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Relationship of Acidogenic Bacteria to Diet in Production of Dental Caries in the White Rat.*

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It has been noted by Hoppert *et al*[1] that white rats which received comparatively coarse foods were more prone to develop dental caries than those animals receiving a finely ground ration. This was explained on the basis of impaction; the coarse food particles became firmly lodged in or between the teeth and caries developed following the fermentation of these particles. The finely ground food was not subject to impactions; as a result dental caries did not develop in the absence of a fermentable material.

In this experiment an attempt was made to determine the ability of certain acid producing organisms in pure cultures to produce caries when introduced in connection with a sterilized coarse ration. The following cultures were employed:

No. 1. *Lactobacillus acidophilus,* oral strain, isolated from an old rat with extensive caries.

No. 2. A rough type of *L. acidophilus,* from the mouth of a human having dental lesions.

No. 3. A cocco-bacillus from same source as No. 2.

No. 4. A coccus of fowl origin, isolated in pure culture from a fowl having a partially eroded beak.

The diet chosen for the rats was one that was adequate for growth, retained its physical characteristics upon sterilization and was palatable. The formula for the ration in percentages by weight was as follows: Alfalfa 10, corn 63, oilmeal 15, yeast 5, casein 5, sodium chloride 1, and calcium carbonate 1.

The ration after having been thoroughly mixed, was placed in suitable containers, plugged with cotton and autoclaved for 30 minutes at 15 pounds pressure. A control container was plated for bacterial growth to insure sterility. After being sterilized the food was broken up with a sterile glass rod. One cc. quantities of 24-hour yeast extract broth[2] cultures of the organisms were added to the rations daily. The control animals received both sterile and non-sterile coarse rations and a finely ground non-sterile ration.

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[1] Hoppert, C. A., *et al., J. Dent. Res.,* 1932, **12,** 161.

[2] Devereux, E. D., *A. J. P. H.,* 1932, **22,** 1293.

After a period of 8 to 10 weeks the animals were etherized, the jaws removed and streak plates made from carious areas of the teeth upon yeast extract agar.[2] Although only 8 animals had the test organisms added to their sterile coarse ration, two for each organism, all displayed extensive dental lesions. Organisms No. 1, 3 and 4 were reisolated from the carious lesions of their respective animals. While the organism isolated from the rats receiving organism No. 2 corresponded closely to that organism culturally and morphologically it was not present in as great numbers as the others when reisolated. It was noted that in the 2 control animals on a sterilized coarse diet dental lesions were negligible in that only one small cavity was found in one of the rats. Two other control rats receiving the unsterile coarse ration, containing the organisms naturally present in the food, displayed extensive dental lesions. In both cases impaction had occurred. However, no caries developed in the 2 control rats which were fed the same unsterile diet in a finely ground condition. This has been explained by Hoppert as being due to the fact that there was no impaction of the food. The results obtained from those animals which received the test organisms are in striking contrast to those obtained from those control animals on a sterilized coarse ration and those on the non-sterile finely ground diet. From this there appears to be a relationship between the mechanical factor of impaction and the relative numbers of significant bacteria present.

It was assumed that in the case of an extensively decayed tooth, in which the cavity proceeded to the bone tissue, that the organisms might be introduced into the blood stream, and give rise to agglutinins. When agglutination tests were conducted in the usual macroscopic manner it was observed that the antigen of organism No. 1 was agglutinated by sera from rats receiving this organism in their diets, the highest titre in each case being 1-256. The sera of the rats which received organisms Nos. 2, 3 and 4 agglutinated their specific organisms only in very low dilutions, 1-1 and 1-2.

In conclusion it might be said that while there are many contributing factors to the causation of dental caries, indications are that in the production of dental caries in the white rat there exists a relationship between the mechanical factors of impaction and the relative numbers of significant bacteria present.