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Biofilm medicines reinstate human gut microbiota for improved health

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Background: Gut microbiota consists of trillions of microorganisms specially bacteria and fungi that colonize intestines. Its diversity controls the host during homeostasis and illness by connecting with especially nervous and immune systems. However, gut microbial diversity has decreased drastically with the modern lifestyle including use of antibiotics and processed food with low fiber content. It has been found that the gut microbial diversity is a subset of soil microbial diversity. In the soil, developed microbial biofilms are reported to reinstate the lost microbial diversity, because their exuded biochemicals break the dormancy of microbial seed banks formed under stress. The same concept can be applied to the human body ecosystem as well.

Objective: The present *in-vitro* study was designed to investigate the effect of biofilm exudates (BFEx, biochemicals exuded by a developed fungal-bacterial biofilm) on human gut microbiota under different dietary patterns.

Methods & Materials: Five commonly found microbes viz. *Bacillus clausii, Lactobacillus sporogenes, Lactobacillus reuteri, Bacillus subtilis,* and *Aspergillus niger* were taken as test gut microbes (many of them are soil-based probiotics). The microbes were grown as monocultures and mixed cultures in a simulated gut environment developed using eight dietary patterns, i.e. low-carbohydrate, high-carbohydrate, low-protein, high-protein, low-lipid, high-lipid, low-fiber, and high-fiber. The microbial cultures were separated in to two groups, and BFEx was applied to one group to form two treatments. Live microbial cell concentrations were determined after 24 and 48 hours of inoculum using LIVE/DEAD™ BacLight™ bacterial viability kit.

Results: BFEx produced higher live microbial cell concentrations than the treatment without BFEx application in all dietary patterns. However, this was observed only in the mixed cultures suggesting that there is a need of microbial interaction to trigger the mechanism of BFEx.

Conclusion: BFEx have promoted the growth and possibly the dormancy-breaking of the tested gut microbes, and hence they can be developed as biofilm medicines to reinstate gut microbiota for improved human health.