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Microbial biofilms can shape gut microbiota better than diet-based interventions

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Abstract: Anthropogenic impacts have led to loss of microbial diversity in both managed and natural ecosystems. In fact, excessive use of chemical inputs depletes microbial diversity in agroecosystems whereas modern lifestyle and dietary habits lead do similar consequences in gut microbiota of human body ecosystem. Therefore, restoring the lost microbial diversity is vital to ensure the better functioning of any ecosystem. Our previous studies showed that microbial biofilms developed *in-vitro* are capable enough to restore the lost microbial diversity by secreting a blend of diverse biochemicals that reinstate the microbial diversity and their network interactions in the soil-plant-microbial system. Thus, we hypothesized that the same intervention could also be used to restore altered gut microbiota as gut also contains a subset of microbes originated from the soil through the evolutionary pathway. The present study was designed to examine the ability of biofilm exudates (BFEx, biochemicals secreted by a developed fungalbacterial biofilm) in shaping altered gut microbiota under different dietary patterns i.e. low and high levels of carbohydrate, protein, lipid, and fiber in a simulated gut setting. Four commonly found soil based probiotic gut bacteria *viz.*, *Bacillus clausii*, *Lactobacillus sporogenes*, *Lactobacillus reuteri*, *Bacillus subtilis*, and a fungus, *Aspergillus niger* were used as test microbes. The microbes were grown in mono and mixed culture modes with and without BFEx application. Live microbial cell concentrations of the cultures were measured at 24 and 48 hours after the inoculation using a bacterial viability kit. Furthermore, BFEx was tested for its cytotoxic activity using brine shrimp lethality assay. Results showed that the BFEx produced higher live microbial cell concentrations in all dietary patterns when compared to the treatment without BFEx. However, this result was detected only in the mixed cultures, suggesting the need of microbial interactions to trigger the action of BFEx. Further, the BFEx showed no toxicity to brine shrimp nauplii, instead it supported their survival by providing them with a food source. In conclusion, this biofilm-based method can be used as a promising tool in shaping gut microbiota instead of using diet-based interventions that restrict people from deciding their dietary preferences.

Keywords: Biofilm biochemicals, Fungal-bacterial biofilms, Gut microbiota, Microbial diversity