Proceedings of the Nutrition Society (2025), **84 (OCE1)**, E28 doi:10.1017/S0029665125000382

The 48th Annual Scientific Meeting of the Nutrition Society of Australia, 3-6 December 2024

Metabolomic profiles in response to healthy and typical dietary patterns in Australian adults: a randomised, cross-over feeding trial

J. Stanford[1,2], E.D. Clarke[1,2], M. Gomez Martin[1,2], J.J.A. Ferguson[1,2], L.G. Wood[1,3], T.L. Burrows[1,2] and C.E. Collins[1,2]

[1]*The University of Newcastle, Callaghan, New South Wales, Australia*

[2]*Food and Nutrition Research Program, Hunter Medical Research Institute, New Lambton Heights, New South Wales, Australia*

[3]*Immune Health Research Programme, Hunter Medical Research Institute, New Lambton Heights, New South Wales, Australia*

Objective biomarkers of a healthy and typical Australian diet could enhance dietary assessment and provide insight into how adherence to, or deviations from, dietary guidelines impact health. This study aimed to identify and compare plasma and urinary metabolites in healthy Australian adults in response to a healthy and typical dietary pattern. This was an 8-week randomised, cross-over feeding trial[(1)]. After a two-week run-in period, participants were randomly allocated to follow each diet for two weeks, with a minimum two-week washout period in between. The Healthy Australian Diet adhered to the Australian Dietary Guidelines[(2)], including a balanced intake of the five food groups and meeting Acceptable Macronutrient Distribution Range targets[(3)]. The Typical Australian Diet was formulated based on apparent consumption patterns in Australia[(4)]. During each feeding phase, all food items were provided to ensure compliance. Both diets included different key indicator foods associated with known metabolites. Comprehensive data collection occurred at four key visits: week 0 (end of run-in; baseline 1), week 2 (post-feeding phase 1), week 4 (end of washout, baseline 2), and week 8 (post-feeding phase 2). Blood samples following a ≥ 8-hour fast were collected by an accredited pathologist, and spot urine samples were self-collected by participants at the morning appointment. Metabolomics data was obtained using Ultra-high Performance Liquid Chromatography-Tandem Mass Spectrometry (UHPLC-MS/MS) through Metabolon Inc.'s (Morrisville, USA) Global Discovery Panel. Metabolite concentrations were log-transformed. Differential changes in metabolites between intervention groups were evaluated using linear mixed-effect models, adjusting for diet sequence, feeding phase, and subject ID as a random variable to account for potential autocorrelation. Post-hoc pairwise comparisons were conducted to assess the impact effects of each diet. A total of 34 healthy Australian adults (age 38.4 ± 18.1 years, 53% females) completed all study measures. After adjusting for multiple comparisons, significant differences between TAD and HAD groups were observed for 257 plasma and 91 urine metabolites. Of these, 44 known metabolites consistently differed between dietary pattern groups in both biofluid types (plasma and urine). Several associations between specific food groups and metabolites were identified, including the externally validated metabolites associated with dark chocolate (theobromine), orange juice (proline betaine), and cruciferous vegetables (S-methylcysteine sulfoxide, S-methylcysteine). Consumption of dietary patterns aligned with Australian dietary guidelines had a measurable impact on the short-term human metabolome compared to a typical Australian dietary pattern. While some metabolites are established as biomarkers of specific foods, others may represent novel biomarkers requiring validation in future clinical trials and diverse populations. Further research should explore the relationship between these metabolites, the gut microbiome, and clinical outcomes. Additionally, studies are needed to assess the feasibility of using these biomarkers to evaluate diets in real-world settings.

References

1. Ferguson JJA, Clarke E, Stanford J *et al.* (2023) *BMJ Open* **13**, e073658.
2. National Health and Medical Research Council (2013) Australian Dietary Guidelines https://www.nhmrc.gov.au/adg
3. Lee E, Choi J, Ahn A, Oh E, Kweon H *et al.* (2015) *Clin Exp Hypertens* **37**(6), 463–467.
4. Australian Bureau of Statistics (2022) Apparent Consumption of Selected Foodstuffs, Australia https://www.abs.gov.au/statistics/health/health-conditions-and-risks/apparent-consumption-selected-foodstuffs-australia/latest-release