

The “KarMeN”-cohort: a cross-sectional study of nutrition, life-style and metabolomics

Manuela J. Rist, Achim Bub, Susanne Bandt, Anita Kriebel, Alexander Roth, Ralf Krüger, Christoph H. Weinert, Björn Egert, Lara Frommherz, Eva Hummel, Friederike Wittig, Kimberley Hoffmann, Ingrid Hoffmann, Sabine E. Kulling, Gerhard Rechkemmer, Bernhard Watzl

Max Rubner Institut, Federal Research Institute of Nutrition and Food, Karlsruhe, Germany

Metabolomics has become an important approach in nutrition and health research. It allows to analyse a wide range of small molecules present in a biological system. Major determinants of the composition of the human metabolome are not well defined yet including the impact of specific foods, of acute and long-term food consumption, of the level of physical activity, or of the genetic background. Therefore, the primary objective of this cross-sectional study is to assess the human metabolome in a well-defined healthy cohort and its major life-style-related determinants using a multi-method platform approach.

The Karlsruhe Metabolomics and Nutrition (KarMeN) cohort recruits healthy female and male subjects (age >18 years, BMI ≤30) until July 2013 (approximately 300 study participants). Anthropometric parameters determined include height, weight, waist circumference, and body composition (DEXA). Further, blood pressure, arterial stiffness, and pulmonary function are measured. Clinical parameters include ECG, blood and urine clinical chemistry. A food frequency questionnaire and two 24h-recalls (EPIC-Soft) are used to assess food consumption, allowing to differentiate between acute and long-term impact of diet on the human metabolome. The level of physical activity is determined via a standardised questionnaire (IPAQ) and by a combined heart rate monitor/accelerometer (Actiheart®). Resting energy expenditure is measured by indirect calorimetry, while cardio-respiratory fitness is investigated by means of spiro-/ergometry and lactate diagnostics. All study participants are subjected to a standardised examination schedule. Fasted blood plasma, 24h urine, and three spot urines (fasted and non-fasted) are available for metabolomics measurements. Additionally, DNA is available to investigate selected SNPs, especially if interesting phenotypes are observed. Samples are stored at -190°C until analysis (gas phase of liquid nitrogen). The multi-method platform consists of targeted LC-MS, non-targeted GCxGC-MS, and 1D-1H-NMR analysis [details see separate poster] allowing the detection of more than 400 metabolites.

The well-characterised KarMeN cohort in combination with this multi-method metabolomics approach and biostatistical predictive modeling will help to unravel how different life-style factors including acute and long-term food consumption as well as physical activity/inactivity and fitness impact the human plasma and urine metabolome. New insights into these complex interrelationships will provide a substantiated basis to develop new and reliable biomarkers defining the nutritional as well as the health status of people.