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Sugar, snacks, fluoride and dental caries in RSA preschool children: an overview

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For some time now we have carried out epidemiological field studies on dental caries, sucrose intake and related matters, in South African groups. It seems appropriate to provide, for the general dental practitioner, an overview of research abroad in relation to our local research. This is the purpose of this article.

SUCROSE CONSUMPTION AND CARIES

Sucrose consumption in preschool or school children, or in adolescents is generally accepted as being promotive of dental caries. (Takeuchi, 1961; Yudkin, 1969; Bowen, 1978; Newbrun, 1979; Shaw, 1985). That this is no recent association has been illustrated by Shaw (1985) in his review of the relationship of diet to dental caries in which he quoted a question posed by Aristotle in 350 BC "Why do figs when they are soft and sweet produce damage to the teeth?" This cloying stickiness is accepted by many to be the form in which sugar eaten frequently, for instance in sweets, cakes and other snacks, is particularly harmful (Fisher, 1971; Poole and Darling, 1972; Grenby, 1976). The findings of the well-known Vipeholm study (Gustafsson *et al,* 1954) strongly support this point of view. In contrast there are the findings in another classical study completed at much the same time. King (1946) reported that over a 2 year period the eating of sweets and chocolate biscuits by young children on retiring was found not to give rise to excessive caries.

If overseas workers disagree on the role of sucrose in caries promotion or causation what conclusions can we draw from our South African studies, particularly those conducted on preschool children? Sreebny (1982) has suggested that an intake of 50 grammes of sugar per day could possibly be considered a 'safe' or an acceptable amount, presumably, irrespective of the form in which it is eaten. If 50 g is considered a 'safe' daily sucrose intake then there are groups of preschool children in South Africa who comply with these amounts. Caries should not therefore be a problem. In a large series of preschool children aged 2 to 5 years in 4 ethnic groups the mean daily sucrose intake in 1976/78 ranged from 51-89 g, in 1980 from 33-94 g, and in 1984 from 38-85 g. Black rural children had the lowest sucrose intakes as can be seen in Table I. There has been a fall in the mean sucrose intake over the period studied, except among coloured (Eur-African-Melay) children, whose mean intake has risen. However, within each ethnic group sucrose intakes have remained relatively constant, in other words there was little difference in mean intake at 2-3 compared to 4-5 years (Table I) except for black rural children in 1980.

The caries pattern rose consistently with age (Richardson *et al,* 1984). This is not unexpected as caries is an accumulative condition. What is surprising is the overall rise of caries prevalence in groups on mean daily sucrose intakes of around 50 g and its fall with a mean as high as 89 g. In Table II the percentages of caries over 8 years in 4 ethnic groups of children aged 2-3 and 4-5 years are shown — here too the rise in prevalence of caries with age is apparent. However, among 4-5 year old children there has recently been a fall in caries prevalence in both black groups, more marked in black rural than in urban groups, a steady state in Indian but a fall in white children. Among younger children only the white group showed a falling prevalence by 1980. This fall in black childrens' caries prevalence was predicted by Cleaton-Jones *et al* (1979) as was that for whites. The anticipated rise in Indian childrens' caries prevalence has also come to pass, and may have reached its peak.

Table I: **Mean sucrose intakes in grammes per day for South African preschool children aged 2-3 and 4-5 years from 1976-1985.**

Group	Mean sucrose intakes in grammes per day				
	2-3 years		4-5 years		
	1976/78	1980	1976/78	1980	1984
Black rural	55	33	51	78	38
Black urban	58	62	68	50	54
Coloured urban	78	75	72	86	
Indian urban	68	94	94	85	85
White urban	88	73	89	75	75

Table II: **Percentage caries in South African preschool children aged 2-3 and 4-5 years from 1976 to 1984**

Group	Percentage caries				
	2-3 years		4-5 years		
	1976/78	1980	1976/78	1980	1984
Black rural	40	53	46	78	52
Black urban	40	62	74	79	71
Coloured urban	46	80	75	85	
Indian urban	36	43	79	85	85
White urban	64	35	71	72	48

FREQUENCY OF SUGAR INTAKE AND SNACKING

Many workers have been unable to show that between meal snacking was associated with an increase in dental caries (Bibby, 1975; Walker and Cleaton-Jones, 1978; Jackson, 1979; Garn *et al,* 1980; Walker, 1984). Questions may therefore be asked — are snack eating habits as harmful as is thought? Does total sucrose intake play a meaningful role in caries development? Sundin, Birkhed and Granath (1983) have shown that in Swedish children sweets are not as harmful now as they previously appeared to be. Stecksén-Blicks, Arvidsson and Holm (1985) have noted no change over 10-15 years in sugar intake from meals and snacks, or the frequency of eating these, but have recorded a falling caries prevalence in 3 areas in Sweden in 4,8 and 13 year old children. The frequency of eating, including sucrose containing items, has now been extended to 5 times a day, but more frequent consumption is considered cariogenic (Granath *et al,* 1978). The latter authors have emphasized the complex interaction of several factors, which they consider may modify the role of sucrose in dental caries. However, Bowen (1979) and Newbrun (1982) are convinced that sucrose is harmful, but Naylor (1984) points out that it is not the absolute amount of sucrose eaten but the pattern of eating that is important in caries causation.

