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Dietary assessment and metabolomic methodologies in feeding studies: a scoping review

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Dietary metabolomics quantifies the appearance of a range of metabolites in body fluids (blood and urine) following food ingestion.[(1)] Results can be quantified in terms of specific metabolites present in single foods, food groups or it can be extended to whole dietary patterns. However, the methods used across dietary metabolome feeding studies varies and can make it challenging to compare results. Therefore, the aim of this review was to synthesise the methodological components of feeding studies designed to quantify the diet-related metabolome in biological samples including plasma and urine in response to variable dietary 'feeding' interventions. Six electronic databases were searched using a pre-specified search strategy. Included studies were (1) conducted in adults with no chronic health conditions that affected the gastrointestinal tract, metabolism or dietary requirements; (2) intervention studies; (3) feeding studies focusing on dietary patterns for at least 1 day or longer; and (4) collection of biospecimens (e.g. serum, plasma or urine) to measure the relationship between dietary intake and sample metabolite (the metabolome). Title and abstract screening were performed in duplicate, full text screening and data extraction was shared among two authors and data was synthesised descriptively. Of the initial 10880 texts identified, 45 studies met inclusion criteria and were included in this review. This included randomised cross-over feeding studies ($n = 21$), parallel randomised controlled trials ($n = 21$), non-randomised cross-over feeding studies ($n = 2$) and a pre-post intervention ($n = 1$). Studies included between eight and 395 participants (median 50 participants). In total, 43 different dietary patterns were tested. The two most commonly evaluated dietary interventions were feeding a Western diet ($n = 8$) and Mediterranean-style diet ($n = 7$). Of the included studies, 28 provided all or the majority (90%) of food to participants, 16 provided some but not all food, and one was highly prescriptive but did not provide any food. Metabolites were identified in urine ($n = 30$) and plasma/serum ($n = 26$) biofluid samples. Few studies provided methodological details of biofluid collection prior to metabolomic analysis. The majority of studies used liquid chromatography ($n = 30$) and untargeted metabolomics methods ($n = 33$) to quantify metabolites in urine and blood samples. Overall, the findings from this review identified that the dietary metabolome in response to varying dietary intervention has been characterised equally using both blood and urine samples. While a wide variety of dietary patterns have been explored, further research is needed to define key characteristics of dietary patterns to enhance identification and quantification of key metabolites that could be used as biomarkers of specific foods or dietary patterns. Lastly, future research should consider publishing more detailed methodologies regarding how biosamples were collected prior to analysis to determine if there is any variation in findings based on sampling technique.

Reference

1. Guertin KA, Moore SC, Sampson JN, *et al.* (2014) *Am J Clin Nutr* **100**, 208–217.