Chronic intestinal *Mycobacteria* infection: discrimination via VOC analysis in exhaled breath and headspace of feces using differential ion mobility spectrometry[*]

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Abstract
Differential ion mobility spectrometry (DMS) is a method to detect volatile organic compounds (VOC) in the ppt range. This study assessed whether VOC analysis using DMS could discriminate subjects with an experimentally induced chronic intestinal infection caused by *Mycobacteria* from non-infected controls. The animal model consisted of two groups of goats orally infected with two different doses of *Mycobacterium avium* subspecies *paratuberculosis* (MAP) and one group of non-infected healthy controls (each group: $n = 6$). Using DMS, exhaled breath and headspace of feces were analyzed on-line on an individual basis 9 months after inoculation of MAP. Data analysis included peak detection, cluster analysis, selection of discriminating VOC features (Mann–Whitney U test), and classification using a support-vector-machine. Taking the background of ambient air conditions into account, VOC analysis of exhaled breath as well as of feces revealed significant differences between chronically infected animals and non-infected controls. In both specimens, increasing as well as decreasing VOC features could be attributed to infection. Discrimination between infected and non-infected animals was sharper analyzing exhaled breath compared to headspace of feces. In exhaled breath, at least two VOC features were found to increase in a dose-dependent manner with increasing doses of MAP inoculated. Results of this study provide strong evidence that DMS analysis of exhaled breath has the potential to become a valuable tool for non-invasive assessment of VOC specifically related to certain diseases or infections.

(Some figures in this article are in colour only in the electronic version)

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