permission from parents, to examine their children, was also received. A total of 800 pupils was the target number but ultimately 611 participated in the study as co-operation from teachers, parents and pupils varied from school to school. The pupils were examined in good daylight or in a mixture of artificial light and daylight using a plane mouth mirror and sharp sickle-shaped probe. Dental caries was diagnosed as being obvious caries when a sharp probe caught in a suspicious area, pit or fissure or when obviously carious (Staz, 1938). In the study the amount of "catch" accepted corresponded to the diagnostic criteria of the WHO (1977). If there was any doubt, the tooth was regarded as

healthy. Teeth lost due to trauma or for orthodontic reasons were not included in the study. To ensure consistent diagnosis the examiner (W.T.) was calibrated according to a method advocated by Dr. John Bulman of the London Hospital Dental School (personal communication to Dental Research Institute), using extracted teeth mounted in plaster of Paris blocks. After reaching a percentage reproducibility of 98 per cent the study was begun. During the survey 10 per cent of the pupils were re-examined to check reproducibility of the examiner which was 93 per cent.

Oral hygiene was determined using the Simplified Oral Hygiene Index (OHI-S) of Greene and Vermillion (1964).

The information was recorded on computer coding sheets, transferred to punch cards and analysed in an IBM 370/158 computer using SPSS (Nie *et al*, 1975) and SAS (SAS Institute, 1982). Statistical tests used were the median and chi-square tests (Siegel, 1956) while the critical level of statistical significance chosen was $p < 0,05$.

RESULTS

The ages of the children ranged between 15 and 19 with a mean age of 16,3 (sd 0,8) which was also the mean age and standard deviation for the 275 females and 336 males. To ensure adequate sample size for the various groups examined the original recommendation of WHO (1971) that subjects between 15 and 19 be grouped into a single class was followed. The first variable examined was sex. The percentage of caries-free pupils and DMFT scores were similar for females and males, although components of the DMFT did show statistically significant differences. This is best illustrated by the ratios of D, M and F to DMFT expressed as a percentage. Females had significantly less untreated caries ($p < 0,05$) than males (D/DMFT 32,4%:30,0%) and significantly more ($p < 0,05$) fillings (F/DMFT 54,3%:48,0%). Females also had significantly lower ($p < 0,05$) OHI-S scores (mean 0,7 sd 0,6) than males (mean 0,9 sd 0,7). Subsequent results presented in this paper will not be broken down by sex.

The dental caries and OHI-S results for Afrikaans-speaking and English-speaking pupils are summarized in Table 1. The DMFT scores ($p < 0,05$) and M component of this ($p < 0,01$) were significantly higher for the Afrikaans-speaking group.

Table 1: Dental caries and OHI-S observations by language group

	Afrikaans	English	Combined group
n	275	336	611
% caries free	0,4	0,3	0,3
mean DMFT	10,8	9,7	10,2
s.d.	4,4	3,8	4,1
median DMFT	9	8	9
D/DMFT (%)	34,1	37,5	35,9
M/DMFT (%)	15,4	11,4	13,3
F/DMFT (%)	50,5	51,1	50,8
Mean OHI-S	0,8	0,7	0,8
s.d.	0,7	0,7	0,7

Three oral hygiene groups were defined according to OHI-S scores as follows: "clean" = 0; "average" = > 0 and $< 1,0$; "dirty" = $> 1,0$. The pupils were subdivided according to these categories and the dental caries results are presented in Tables I and II. In the combined language group (Table II) there were only 2 caries-free

individuals and there was a slight increase in mean DMFT as oral hygiene worsened. The proportion of untreated caries also increased while the proportion of restored teeth fell with worsening oral hygiene. No statistically significant differences were found.

Table II: Dental caries observations by oral hygiene group

	Clean	Average	Dirty
n	105	348	158
% Caries free	0	0,3	0,6
Mean DMFT	9,6	10,3	10,6
s.d.	4,4	3,9	4,2
Median DMFT	8	10	10
D/DMFT (%)	23,5	33,3	48,6
M/DMFT (%)	16,5	12,1	14,3
F/DMFT (%)	60,0	54,6	37,1
Mean OHI-S	0	0,6	1,7
s.d.	0	0,3	0,6

Subdivision according to language group (Table III) showed consistently lower mean DMFT in the English-speaking pupils for each oral hygiene category but this was statistically significant only in the "dirty" group ($p < 0,02$). The proportions of the components of DMFT varied somewhat but extractions were more common in the Afrikaans-speaking group. Within the Afrikaans-speaking group there was also a steady increase in mean and median DMFT and in untreated caries with worsening oral hygiene. English-speaking pupils had approximately constant mean DMFT values but showed the same pattern of change in DMFT components as their Afrikaans-speaking compatriots. Further comparison between the oral hygiene groups within each language group showed that among Afrikaans-speaking pupils the "clean" group had significantly lower DMFT values than the "average" and "dirty" groups. No other statistically significant differences were found.