MEAL PATTERNS

In considering the meal patterns of children both overseas and locally various differences are notable. In Sweden the accepted meal pattern for children is to eat 5 times a day, namely breakfast, lunch, dinner, a midmorning and a mid-afternoon snack (Granath, *et al* 1978). This is considered as constituting a 'good diet'. This pattern is also found in German children amongst whom most have 4-5 meals a day and nearly all had snacks (Kormann and Möhr, 1984).

In South Africa meal patterns may range from 2 to 5 a day with or without snacks. From discussions with community leaders and teachers and from field experience we find that in the country black people may have only 2 meals a day with a meal taken at around 10-11am and the evening meal as the main meal. Children may take a bowl, or other container, of stiff maize porridge to eat at school. Breakfast, if taken, consists of a cup of tea and some left over maize porridge or a slice of bread. Snacks are not often eaten. Urban black children usually have 4 meals a day, tending to have a light breakfast, similar to country dwellers. Schoolchildren have a meal (usually achaar on bread bought from vendors at school) at midmorning, a meal on returning home from school in the afternoon and the main meal in the evening. Snacks may or may not be eaten in the late afternoon. Working adults tend to have 3 meals with a little snacking, but if taken usually in the afternoon. Coloured, Indian and white meal patterns tend to follow overseas patterns, with 3 meals a day plus 2 snack periods midmorning and afternoon. Individual variations, of course, occur in all groups.

What therefore, of the frequency of intake? Zita, McDonald and Andrews (1959) found no correlation between frequency of eating snacks and DMFT. In our studies on Indian 5 year old children who had the highest caries prevalence, those who ate snacks and sweets frequently raised the mean dmft by 1. Frequent snack eating in the presence of poor oral hygiene increased the possibility of developing a greater number of cavities, but again not in the proportion expected if snack eating *per se* was causative (Cleaton-Jones *et al,* 1984). In the presence of high sucrose intakes and poor oral hygiene, dmft rose by only 1,8 teeth, hardly a significant difference, but an important clinical observation. In those caries-free, the frequency of eating sweets and snacks only differed significantly for biscuits (a non-sticky snack food). The actual amounts of snacks and sweets eaten by these 2 contrasting groups were almost identical (Richardson, 1981).

FLUORIDE AND CARIES

What are the facts? That fluoride has decreased the prevalence of dental caries has been proven without a doubt (Fejerskov, Antoft and Gadegaard, 1982; Burton *et al,* 1984). Areas with high fluoride content in the drinking water generally have lower caries prevalences compared to those with low fluoride levels (Anonymous, 1974; Forsman, 1974). The almost universal use of fluoridated toothpastes has probably played a large role in the reduction of caries in the western world (König, 1982) but was found to be largely of academic importance in Kenya where Ogada (1984) reports that on average a 20 g tube of toothpaste would last a Kenyan for a year. Only 10 per cent of this population used toothpaste and 35 per cent used a toothbrush.

What of the effect of fluoride on caries development in young children in South Africa? White childrens' caries prevalence is dropping (Cleaton-Jones *et al,* 1983) possibly related to the use of fluoridated toothpastes which were used by the majority of children; only about 5 per cent did not have their teeth cleaned. Only some 50 per cent of white children are given fluoride tablets. Approximately 20 per cent of Indian children were given fluoride tablets, but the majority had their teeth cleaned with fluoridated toothpaste and very few, about 5 per cent, had no oral hygiene, and yet Indian children had the highest caries prevalence. No explanation can be given for the recent drop in caries prevalence in black groups as fluoride tablet use was virtually nil, but most black children in town used toothpaste and about a half in the country; 20 per cent of urban and 50 per cent rural children did not have their teeth cleaned, and yet rural children had the lowest caries prevalence of all groups (Richardson, Cleaton-Jones and Sinwel, 1985).

Two groups of rural coloured children were examined; one group living in an area characterised by a high fluoride level in the drinking water (3-8ppm), and the other group in a low fluoride area (0,2ppm), living about 90 km apart. Children in the high fluoride area had a significantly greater mean daily sucrose intake of 64 g per day, than those living in the low fluoride area, 49 g per day. Both groups can, however, be considered to have a low sucrose intake (Richardson, 1981). Caries was very common, with a prevalence of 68 per cent in the area of low fluoride intake, and yet in the high fluoride

area was very low, 19 per cent, indeed lower than that found in any other group studied.

