Indoor microbiome, microbial and plant metabolites, chemical compounds, and asthma symptoms in junior high school students: a multicentre association study in Malaysia

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Shareable abstract (@ERSpublications)
Natural metabolites (plant-derived flavonoids and isoflavonoids, and micro-organism-derived indole and derivatives) and synthetic chemicals in the indoor environment are important for the development of asthma symptoms. https://bit.ly/3wjfC8g

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Abstract

Background Indoor microbial exposure is associated with asthma, but the health effects of indoor metabolites and chemicals have not been comprehensively assessed.

Methods We collected classroom dust from 24 junior high schools in three geographically distanced areas in Malaysia (Johor Bahru, Terengganu and Penang), and conducted culture-independent high-throughput microbiome and untargeted metabolomics/chemical profiling.

Results 1290 students were surveyed for asthma symptoms (wheeze). In each centre, we found significant variation in the prevalence of wheeze among schools, which could be explained by personal characteristics and air pollutants. Large-scale microbial variations were observed between the three centres; the potential protective bacteria were mainly from phyla Actinobacteria in Johor Bahru, Cyanobacteria in Terengganu and Proteobacteria in Penang. In total, 2633 metabolites and chemicals were characterised. Many metabolites were enriched in low-wheeze schools, including plant secondary metabolites flavonoids/isoflavonoids (isoliquiritigenin, formononetin, astragalin), indole and derivatives (indole, serotonin, 1*H*-indole-3-carboxaldehyde), and others (biotin, chavicol). A neural network analysis showed that the indole derivatives were co-occurring with the potential protective microbial taxa, including *Actinomycetospora*, *Fischerella* and *Truepera*, suggesting these microorganisms may pose health effects by releasing indole metabolites. A few synthetic chemicals were enriched in high-wheeze schools, including pesticides (2(3*H*)-benzothiazolethione), fragrances (2-aminobenzoic acid, isovaleric acid), detergents and plastics (phthalic acid), and industrial materials (4,4-sulfonyldiphenol).

Conclusions This is the first association study between high-throughput indoor chemical profiling and asthma symptoms. The consistent results from the three centres indicate that indoor metabolites/chemicals could be a better indicator than the indoor microbiome for environmental and health assessments, providing new insights for asthma prediction, prevention and control.