Table III: Dental caries observations by oral hygiene group by language group. A = Afrikaans-speaking pupils, E = English-speaking pupils

	Clean		Average		Dirty	
	A	E	A	E	A	E
n	45	60	152	196	78	80
% Caries free	0	0	0,7	0	0	1,3
mean DMFT	9,8	9,5	10,9	9,8	11,4	9,8
s.d.	5,7	3,3	4,2	3,7	3,9	4,3
median DMFT	8	9	10	9	11	9
D/DMFT (%)	26,5	21,1	29,7	36,4	46,0	51,9
M/DMFT (%)	23,4	11,1	13,2	11,1	15,7	12,5
F/DMFT (%)	50,1	67,8	57,1	52,5	38,3	35,6
mean OHI-S	0	0	0,6	0,6	1,7	1,7
s.d.	0	0	0,3	0,3	0,7	0,5

In the third investigation the results for the two language groups were subdivided by socio-economic area (Table IV). A consistent finding was that mean and median DMFT was more prevalent in the lower compared to the higher area. Also the prevalence of untreated caries, and missing teeth due to caries were higher in the lower socio-economic area while the prevalence of filled teeth was lower. English-speaking pupils had the lower mean and median DMFT values. Mean ODI-S scores were higher in the lower socio-economic areas. Statistical analysis showed no significant differences within each socio-economic area, between the DMFT values for Afrikaans- and English-speaking pupils. In contrast, within each language group pupils in lower socio-economic areas had significantly higher DMFT ($p < 0,05$).

Further subdivision according to oral hygiene group within each socio-economic area and language group was undertaken. The general trends were those already noted in Tables III and IV.

Table IV: Dental caries observations by socio-economic area by language group

	Lower socio-economic area		Upper socio-economic area	
	A	E	A	E
n	139	145	135	191
Caries-free (%)	0,7	0,7	0,8	0
Mean DMFT	11,9	10,3	9,8	9,3
s.d.	4,8	4,2	3,7	3,3
Median DMFT	11	10	9	8
D/DMFT (%)	37,8	48,4	29,5	28,4
M/DMFT (%)	21,5	13,7	8,0	9,6
F/DMFT (%)	40,7	37,9	62,5	62,0
Mean OHI-S	1,1	1,1	0,5	0,5
s.d.	0,8	0,7	0,5	0,5

DISCUSSION

No generally accepted classification of socio-economic status exists for scientific studies in South Africa, thus this study was based on a Master of Education dissertation by Coetzee (1977). In this he clearly showed a difference in the socio-economic strata of the pupils attending Hoërskool Linden compared with the pupils of Die Burger Hoërskool. He compared, among many things, the level of schooling reached by the parents as well as the occupation of the parents. For example, at Hoërskool Linden there were numerous pupils whose fathers were in one of the professions compared to only one at Die Burger Hoërskool.

The socio-economic difference was obvious during the study. The Hoërskool Linden feeder area is a residential area with wide streets, large houses and neat gardens, that give an impression of prosperity compared with the narrow streets, small houses and gardens from the Die Burger Hoërskool feeder area. The general appearance of the pupils at Hoërskool Linden from a higher socio-economic area matched expectations. They were well dressed and their school uniforms were well cared for. The pupils of Die Burger Hoërskool also appeared neatly dressed, but their uniforms were not as well cared for. The principal of the latter school explained that an organization supplied school clothes to pupils whose parents could not afford them so that all the pupils had a uniform appearance. At Hoërskool Linden the number of matric pupils (150) was approximately 85 per cent of those who started off in Standard 6, a pattern that had been observed over many years. In contrast, at Die Burger Hoërskool only 50 of the original 300 Standard 6 pupils progressed to matriculation. This pattern had been maintained over many years even when the economic climate was good. These observations appear to justify the choice of schools as representative of differences between the socio-economic areas.

The pupil population examined at each school was self-selected through having to provide written parental consent to examination. Usually, in non-invasive dental examinations high co-operation is obtained, but accompanying this dental investigation parents were asked to complete a questionnaire on habitual sugar intake as well as an anthropometric investigation requiring undressing down to underwear. Teenage sensitivity at one school appeared to resent this, which resulted in a lower than usual volunteer rate. In spite of this, sufficient numbers were examined to provide a precision of 0,7 DMFT (WHO 1977).