The presence of fluoride at high levels in the drinking water resulted in a far lower prevalence, mean dmft of 0,7 ± 2,0 (331 subjects) than when it was in low concentration, where the teeth decayed very rapidly, with a mean dmft of 5,4 ± 6,0 &177 subjects) (McInnes and Richardson, 1979). With such a high fluoride intake fluorotic mottling was present in more than half of the children, and was even present at one year of age in 40 per cent of the babies who were for the most part breastfed (McInnes, Richardson and Cleaton-Jones, 1982).

DISCUSSION

A declining caries prevalence has been reported from western countries (Lawson, Brown and Oliver, 1978; Naylor, 1982). In the case of South African white children falls have also occurred (Cleaton-Jones *et al,* 1983). These childrens' sucrose intakes have also fallen. On the other hand caries prevalence has been reported as increasing in third world populations (Newbrun, 1982). In South African black groups this has also been found, but in spite of this upward caries trend and the more recent decline, mean sucrose intakes have fallen. In Indian children mean sucrose intakes decreased which was associated with an increasing caries prevalence; however, this trend may now have reached its peak.

There are as yet too many confusing epidemiological results to incriminate sucrose as the main cause of caries in these young children, or to state definitely that snacking is promotive, or that frequency of sucrose ingestion is harmful. That fluoride in the drinking water reduces caries attack is quite clearly demonstrated and its influence by far supersedes that of differences in daily dietary intake of sucrose; in fact even in the presence of a generally low sucrose intake its caries reducing action is evident. Fluoridated toothpastes have probably also played a role in the reduction of caries, at least in the western world, where their use is almost universal (Koch, 1982; König, 1982) and their use is also being encouraged in third world countries (Ogada, 1984). However, we have yet to produce convincing evidence of harm to the teeth from the 'sweet' things of life. This does not mean a licence to gorge on sweets, snacks or sucrose, but taken in moderation little evidence of a harmful effect is present at least for the non-susceptible child. The susceptible child may well be advised to reduce intake of 'sweet' foods as a precautionary measure. Unfortunately, at present, there is no accepted measure that can differentiate between the susceptible and the non-susceptible subjects. However, for both types fluoride, in tablet form and/or the use of fluoridated toothpaste would obviously be beneficial.

REFERENCES

Anonymous. (1974) Dental caries prevalence and trace elements other than fluoride. *Nutrition Reviews.* **32,** 120-122.

Bibby, B.G. (1975) The cariogenicity of snack foods and confections. *Journal of the American Dental Association.* **90,** 121-132.

Bowen, W.H. (1978) Dental caries. *New York State Journal of Medicine.* **78,** 2278-2279.

Bowen, W.H. (1979) Role of carbohydrates in dental caries. In *Proceedings of the National Symposium on Dental Nutrition.* ed Wei Shy. p 78. Iowa City: University of Iowa Press.

Burton, V.J., Rob, M.I., Craig, G.G. & Lawson, J.S. (1984) Changes in the caries experience of 12-year-old Sydney schoolchildren between 1963 and 1982. *Medical Journal of Australia.* **140,** 405-407.

Cleaton-Jones, P., Richardson, B.D. & Walker, A.R.P. (1979) Anticipated changes in caries prevalence in South Africa. *Journal of Dental Association of South Africa.* **34,** 723-727.

Cleaton-Jones, P., Richardson, B.D., Setzer, S. & Williams, S. (1983) Primary dentition trends, 1976-1981, in four South African populations. *Community Dentistry and Oral Epidemiology.* **11,** 312-316.

Cleaton-Jones, P.E., Richardson, B.D., Sinwel, R.E., Rantsho, J. & Granath, L. (1984) Dental caries, sucrose intake and oral hygiene in 5-year-old South African Indian children. *Caries Research.* **18,** 472-477.

Fejerskov, O., Antoft, P. & Gadegaard, E. (1982) Decrease in caries experience in Danish children and young adults in the 1970's. *Journal of Dental Research.* **61,** 1305-1310.

Fisher, A.M. (1971) Sugar and dental health. *Journal of the American Dental Association.* **83,** 513.

Forsman, B. (1974) Dental fluorosis and caries in high-fluoride districts in Sweden. *Community Dentistry and Oral Epidemiology.* **2,** 132-148.

Garn, S.M., Cole, P.E., Solomon, M.A. & Schaefer, A.E. (1980) Relationship between sugar foods and the DMFT in 1968-1970. *Ecology of Food and Nutrition.* **9,** 135-138.

Granath, L.E., Rootzen, H., Liljegren, E., Holst, K. & Köhler, L. (1978) Variation in caries prevalence related to combination of dietary and oral hygiene habits and chewing fluoride tablets in 4 year-old children. *Caries Research.* **12,** 83-92.

