# Ineffectiveness of Racemic Glyceric Aldehyde in the Prevention of Experimental Tooth Decay. (17422)

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The striking ability of racemic glyceric aldehyde to inhibit acid production by the oral flora during the incubation of saliva was demonstrated in the experiments of Fosdick and Calandra.[1] This observation suggested the need to investigate the ability of dl-glyceric aldehyde to influence the initiation and development of carious lesions in experimental animals of known caries-susceptibility. In an earlier series of experiments conducted in this laboratory, additions of 0.5%, 1.0% and 2.0% crystalline racemic glyceric aldehyde to the caries-producing purified ration throughout the experimental period had no effect on the dental caries incidence of white rats and cotton rats.[2] In the above tests, the glyceraldehyde was present in the ration in the dimeric form and, presumably, passed through the oral cavity largely, if not entirely, as the dimer. Since the glyceraldehyde used in the experiments of Fosdick and Calandra was in solution, where some dissociation of the dimer to the monomer might have occurred, experiments with caries-susceptible animals were undertaken to determine if racemic glyceraldehyde given throughout the experimental period as the monomer influenced the dental caries experience.

*Experimental.* Six litters of white rats were used as the subjects of the first experiment. These animals were born to females which had been maintained throughout their reproductive lives on purified ration 100.[3] Previous litters from the same females had had a high caries-susceptibility. The 35 weanling rats from these litters were distributed into 3 groups. The 12 rats in the first group were fed ration 100 plus 10% Cellu flour and allowed to drink tap water. The second group of 9 rats was offered the above ration supplemented with 0.5% crystalline dl-glyceric aldehyde and drank tap water. The third group of 14 rats was fed ration 100 plus 10% Cellu flour and was only allowed to drink tap water to which 0.2% dl-glyceric aldehyde had been added.

In the second experiment a litter of 6 weanling cotton rats was divided into 2 equal groups. The cotton rats in the first group served as controls and were offered ration 100 plus 10% Cellu flour and tap water; those in the second group were fed the same ration but 0.2% dl-glyceric aldehyde was incorporated into the drinking water.

In both experiments, food and drinking water were provided *ad libitum* and the rodents were housed in individual screen bottom cages. The dl-glyceric aldehyde solution was prepared sufficiently in advance of its use to permit dissociation of the dimer to the monomer. Tap water and the 0.2% solution of glyceraldehyde were offered to the animals in identical watering bottles. The 0.2% level of dl-glyceric aldehyde in the drinking water was selected on the basis of a comparison between the average food and water consumptions of these rodents. This value permitted the consumption of approximately the same amount of glyceraldehyde as the 0.5% supplement to the purified ration.

The first experiment was terminated at the end of 20 weeks and the second experiment at the end of 14 weeks. After fixation of the skulls in 95% ethanol, the molar teeth were examined to determine the number and size of the carious lesions.

*Results.* The average rates of growth of the white rats and cotton rats fed dl-glyceric aldehyde either in the ration or in the drinking water were the same as the average rates of growth of comparable control animals.

[1] Fosdick, L. S., and Calandra, J. C., *J. Dental Research*, 1947, **26**, 309.

[2] Shaw, J. H., *J. Dental Research*, 1948, **27**, 727; *ibid.*, to be published.

[3] Shaw, J. H., *J. Dental Research*, 1947, **26**, 47.

TABLE I.

Caries Incidence of Rodents Fed Racemic Glyceric Aldehyde in the Ration or in the Drinking Water.