The low prevalence of caries-free pupils seen in all groups was based on earlier studies (Retief, Cleaton-Jones & Walker, 1975; Walker *et al*, 1982). The percentage of caries-free subjects among English-speaking pupils had decreased since 1973, the year in which Retief *et al's* (1975) study was carried out (Table V). This implies that the improvement in dental caries observed elsewhere in the world has not yet reached the Johannesburg White 16-18 year old. Comparison of Walker *et al's* (1982) figures to those of the present study shows similar trends.

Table V: Comparison of dental caries prevalence in 16-18 year-old Afrikaans- (A) and English-speaking (E) pupils

	Walker <i>et al</i> , 1982		Present study		Retief <i>et al</i> , 1975
	A	E	A	E	E
n	431	308	251	268	105
Caries free (%)	0,5	0,7	0,4	0	3,8
Mean DMFT	10,2	9,0	11,0	9,9	10,0
D/DMFT (%)	29,1	26,6	34,6	35,0	
M/DMFT (%)	15,8	9,3	18,0	11,4	
F/DMFT	55,1	64,1	47,4	53,6	

In this investigation self performed oral hygiene has been shown to have some modifying effect, the clean group having less caries than either average or dirty groups but this was not as great as had been expected. This may be influenced by the empirical classification into groups and perhaps the OHI-S score on the day of examination might not have been representative of a pupil's usual oral hygiene status. More research in this area is needed, particularly since the OHI-S index was mainly developed for studying the relationship between plaque and periodontal disease and may have limitations when used in caries studies. Other modifying factors such as diet, use of fluoride and so on should be included in future studies.

This study has clearly shown that pupils from low socio-economic areas have significantly greater caries experience, confirming a long-held clinical impression. Less dental treatment had been received by the children from poorer areas, and more of this was in the form of extractions. The effect of socio-economic area was slightly greater for the Afrikaans-speaking pupils. These observations suggest that a greater effort is needed to make lower socio-economic areas more dentally aware.

Although not specifically reported earlier in this paper, it was noted that in the higher socio-economic group more pupils were undergoing orthodontic treatment, more had fissure sealants applied to their teeth, more had crowns and a higher level of conservative dentistry was present than in the low socio-economic group confirming the original selection of the schools on the basis of socio-economic status. An unexpectedly high number of pupils with fixed orthodontic appliances had untreated dental caries.

Although dental caries experience was greater among Afrikaans-speaking compared to English-speaking pupils, this difference has little clinical relevance.

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REFERENCES

- Bellini, H.T., Arneberg, P. & von der Fehr, F.R. (1981) Oral hygiene and caries : A review. *Acta Odontologica Scandinavica*, **39**, 257-265.
- Coetzee, C.N. (1977) 'n Skooldiagnostiese ondersoek na skoolstaking, met beklemtoning van die toekoms verwagtings van leerlinge as faktor by skoolstaking. Master of Education dissertation, Randse Afrikaanse Universiteit.
- Greene, J.C. & Vermillion, J.C. (1964) The simplified oral hygiene index. *Journal of the American Dental Association*, **68**, 25-31.
- Nie, N.H., Hull, C.H., Jenkins, J.G., Steinbrenner, K. & Bent, D.H. (1975) *Statistical Package for the Social Sciences*. 2nd Ed. New York: McGraw-Hill.
- Retief, D.H., Cleaton-Jones, P., & Walker, A.R.P. (1975) Dental caries and sugar intake in South African pupils of 16-17 years in four ethnic groups. *British Dental Journal*, **138**, 463-469.
- Siegel, S. (1956) *Non-parametric statistics for the social sciences*. Tokyo: McGraw Hill-Kogakusha.
- Statistical Analysis System* (1982) Cary: SAS Institute Inc.
- Staz, J. (1938) Dental caries in South Africa. *South African Journal of Medical Sciences*, **3**, Supp. 1-63.
- Walker, A.R.P., Dison, E., Duvenhage, A., Walker, B.F., Friedlander, I. & Aucamp, V. Dental caries in South African Black and White high school pupils in relation to sugar intake and snack habits. *Community Dentistry and Oral Epidemiology*, **9**, 37-43.
- Walker, A.R.P., Dison, E., Walker, B.F. & Segal, A.F. (1982) Contrasting patterns of caries profile and dental treatment in pupils of 16-18 years in South African ethnic groups. *Community Dentistry and Oral Epidemiology*, **10**, 69-73.
- World Health Organization (1971) *Oral health surveys*. Geneva: World Health Organization.
- World Health Organization (1977) *Oral health surveys*. 2nd Ed. Geneva: World Health Organization.