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Titel des Beitrags:
The dynamic range of the human metabolome revealed by challenges

Abstract:
Metabolic challenge protocols, such as the oral glucose tolerance test, can uncover early alterations in metabolism preceding chronic diseases. Nevertheless, most metabolomics data accessible today reflect the fasting state. To analyze the dynamics of the human metabolome in response to environmental stimuli, we submitted 15 young healthy male volunteers to a highly controlled 4 d challenge protocol, including 36 h fasting, oral glucose and lipid tests, liquid test meals, physical exercise, and cold stress. Blood, urine, exhaled air, and breath condensate samples were analyzed on up to 56 time points by MS- and NMR-based methods, yielding 275 metabolic traits with a focus on lipids and amino acids. Here, we show that physiological challenges increased interindividual variation even in phenotypically similar volunteers, revealing metabotypes not observable in baseline metabolite profiles; volunteer-specific metabolite concentrations were consistently reflected in various biofluids; and...
readouts from a systematic model of beta-oxidation (e.g., acetylcarnitine/palmitylcarnitine ratio) showed significant and stronger associations with physiological parameters (e.g., fat mass) than absolute metabolite concentrations, indicating that systematic models may aid in understanding individual challenge responses. Due to the multitude of analytical methods, challenges and sample types, our freely available metabolomics data set provides a unique reference for future metabolomics studies and for verification of systems biology models.