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The unibiome project: New microbiome-inspired approaches for a sustainable urban regeneration of universities Microbial communities

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Background and Aims

Spending most of our time indoors, urban contexts have gradually become our primary habitats, profoundly influenced by modernization and its subsequent ecological changes affecting organisms and their interactions. For humans, the abrupt disappearance of microbial species disrupted immunomodulation mechanisms contributing to civilization-related diseases. Recognizing the urgency for consensual urban biodiversity renovation plans, the UniBiome Project seeks to assess the microbial salubrity of different urban areas of Milan, Italy.

Methods

As part of the MUSA initiative (Multilayered Urban Sustainability Action), funded by the European Union's NextGenerationEU (NRRP), over 160 volunteer students of the "University Milano-Bicocca" and "Politecnico di Milano" donated skin and gut microbiome samples and more than 500 environmental samples have been collected for both Spring and Autumn 2023. We conducted amplicon-based sequencing to characterize both host-associated and environmental samples.

Results

We identified 714 bacterial families and measured high alpha-diversity in both host-associated and environmental samples. Gut samples exhibited significant intrapersonal biodiversity differences, with the most abundant families being Bacteroidaceae, Ruminococcaceae, Lachnospiraceae, and Prevotellaceae. The families shared in more than 5% of the environmental sequences are Staphylococcaceae, Moraxellaceae, Rhodobacteraceae, Corynebacteriaceae, and Micrococcaceae. Noteworthy, according to Bray–Curtis dissimilarity, indoor and outdoor samples differ significantly (p -value=0.001), confirming the different microbial signatures of such environments. Further analysis will integrate skin data, revealing the intricate interplay between human and environmental microbiomes.

Conclusions

The results will shed light on the microbial profiles across heterogeneous urban zones, building a comprehensive microbial map poised to inspire evidence-based interventions and harmonize urban renovation with human and environmental health.