SHORT COMMUNICATION

Effect of fumarate on the butyrate formation by certain species of genus *Treponema*

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In treponemal cells, various carbohydrates are metabolized to produce lower fatty acids and alcohols. The characteristic end product patterns of the cultivable treponemes have been reported in *Bergey's manual* and *Anaerobe laboratory manual* (V.P.I. Manual). *Treponema denticola* and *T. vincentii* utilize fumarate without succinate formation, but, *T. phagedenis* and *T. refringens* form succinate from fumarate. Especially, Reiter treponeme form large amounts of butyrate via butyryl-CoA in the CoA transphorase system. However, study of the metabolic pathway of oral *Treponemes* has been reported poorly.

Oral *Treponemes* utilize carbohydrates and amino acids as major energy sources. It is noted that fumarate and succinate are important intermediates of the metabolic pathway in the cells of genus *Treponema*.

The objective of the research described in this report is to clarify the end product patterns in several strains of *Treponemes* with the use of three media.

The experimented strains were *T. phagedenis* Reiter and three oral *Treponemes* sp. E-21, T-2 and S-173. These oral *Treponemes* were isolated from the pus of human periodontal foci, and their physiological characteristics were reported elsewhere.

The four strains of *Treponema* were cultivated in the following three media for 7 days under anaerobic conditions (5% CO₂, 95% N₂); (1) Peptone yeast extract glucose medium supplemented with 10% horse serum (PYG-HS), (2) PYG-HS supplemented with 0.2% fumarate and (3) PYG-HS supplemented with 0.2% succinate. After cultivation, gas chromatographic samples were prepared by using the method described in the V.P.I. Manual. The extracted alcohols and lower fatty acids in each medium were subjected to gas chromatograph (Shimadzu GC-7A) with FID as a detector.

Tables 1-a~1-c show the relative concentration of the released metabolites with the experimented strains in each medium.

The results suggest that Reiter treponeme...
metabolizes fumarate to pyruvate and succinate and that in oral *Treponema sp. S-173* the exogenous fumarate stimulates the production of ethanol and acetate and of lactate utilization. However, the others did not utilize the supplemented fumarate. The succinate does not seem to be utilized nor converted by all the *Treponemes* in this research. It was noted that this non-volatile acid stimulated the production of acetate and utilization of lactate by oral *Treponema sp. S-173*.

Our experiments showed that the four strains possess different enzyme activities, respectively, which are concerned with energy metabolism in the cells.

Recently, a membrane-associated fumarate reductase which oxidized reduced ferredoxin and flavin nucleotide was found in the subcellular fraction of Reiter treponeme\(^2\)). Hence, further study on the utilization of the exogenous fumarate and succinate by oral *Treponema sp. S-173* should be made at enzymic level.

### References