| % glyceric aldehyde in supplement | No. of animals | No. of carious molars | | | No. of carious lesions | | | Extent of carious lesions | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Avg | S.E.M.* | C.R.† | Avg | S.E.M.* | C.R.† | Avg | S.E.M.* | C.R.† |
| Exp. 1. White rats *(Mus norvegicus)* | | | | | | | | | | |
| 0 | 12 | 5.7 | 0.8 | 0.3 | 7.6 | 1.1 | 0.4 | 18+ | 5+ | 0.4 |
| 0.5 in ration | 9 | 6.0 | 0.7 | 0.1 | 8.4 | 1.5 | 0.5 | 21+ | 5+ | 0.3 |
| 0.2 in drinking water | 14 | 5.6 | 0.5 | 0.5 | 6.9 | 1.0 | 0.8 | 16+ | 3+ | 0.8 |
| Exp. 2. Cotton rats *(Sigmondon hispidus hispidus)* | | | | | | | | | | |
| 0 | 3 | 10.7 | 0.5 | 0 | 25.7 | 3.5 | 0.5 | 77+ | 19+ | 0.3 |
| 0.2 in drinking water | 3 | 10.7 | 0.5 | | 23.3 | 3.1 | | 69+ | 13+ | |

* Standard error of mean.

† Critical ratio—the ratio of the difference between 2 means to the standard error of the difference between the means. Wherever the critical ratio is less than 2.0, the difference between the means is considered to be statistically insignificant; when the critical ratio is between 2.0 and 2.9, the difference is of borderline significance; when the critical ratio is 3.0 or higher, the difference is highly significant. The criss-cross lines in the above table connect sets of data which are being compared for the critical ratio test of significance.

There was no evidence of a toxic effect of the glyceraldehyde additions.

The average caries experiences of the groups of white rats and cotton rats fed racemic glyceric aldehyde in the ration or in the drinking water, and of comparable control groups are presented in Table I. In the white rat, the consumption of a purified caries-producing ration supplemented with 0.5% of dl-glyceric aldehyde in the dimeric form did not influence the average number of carious molars, the average number of carious lesions, nor the average extent of tooth substance affected by the carious processes. Likewise, the consumption of water containing 0.2% dl-glyceric aldehyde as the monomer throughout the experimental period of maintenance on the purified ration did not alter the caries experience of both species.

*Discussion.* The results of the above experiments and of those reported previously[2] indicate the inability of racemic glyceric aldehyde, as the dimer or as the monomer, to alter the initiation and rate of development of carious lesions in experimental animals maintained under the conditions of these studies. These observations are in contrast to those which indicated the strong ability of glyceric aldehyde to inhibit acid production in incubated saliva. For a number of years, dental investigators in several laboratories have suggested that compounds which were able to inhibit acid production in incubated saliva or in incubated cultures of *Lactobacillus acidophilus* would have a similar inhibitory effect on the initiation and development of tooth decay in experimental animals and human beings. In view of the divergent results between *in vitro* studies and animal experiments with racemic glyceric aldehyde, the above generalization does not appear to be valid. Careful examination of suggestive *in vitro* findings by suitable *in vivo* procedures with caries-susceptible laboratory animals and later with human subjects is necessary to establish the exact value of any compound or treatment for caries prevention. The striking gross and histologic similarity between experimentally produced carious lesions in the Norway rat[4] and in the cotton rat[5] to the naturally occurring lesions in human teeth is indicative of the validity of these two species for the evaluation of *in vitro* inhibitors prior to clinical application.

*Summary.* The addition of 0.5% of dl-glyceric aldehyde to a caries-producing ration or of 0.2% dl-glyceric acid to the drinking water did not reduce the initiation nor the rate of development of carious lesions in caries-susceptible white rats and cotton rats.

4 Sognnaes, R. F., *J. Nutrition*, 1948, **36**, 1.
5 Shaw, J. H., *J. Nutrition*, 1949, **38**, 275.

Received August 15, 1949. P.S.E.B.M., 1949, **72**.

## Symbiotic Growth of Pleuropneumonia-like Organisms with Bacterial Colonies. (17423)

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A symbiotic relationship among bacteria was first described by Grassberger.[1] He observed that in the vicinity of colonies of various bacteria, particularly *Staphylococcus aureus, Hemophilus influenzae* grew as satellite colonies on blood agar. It is now well known that the staphylococci synthesize necessary growth factors required by *Hemophilus influenzae* which are not contained in the medium.

A similar symbiotic relationship has been observed with the pleuro pneumonia-like organisms (PPLO). In the course of our work

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1 Grassberger, R., *Z. f. Hyg.*, 1897, **25**, 453.