

Short communication

A LABORATORY EVALUATION OF THE EFFICACY OF A HERBAL DENTIFRICE ON DENTAL CARIES IN THE RAT

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The efficacy of a topically applied herbal dentifrice (toothpaste) Dabur^(R) was evaluated in thirty albino rats. Dental caries was induced by inoculating their mouths with Streptococcus viridans and then fed a cariogenic 56% sucrose sugar in addition to rat pellets. The animals were then divided into 3 equal groups with 10 rats per group. Group 1, the (control) had daily molar teeth brushing with water, while Group II Dabur^(R) had molar teeth brushing daily with the paste and Group III Maxam^(R) had molar teeth brushing using Maxam^(R) toothpaste. Water was available throughout the eight weeks of the study after which the animals were sacrificed, the jaws separated and the molar teeth scored for dental caries. The results showed a significant ($p < 0.05$) caries reduction of 54.37% by the Dabur^(R) toothpaste and 36.86% by Maxam^(R). This reduction suggested the inhibitory role the experimental herbal dentifrice Dabur^(R) plays in caries development.

Keywords: Dental Caries, Dentifrices, Dabur^(R), Maxam^(R), Caries Scores.

INTRODUCTION

Dental Caries (tooth decay) is a disease of insidious onset and its rate of progress is slow in children and adults.¹ It involves gradual demineralization of hard tooth substance (especially enamel and dentine) with eventual cavity formation. The decalcification process is due to acid production by bacterial in the mouth, followed by invasion and destruction of the remaining organic tissue by bacterial enzymes². Dental caries is more commonly found in the developing and developed countries where there is a high consumption rate of refined carbohydrates². In Nigeria, caries levels have increased tremendously in different age groups as previously reported^{3, 4, 5}. In children, dental caries is most likely to occur soon after the eruption of the tooth and since the majority of clinical trials are concerned with the primary prevention of caries, it is essential that the subjects have surfaces available which have a high potential for developing lesions¹. Indeed, a carious lesion of a permanent

tooth may take a year or even longer before it is detectable at the clinical level.

The literature abounds with reports of clinical trials carried out to test the efficacy of dentifrices in combating tooth decay, periodontal disease, calculus formation and dentinal hypersensitivity. The earliest reported clinical study to test the anti-caries effect of a dentifrice would seem to be that by Stephan and Miller⁶ in which the 16 months use of a dentifrice containing 45% urea produced a 100% reduction in decayed, missing and filled surfaces in 12 subjects aged 12-15 years⁶. Over the years clinical trials have been published concerning the efficacy of incorporating sodium monoflorophosphate into a dentifrice in concentrations ranging from 0.76 to 2%.

All studies have shown some benefits in reducing caries incidence over a period of the clinical trial, the percentage reduction varying between 8 and 53%⁷⁻¹¹. The replacement of fluoride by a more active agent in topically applied product has been the subject of many investigations. In recent years, however, dentifrices have been

developed containing antibacterial substances, which are thought may reduce bacterial activity in plaque and in the stagnant parts of the mouth^{12, 13}.

Laboratory studies have tried to simulate oral conditions as closely as possible, and in order to find out whether conclusions reached from in vitro studies are correct, a biological model is desirable¹². There is a preponderance of various brands of herbal and fluoride toothpastes being marketed all over the place and the literature is not clear about their acclaimed efficacy or inhibition of caries development. Therefore the thrust of this study was to evaluate the efficacy of a herbal dentifrices on dental caries reduction in the rat and compare this reduction with a fluoride containing toothpaste (Maxam).

MATERIALS AND METHOD

Thirty albino rats (21 days old), and of both sexes were inoculated orally, with 0.2ml of a freshly prepared glucose nutrient broth culture of *Streptococcus viridans* for the first five days of the experiment. The animals were then divided into three groups and fed rat pellets containing in addition 56% sucrose in granulated form. Water was provided *ad libitum*.

Group I had daily brushing of their molar teeth with water and therefore served as control. Group II had brushing of their molars with the herbal toothpaste Dabur^(R). Group III had molar teeth brushing with Maxam^(R) toothpaste. The toothpaste application was given daily for two to three minutes per rat with the use of cotton buds (modified tooth brush) in back and forth motion on the molars from the sixth day and for a period of eight weeks. The animals were sacrificed at

the end of the experiment after which the jaws were dissected out and put in 95% ethyl alcohol. The maxillary and mandibular molar teeth were then scored for dental caries using modified Blechman et al¹³ scoring method with the aid of a demonstration magnifying lens.

Composition of Dabur toothpaste: 5% herbal extract (active principle), calcium carbonate, detergent, sodium laurylsulphate sweetener and sorbitol.

Statistical Analysis: Results are expressed as mean \pm standard deviation. Comparison between control and experimental values was performed using the student t- test. Significance level was set at 95% confidence interval and P values less than 0.05 were accepted as significant.

RESULTS

The mean caries scores observed in Group I, II and III are shown in Table 1. The total caries score in the control Group was 103 with the mean caries score of 10.3 ± 0.94 (mandibular 7.0 ± 0.63 and maxillary 3.3 ± 0.31).

The total caries score in Group II (Dabur) was 47 with the mean caries score of 4.7 ± 0.37 (mandibular 2.9 ± 0.24 and maxillary 1.8 ± 0.13) the caries score in Group III was 64 with the mean score of 6.4 ± 0.49 (mandibular $4.4 \pm .33$ and maxillary 2.0 ± 0.16). The Dabur^(R) Group significantly reduced caries scores in both jaws ($p < 0.05$) while the Maxam^(R) Group caries reduction was not significant.

Table 1.

