

## Fruit and vegetable intakes and the association with blood pressure within adults in the United Kingdom's National Diet & Nutrition Survey Rolling Programme (2008/09–2011/12)

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In intervention studies, increased fruit and vegetable (F&V) intake is associated with a decreased risk of hypertension<sup>(1–2)</sup>. Observational studies also report consistent inverse associations<sup>(3)</sup>. However, fruit or vegetable type has been less frequently explored. This study aimed to explore the association between total fruit and vegetable intakes, type of fruit and vegetables according to polyphenol content and blood pressure (mmHg) in the National Diet and Nutrition Survey Rolling Programme from 2008 to 2012.

Total fruit and total vegetable intakes (g/day) derived from 3–4 day food diaries obtained from 1,002 adults (age range 19 to 91 years) after exclusions were explored. Fruit and vegetable intakes were sub-categorised according to similarities in polyphenol content from Phenol Explorer<sup>(4)</sup>, including berries, citrus, drupes, pomes and tropical fruits for fruits; Allium, Brassicaceae, fruit vegetables, pod vegetables and root vegetables for vegetables. Valid blood pressure (mmHg) results were used as the measurement outcome. Multivariate regression was conducted to calculate change in systolic (SBP) and diastolic blood pressure (DBP) (mmHg) per unit increase in F&V in adults (19+ years) not taking blood pressure related medication. Change in blood pressure was determined by comparing each intake group with the reference group (data not shown). Linear trend was also determined by 80 g portions of fruit and vegetables.

Dietary intakes and  $\beta$ -coefficient for change in systolic and diastolic blood pressure (mmHg)

Exposure (80 g/day)	SBP (mmHg) (95 % <sup>a</sup> or 99 % <sup>b</sup> CI)		DBP (mmHg) (95 % <sup>a</sup> or 99 % <sup>b</sup> CI)	
	Age Adjusted	Fully Adjusted	Age Adjusted	Fully Adjusted
Total Fruits & Vegetables <sup>a</sup>	-0.57 (-0.98, -0.15)**	-0.58 (-1.00, -0.15)**	-0.45 (-0.75, -0.15)**	-0.43 (-0.74, -0.12)**
Total Fruits <sup>a</sup>	-0.91 (-1.60, -0.22)**	-0.65 (-1.37, 0.07)	-0.95 (-1.44, -0.45)**	-0.82 (-1.34, -0.29)**
Berries <sup>b</sup>	-1.49 (-4.32, 1.34)	-0.83 (-3.64, 1.97)	-1.17 (-3.23, 0.88)	-1.02 (-3.04, 0.99)
Citrus <sup>b</sup>	0.10 (-0.81, 1.02)	-0.47 (-1.68, 0.74)	-0.30 (-0.97, 0.36)	-0.96 (-1.83, -0.09)**
Drupes <sup>b</sup>	2.64 (-1.09, 6.38)	3.54 (-0.10, 7.18)	-0.75 (-3.46, 1.96)	0.09 (-2.56, 2.74)
Pomes <sup>b</sup>	-1.18 (-2.75, 0.38)	-1.00 (-2.57, 0.56)	-1.29 (-2.43, -0.16)**	-1.14 (-2.27, -0.01)**
Tropical Fruits <sup>b</sup>	-0.62 (-2.93, 1.69)	0.33 (-2.04, 2.70)	-0.93 (-2.60, 0.75)	-0.09 (-1.81, 1.63)
Total Vegetables <sup>a</sup>	-0.60 (-1.25, 0.05)	-0.52 (-1.20, 0.16)	-0.28 (-0.76, 0.19)	-0.07 (-0.57, 0.42)
Allium <sup>b</sup>	-0.92 (-5.21, 3.36)	-0.31 (-4.78, 4.16)	0.31 (-2.80, 3.42)	0.64 (-2.60, 3.87)
Brassicaceae <sup>b</sup>	-2.83 (-6.53, 0.87)	-1.48 (-5.24, 2.27)	-1.62 (-4.31, 1.06)	-0.62 (-3.34, 2.09)
Fruit Vegetables <sup>b</sup>	-0.89 (-2.80, 1.02)	0.13 (-1.89, 2.16)	-0.44 (-1.83, 0.94)	0.27 (-1.20, 1.73)
Pod Vegetables <sup>b</sup>	-0.68 (-5.85, 4.48)	-0.42 (-5.41, 4.56)	0.28 (-3.47, 4.02)	0.88 (-2.72, 4.49)
Root Vegetables <sup>b</sup>	-1.83 (-4.43, 0.77)	-0.50 (-3.20, 2.19)	-1.06 (-2.95, 0.82)	-0.12 (-2.07, 1.82)

If 95 %<sup>a</sup> CI, significance level is \* $P < 0.05$ ; if 99 %<sup>b</sup> CI, significance level is \*\* $P < 0.01$

Systolic and diastolic blood pressure was -0.58 mmHg (95 % CI -1.00, -0.15) and -0.43 (95 % CI -0.74, -0.12) mmHg lower respectively for each 80 g/day total F&V consumed. Diastolic blood pressure was -0.82 mmHg (95 % CI -1.34, -0.29), -0.96 (99 % CI -1.83, -0.09) mmHg and -1.14 (99 % CI -2.27, -0.01) mmHg lower respectively for 80 g/day intake of total fruit, citrus and pomes. Consumption of total fruits, citrus and pomes in particular was associated with a lower diastolic blood pressure in this cohort. Vegetable consumption was however, not associated with lower SBP or DBP measurements. These findings support guidelines encouraging fruit consumption for health, and provide evidence to suggest that higher intakes of citrus and pomes may be particularly beneficial in terms of lowering blood pressure, offering potential as a primary prevention to lower cardiovascular disease<sup>(5)</sup>.

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