Grenby, T.H. (1976) Dental decay and surgary foods. *Nursing Mirror.* August 19, 46-51.

Gustafsson, B.E., Quensel, C.E., Lanke, L.S., Swenander, L., Lundquist, C., Grahnen, H., Bonow, B.E. & Krasse, B.O. (1954) Vipeholm Dental Caries Study. The effect of different levels of carbohydrate intake on caries activity in individuals observed for five years. *Acta Odontologica Scandinavica.* **11,** 232-364.

Jackson, D. (1979) The 'sweet tooth; and caries experience. *The Probe.* July, 4-8.

King, J.D. (1946) Dental caries. Effect of carbohydrate supplements on susceptibility of infants. *Lancet.* **1,** 646-649.

Koch, G. (1982) Evidence for declining caries prevalence in Sweden. *Journal of Dental Research.* **61,** 1340-1345.

König, K.G. (1982) Impact of decreasing caries prevalence: Implications for dental research. *Journal of Dental Research.* **61,** 1378-1383.

Kormann, I. & Möhr, M. (1984) Dietary behaviour of Class 6 pupils. *Ernährungsforschung — Wissenschaft und Praxis.* **29,** 98-102. Cited from *Nutrition Abstracts and Reviews* 1985, **55,** 205.

Lawson, J.S., Brown, J.H. & Oliver, T.I. (1978) The dramatic improvement in dental health of school children in the Northern Metropolitan region of New South Wales. *Medical Journal of Australia.* **1,** 124-125.

McInnes, P.M. & Richardson, B.D. (1979) Fluorosis and caries in the deciduous dentition of a South African population. *Journal of Dental Research.* **58,** 522.

McInnes, P.M., Richardson, BD. & Cleaton-Jones, P.E. (1982) Comparison of dental fluorosis and caries in primary teeth of preschool-children living in arid high and low fluoride villages. *Community Dentistry and Oral Epidemiology.* **10,** 182-186.

Naylor, M.N. (1982) The declining prevalence of dental caries. *British Dental Journal.* **153,** 151-152.

Naylor, M.N. (1984) Nutrition and dental decay. *Proceedings of the Nutrition Society,* **43,** 257-263.

Newbrun, E. (1979) Dietary carbohydrates: Their role in cariogenicity. *Medical Clinics of North America.* **63,** 1069-1086.

Newbrun, E. (1982) Sucrose in the dynamics of the carious process. *International Dental Journal.* **32,** 13-23.

Ogada, T. (1984) Fluorides and dental health revisited. *East African Medical Journal,* **61,** 261.

Poole, D.F.G. & Darling, A.I. (1972) Causes of dental decay. *Community Health.* **3,** 214-218.

Richardson, B.D. (1981) Dental caries prevalences: Ethnic differences in South Africa with special reference to the intake of sugar containing foods. pp 77-91. Beunos Aires: World Sugar Research Organisation Symposium.

Richardson, B.D., Cleaton-Jones, P.E., Sinwel, R.E. & Rantsho, J.M. (1984) Trends in sugar intake: Do these parallel changes in caries prevalence among South African preschool children? *Community Dentistry and Oral Epidemiology.* **12,** 140-144.

Richardson, B.D., Cleaton-Jones, P.E. & Sinwel, R.E. (1985) Social class influence on caries prevalence, oral hygiene and daily sucrose intake of South African preschool children. *South African Journal of Science* — under consideration.

Shaw, J.H. (1985) Diet and dental health. *American Journal of Clinical Nutrition.* **41,** 1117-1131.

Sreebny, L.M. (1982) The sugar-caries axis. *International Dental Journal* **32,** 1-12.

Stecksén Blicks, C., Arvidsson, S. & Holm, A.K. (1985) Dental health, dental care, and dietary habits in children in different parts of Sweden. *Acta Odontological Scandinavica.* **43,** 59-67.

Sundin, B., Birkhed, D. & Granath, L. (1983) Is there not a strong relationship nowadays between caries and consumption of sweets? *Swedish Dental Journal.* **7,** 103-108.

Takeuchi, D.D.S. (1961) Epidemiological study on dental caries in Japanese children, before, during and after World War II. *International Dental Journal.* **11,** 443-457.

Walker, A.R.P. & Cleaton-Jones, P.E. (1978) Dental caries and between meal snacks. *British Dental Journal.* **1,** 361.

Walker, A.R.P. (1984) How practical are meaningful reductions in dental caries by dietary means? *Nutrition Abstracts and Reviews.* **54,** 211-217.

Yudkin, T. (1969) Dental decay is preventable: Why not prevented? *British Dental Journal.* **127,** 425-429.

Zita, A.C., McDonald, R.E. & Andrews, A.L. (1959) Dietary habits and the dental caries experience in 200 children. *Journal of Dental Research.* **38,** 860-865.