

Summary in English

Type 2 diabetes mellitus (T2DM) is a non-communicable and long-lasting hyperglycemic condition that has turned into a global epidemic. It is mostly managed by glycemic control via pharmacotherapeutic and evidence-based alternative approaches which come with a price and are causatives of financial strains on global healthcare systems. Therefore, precision nutrition-based approaches have recently been proposed as alternatives to prevent and/or treat T2DM and its complications. Precision nutrition is a way of personalization of dietary and nutritional recommendations. Although it is at the infancy stage, numerous dietary recommendations have already been suggested. Considering macronutrients consumption, several human studies have been reported unveiling comparable results of reduction in mean body weight, glycosylated haemoglobin, low- and high-density lipoprotein cholesterol, insulin, and fasting plasma glucose after high- carbohydrate (HC) and low-carbohydrate (LC) diet. Except macronutrients, inclusion of specific food additives/spices in a diet may exert a positive effect in the prevention of weight gain and T2DM development. An accumulated number of studies have demonstrated that cinnamon and capsicum have prebiotic, hypoglycemic, hypolipidemic, antioxidative, and anti-inflammatory effects and improve glycemic control, hyperlipidemia, and insulin resistance. However, the effects of different meal types and/or cinnamon and capsicum intake on plasma metabolome are unknown, which is also a prerequisite to unveil the mechanism behind weight management. Therefore, primarily, placebo-controlled randomized clinical trial was conducted to check the effect of HC and LC meals on plasma metabolome of lean and overweight/obese (OW/OB) participants. Secondly, another clinical trial was conducted in which the effects of cinnamon/capsicum intake on plasma metabolome affected by a HC meal consumption by OW/OB individuals was evaluated. The first study was performed on 24 male subjects divided into two subgroups (12 subjects per group): normal weight (35 ± 9 years old) or OW/OB (38 ± 6 years old). The participants with chronic diseases, a history of smoking and taking any medications were not allowed. The volunteers participated in two meal-challenge tests visits in a cross-over design with 2–3 weeks intervals. On the visit-day from each participant fasting blood sample was collected and after that subjects received a standardized HC or NC meal (both from Nutricia, Poland). In the second study a total of 20 OW/OB male subjects ($BMI > 25.0 \text{ kg/m}^2$, 46 ± 8 years old) took part in the HC-meal challenge study with cinnamon and capsicum. The exclusion criteria, the protocols applied and meal-challenge test conditions were as in the first study. The participants received a meal and one of two investigated products (cinnamon+capsicum, or placebo, in a randomized order). An HC meal

was composed of wheat roll (100g), fruit jam (50g) and juice (200ml). In both studies, additionally to the fasting blood sample, blood was collected 30, 60, 120, and 180 minutes after a meal. Collected blood was used to prepare plasma samples. Obtained plasma was fingerprinted using LC-QTOF-MS. Based on each metabolic feature's intensity change in time, the area under the curve (AUC) was calculated. Obtained AUCs were analyzed using multivariate statistics. The identity of significant metabolites was confirmed by analysis of metabolite's standards (if available) or based on the MS/MS spectra match. Several metabolic pathways were found dysregulated after an HC meal in people from the OW/OB group but not the NW group. The consumption of HC meals by people with overweight/obesity led to a substantial increase in AUC, mainly for metabolites belonging to phospholipids and fatty acid amides. The opposite was observed for selected sphingolipids. The intake of cinnamon and capsicum normalized the concentration of selected altered metabolites induced by the intake of HC meals. A HC meal may induce an unfavourable postprandial metabolic response in individuals with overweight/obesity, and such persons should avoid HC meals.