Publication

Associations of air pollution and greenness with the nasal microbiota of healthy infants: A longitudinal study

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Background: Air pollution and greenness are associated with short- and long-term respiratory health in children but the underlying mechanisms are only scarcely investigated. The nasal microbiota during the first year of life has been shown to be associated with respiratory tract infections and asthma development. Thus, an interplay between greenness, air pollution and the early nasal microbiota may contribute to short- and long-term respiratory health. We aimed to examine associations between fine particulate matter (PM2.5), nitrogen dioxide (NO2) and greenness with the nasal microbiota of healthy infants during the first year of life in a European context with low-to-moderate air pollution levels. Methods: Microbiota characterization was performed using 16 S rRNA pyrosequencing of 846 nasal swabs collected fortnightly from 47 healthy infants of the prospective Basel-Bern Infant Lung Development (BILD) cohort. We investigated the association of satellite-based greenness and an 8-day-average exposure to air pollution (PM2.5, NO2) with the nasal microbiota during the first year of life. Exposures were individually estimated with novel spatial-temporal models incorporating satellite data. Generalized additive mixed models adjusted for known confounders and considering the autoregressive correlation structure of the data were used for analysis. Results: Mean (SD) PM2.5 level was 17.1 (3.8 μg/m3) and mean (SD) NO2 level was 19.7 (7.9 μg/m3). Increased PM2.5 and increased NO2 were associated with reduced within-subject Ruzicka dissimilarity (PM2.5: per 1 μg/m3 -0.004, 95% CI -0.008, $-$ 0.001; NO2: per 1 μg/m3 -0.004, 95% CI -0.007, $-$ 0.001). Whole microbial community comparison with nonmetric multidimensional scaling revealed distinct microbiota profiles for different PM2.5 exposure levels. Increased NO2 was additionally associated with reduced abundance of Corynebacteriaceae (per 1 μg/m3: $-$ 0.027, 95% CI -0.053, $-$ 0.001). No associations were found between greenness and the nasalmicrobiota. Conclusion: Air pollution was associated with Ruzicka dissimilarity and relative abundance of Corynebacteriaceae. This suggests that even low-to-moderate exposure to air pollution may impact the nasal microbiota during the first year of life. Our results will be useful for future studies assessing the clinical relevance of air-pollutioninduced alterations of the nasal microbiota with subsequent respiratory disease development.
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