

## Abstract

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# Associations between plant-based food diversity and cardiometabolic outcomes in adults: A cross-sectional analysis of the UK National Diet and Nutrition Survey Year 9

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The benefits of consumption of a high quantity of plant-based foods on human health are widely reported in observational and intervention studies <sup>(1,2)</sup>. A growing body of evidence indicates plant-based food diversity as a potential additional target for improvement of diet-related health outcomes <sup>(3)</sup>. The aim of this study was to investigate associations between plant-based food diversity and cardiometabolic health outcomes in a nationally representative sample of UK adults.

Cross-sectional data collected as part of the National Diet and Nutrition Survey (NDNS) Rolling Programme Year 9 (2016/2017) were used <sup>(4)</sup>. Plant-based food diversity from all plant food sub-groups (fruits, vegetables, grains, herbs, spices, nuts, seeds, fats, oils and beverages) was determined from analysis of 4-day estimated food diaries. Demographic data were collected by personal interviews and self-reported questionnaires. Health outcome data were collected at nurse visits; body mass index (BMI) and blood pressure were measured, and blood samples were collected for analysis of blood lipids and glycated haemoglobin (HbA1c). Associations between plant-based diversity and health outcomes were explored via multivariable linear regression, adjusted for age, sex, race, education and income (model 0), in addition to quantity of plant-based food, diet quality, daily energy intake, alcohol, smoking status, and prescribed medications (model 1), and BMI (model 2). Differences in health outcomes between diversity tertiles (low, median 5.5 counts/d, IQR 1.8; moderate, median 8.1 counts/d, IQR 1.3; and high, median 11.0 counts/d, IQR 2.3) were assessed via analysis of covariance (ANCOVA), with covariates as described for models 0-2.

Overall, 638 adults were included (median age 47, IQR 30; 58.5% female; 90% white; 29% with a degree). Plant-based food diversity was positively associated with high density lipoprotein cholesterol (HDL-C) concentration ( $B = 0.024$  mmol/L, 95% CI 0.005, 0.043,  $p = 0.014$ , adj.  $R^2 = 0.212$ ; model 0), and inversely associated with HbA1c concentration ( $B = -0.524$  mmol/mol, 95% CI -0.977, -0.71,  $p = 0.023$ , adj.  $R^2 = 0.559$ ; model 1). Associations were no longer significant following additional adjustment for BMI (model 2). There was a significant difference in BMI across diversity tertiles ( $p = 0.003$ ; Quade non-parametric ANCOVA; model 0). Post-hoc pairwise comparisons revealed BMI was significantly higher in the moderate diversity tertile (median 27.5 kg/m<sup>2</sup>, IQR 7.0) in comparison to the high diversity tertile (median 26.0 kg/m<sup>2</sup>, IQR 6.0;  $p = 0.001$ ).

This is the first study to determine the associations between intakes of diverse plant-based foods and cardiometabolic health outcomes in UK adults. Consumption of diverse plant-based foods is associated with cardiometabolic health benefits, namely higher concentrations of HDL-C, lower concentrations of HbA1c, and lower BMI. These results warrant further investigation in a robust randomised controlled trial, to elucidate the health effects and underlying mechanisms of consuming a high diversity of plant-based foods.

## References

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