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Late Breaking Abstract - Volatile organic compounds in exhaled breath reflect physiological changes in ultramarathon runners

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Background: Exhaustive exercise can cause lung damage and other physiological responses in the human body. Volatile organic compounds (VOCs) can be exchanged in the lung alveoli between breath and circulated blood, making them ideal non-invasive biomarkers to understand the effects of exhaustive exercise on the lungs and other parts of the body. Only a limited number of studies have used breath VOCs in exhaustive exercise. To date, no studies have explored breath VOC changes in the context of running an ultramarathon, which takes roughly 40 hours to complete.

Methods: To identify potential breath biomarkers of exhaustive exercise, breath samples of 24 subjects participating in the 2019 Ultra-Trail du Mont Blanc (UTMB) ultra-marathon were collected pre- and post-race. All 48 samples were analyzed using the Breath Biopsy Platform included with the Thermo Fisher GC-Orbitrap™ via TD-GC-MS. The Wilcoxon signed rank test, followed by the Benjamini– Hochberg False Discovery Rate ($p < 0.05$) was used to determine whether the breath VOC abundances differed between pre- and post-race.

Results: The analyses identified 811 VOCs in the breath samples of subjects. Of these, 63 showed significant differences between pre- and post-race samples (12 decreased, 51 increased). Tentatively identified VOCs suggest the involvement of fatty acid oxidation, inflammation, and possible altered gut microbiome activity in response to exhaustive exercise.

Conclusions: This study shows significant changes in VOC abundance resulting from exhaustive exercise. Further investigation with other physiological measurements is necessary to help improve the understanding of VOC biological associations in exhaustive exercise.