

Rhinitis, ocular, throat and dermal symptoms, headache and tiredness among students in schools from Johor Bahru, Malaysia: associations with fungal DNA and mycotoxins in the classroom

ABSTRACT

There are few studies on rhinitis and sick building syndrome (SBS) among students in tropical countries. We studied associations between levels of five fungal DNA sequences, two mycotoxins (sterigmatocystin and verrucarol) and cat allergen (Fel d 1) levels in schools and rhinitis and other weekly SBS symptoms in the students. Fungal DNA was measured by quantitative PCR and cat allergen by ELISA. Pupils (N = 462) from eight randomly selected schools in Johor Bahru, Malaysia participated (96%). Dust samples were collected by cotton swabs and Petri dishes exposed for one week. None of the schools had a mechanical ventilation system, but all classrooms had openable windows that were kept open during lectures and indoor CO₂ levels were low (mean 492 ppm; range 380–690 ppm). Weekly nasal symptoms (rhinitis) (18.8%), ocular (11.6%), throat (11.1%), dermal symptoms, headache (20.6%) and tiredness (22.1%) were common. Total fungal DNA in swab samples was associated with rhinitis ($p = 0.02$), ocular symptoms ($p = 0.009$) and tiredness ($p = 0.001$). There were positive associations between *Aspergillus versicolor* DNA in Petri dish samples, ocular symptoms ($p = 0.02$) and tiredness ($p = 0.001$). The level of the mycotoxin verrucarol (produced by *Stachybotrys chartarum*) in swab samples was positively associated with tiredness ($p = 0.04$). *Streptomyces* DNA in swab samples ($p = 0.03$) and Petri dish samples ($p = 0.03$) were negatively associated with tiredness. In conclusion, total fungal contamination, measured as total fungal DNA) in the classrooms, *Aspergillus versicolor* and verrucarol can be risk factors for rhinitis and SBS symptoms among students in the tropical country Malaysia.

Keyword: Rhinitis; Throat and dermal symptoms; Sick building syndrome (SBS); Students; Tropical countries; Malaysia