Proceedings of the Nutrition Society (2012), **71 (OCE2)**, E182 doi:10.1017/S002966511200239X

Summer Meeting hosted by the Irish Section, 16–19 July 2012, Translational nutrition: integrating research, practice and policy

The effect of daily orange juice consumption on insulin sensitivity and indices of the metabolic syndrome

E. J. Simpson, S. J. Brown, B. Mendis, M. Dunlop, M. Marshall and I. A. Macdonald

School of Biomedical Sciences, University of Nottingham, NG72UH, UK

There is some epidemiological evidence that fruit juice consumption may be associated with an increased risk of developing type 2 diabetes[1], possibly due to an increased dietary glycaemic load, or a greater intake of fructose. However, citrus polyphenols have been shown to improve endothelial function and reduce inflammatory markers in patients with metabolic syndrome[2], effects which would oppose the development of insulin resistance.

This study aimed to assess the effect of drinking orange juice daily on insulin resistance, in an 'at-risk' female cohort, using a randomised, parallel group design.

Thirty two overweight women (20–45 yrs, 27–35 kg/m^2), with mild fasting insulin resistance (HOMA-IR > 1.5) were recruited from the community. A hyperinsulinaemic (60 mIU/m^2), euglycaemic clamp was conducted before and after consuming 250 ml/day of either orange juice (Group A), or an orange flavoured drink (Group B) for 12 wks. Drinks were matched for energy and sugar (sucrose, glucose and fructose) composition. Blood pressure was measured after resting semi-supine for 5 min using automated oscillometry, and arterialised-venous blood samples were taken, before the start of the clamp, from a dorsal hand vein heated in air temperature of 50–55°C. Total body composition and regional analysis of Android (abdominal) and Gynoid (femoral-gluteal) fat distribution, were assessed using Dual Energy X-Ray Absorptiometry. Normally distributed data are presented as the mean (±STD) and non-parametric data are presented as the median (inter-quartile range).

Groups were matched at visit 1 with respect to all parameters, although there was a trend for systolic BP to be higher in Group B ($p = 0.063$). No parameters changed significantly over time, within groups, although there was a trend for TNF-α to fall in Group A ($p = 0.027$). No differences were observed between groups after the 12 wk intervention.

Parameter	Group A Visit 1	Group A Visit 2	Group B Visit 1	Group B Visit 2
Age at screening (yr)	36.1 (7.09)		32.4 (7.43)	
Screening BMI (kg/m^2)	30.7 (2.04)		31.9 (2.21)	
Systolic BP (mmHg)	120.8 (9.55)	122.7 (8.87)	127.5 (10.05)	124.1 (10.25)
Diastolic BP	75.9 (10.47)	74.4 (8.39)	76.2 (7.49)	74.6 (6.92)
Body weight (kg)	83.1 (9.24)	83.9 (9.10)	87.4 (10.33)	88.2 (10.41)
Lean body mass (%)	51.6 (4.09)	50.7 (4.17)	49.9 (4.26)	49.5 (3.89)
Gynoid fat (%)	51.1 (5.15)	51.5 (5.25)	53.5 (4.36)	53.9 (4.15)
Android fat (%)	54.5 (4.16)	55.4 (4.13)	54.8 (5.41)	55.5 (5.13)
Steady state glucose disposal rate (mg/kg.min)	5.04 (1.51)	4.76 (1.55)	4.99 (1.52)	5.32 (1.51)
HOMA-IR	3.50 (2.49–4.22)	4.13 (2.41–4.13)	3.45 (2.57–3.90)	3.22 (2.74–4.81)
C-reactive protein (mg/l)	1.87 (0.52–5.80)	2.26 (0.68–4.82)	1.90 (1.08–5.61)	2.08 (1.23–4.45)
TNF-α (mg/l)	1.90 (1.37–2.96)	1.63 (1.36–1.81)	1.81 (1.55–2.25)	1.72 (1.64–1.98)
IL-6 (mg/l)	1.84 (1.39–2.28)	1.70 (1.45–2.23)	2.33 (1.62–2.54)	2.03 (1.66–2.33)
Total cholesterol (mmol/l)	4.67 (0.74)	4.81 (1.00)	4.64 (0.25)	4.65 (0.89)
LDL (mmol/l)	2.72 (0.52)	2.93 (0.71)	2.77 (0.89)	2.81 (0.74)
HDL (mmol/l)	1.11 (1.06–1.33)	1.15 (1.02–1.29)	1.22 (1.13–1.32)	1.21 (1.06–1.47)
APO-A1 (g/l)	1.26 (1.18–1.33)	1.28 (1.11–1.39)	1.29 (1.17–1.62)	1.25 (1.19–1.59)
APO-B (g/l)	0.92 (0.18)	0.93 (0.20)	0.89 (0.20)	0.88 (0.17)

Daily consumption of 250 ml of orange juice, for 3 months, did not adversely affect insulin sensitivity, body composition, or other indices of the metabolic syndrome.

1. Bazzano LA, Li TY, Joshipura KJ, Hu FB (2008) Intake of fruit, vegetables, and fruit juices and risk of diabetes in women. *Diabetes Care* **31**(7): 1311–7.
2. Rizza S, Muniyappa R, Iantorno M, Kim JA, Chen H, Pullikotil P *et al*. (2011) Citrus Polyphenol Hesperidin Stimulates Production of Nitric Oxide in Endothelial Cells while Improving Endothelial Function and Reducing Inflammatory Markers in Patients with Metabolic Syndrome. *J Clin Endocr Metab* **96**(5): E782–E92.