Animal	Maxillary Molar Score			Mandibular Molar Score			Mean Caries Score \pm S.D	
	1st	2nd	3rd	1st	2nd	3rd	Maxilla	Mandible
Group	1st	2nd	3rd	1st	2nd	3rd	Maxilla	Mandible
Control(I)	14	10	9	28	22	20	3.3 \pm 0.31	7.0 \pm 0.63
Dabur (II)	10	4	4	16	8	5	1.8 \pm 0.13	2.9 \pm 0.24
Maxam(III)	12	4	4	28	10	6	2.0 \pm 0.16	4.4 \pm 0.33

DISCUSSION

The cariostatic efficacy of fluoride-containing toothpaste in various clinical trials cannot be over emphasized. However, the trend in the use of herbal products in combating oral diseases is on the increase and in order to find out whether conclusions reached from in vitro studies are correct, a biological model is desirable.

Therefore, the choice of rat is in agreement with previous reports^{14, 15}. In this study, the mean caries score in the control was 10.3 ± 0.94 while the experimental Dabur^(R) Group was 4.7 ± 0.37 . Caries was significantly reduced ($p < 0.05$) by 54.37% in the experimental Group II, but the 37.86% reduction in Maxam^(R) Group was not significant. The reduction in Dabur^(R) Group is relatively close to previous reports^{15, 16}. This significant level of reduction is also consistent with the findings of Guggeheim, Lutz and Schmid¹⁷. The mechanism of action of fluoride paste is well-documented^{1, 7, 9, 11-16}. However, the mechanism by which Dabur^(R) toothpaste reduced dental caries is not clear. However, it may be largely related to (i) a highly potent antibacterial agent in the herbal extract, (ii) oral acid neutralizer in the extract, (iii) decreased enamel solubility and (iv) plaque bacterial enzyme inhibitor in the extract. The abrasive property of Dabur^(R) toothpaste may also be adduced as a co-factor to its caries reduction.

Obviously, our markets have become dumping ground of several brands of herbal dentifrices with so called proven efficacy and affordable prices. Therefore, further studies on the characterization of antibacterial agent in the herbal extracts are required. In addition, studies on the humectant quantification as well as abrasivity of these products are required before final conclusions can be drawn on the mechanism of herbal dentifrices as shown in this study.

REFERENCES

- Naylor M.N. and Mainwaring, P.J. (1980)** Clinical trials of dentifrices. *Community Dent. Oral Epidemiol.* 8: 273-277.
Jeboda S.O. (1983) Dental Caries. *Nigeria Medical Practitioner* 5 (1): 5-9

Enwonwu C.O. (1974) Socio-economic factors in dental caries prevalence and frequency in Nigerians- An epidemiological study. *Caries Res.* 8: 155-171.

Adenubi J.O. and Okoisor F.E. (1976) Dental problems in 215 Nigerian Children seen at the Lagos University Teaching Hospital. *J. Int. Ass. Dent. Child.* 7:3-9.

Adenubi J.O. (1980) Dental Health status of 4 and 5 years old children in Lagos Private Schools. *Nig. Dent. J.* 1: 28-39.

Stephan R.M. and Miller B.F. (1944) Effectiveness of urea and synthetic detergents in reducing activity of human dental caries. *Proc. Soc. Exp. Biol. Med.* 55: 101-104.

Andlaw R.J. Tucker G.J. (1975). A dentifrice containing 0.8 percent sodium monofluorophosphate in an aluminium oxide trihydrate base. *Br. Dent. J.* 138: 426-432.

Hergreaves J.A. and Chester CG. (1973) Clinical trial among Scottish children on anti-caries dentifrice containing 2 percent sodium monofluorophosphate. *Community Dent. Oral Epidemiol* 1:47-57.

James P.M.C., Anderson R.J., Beal J.F. and Bradnock G. (1977): A 3- year clinical trial of the effect on dental caries of a dentifrice containing 2 percent sodium monofluorophosphate. *Community Dent. Oral Epidemiol* 5: 67-72.

Zacherl W.A. (1972): Clinical evaluation of neutral sodium fluoride, stannous fluoride, sodium monofluorophosphate and acideulated fluoride-phosphate dentifrices. *J. Can. Dent. Assoc.* 38: 35-38.

Murry J.J. and Shawl L. (1980) A 3- year clinical trial into the effect of fluoride content and toothpaste abrasivity on the caries inhibitory properties of a dentifrice. *Community Dent. Oral epidemiol.* 8: 46-51.

Forward, G.C. (1980). Action and interaction of fluoride in dentifrices. *Community Dent. Oral Epidemiol.* 8: 257-66.

Blechman H, Gupta P and Bartels H.A. (1960): A method for Evaluation of Occlusal caries in the White Rat. *J. Dent. Res.* 39 (3) 427-32.

Bowen J (1986): Animal Caries - Working Group Consensus Report (1986) *J. Dent Res.* 65 (Spec Iss) : 1528-29.

Ooshima T., Minami T., Matsumoto M., Fujiwara T., Sobue S., Hamada S. (1998): Comparison of the cariostatic effect between

regimens to administer oolong tea polyphenols in SPF rats. *Caries Res.* 32(1): 75-80.

Martinez - Gomis J, Planas M.E., Planelles x., Bartrons R., Sanchez S (1997). Fluoride and Pilocarpine reduce the risk of caries produced by chronic

clomipramine treatment in rats. *Caries Res.* 31(2): 155-60

Guggenheim B., Lutz F., Schmid R. (1997) Caries and Plaque inhibition in rats by five topically applied dentifrices *Eur J Oral Sc.* 105 (3): 258-63.

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