Resistant starch consumption improves peripheral glucose utilisation in insulin resistant individuals

Kelly L. Johnston[1], John Wright[1], Laura Tripkovic[1], Gary Frost[2] and M. Denise Robertson[1]

[1]Faculty of Health and Medical Sciences, University of Surrey, Guildford, UK, GU2 7XH
[2]Faculty of Medicine, Imperial College London, Hammersmith Hospital, Du Cane Road, London W12 0NN

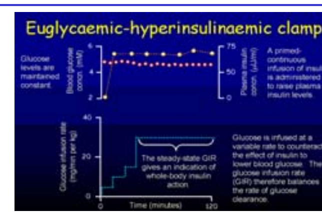
BACKGROUND and AIMS

The major impact of type 2 diabetes (T2DM) on mortality is through premature cardiovascular disease. Dietary fibre has been shown by epidemiological and clinical intervention studies to influence metabolic CVD risk factors and overall T2DM risk (1). The potential benefits of resistant starch (RS), an insoluble, non-viscous fibre, have been demonstrated in both animal and clinical studies, including an improvement in insulin sensitivity after RS supplementation (2) and favourable changes in body fat composition in rodents fed high RS diets. Furthermore, both intra-hepatocellular (IHCL) and intra-myocellular lipid (IMCL) storage are both known to play a key role in insulin resistance (3,4). The extent to which other CVD risk factors are amenable to dietary manipulation of RS is unknown and thus the objectives of this study were to assess effect of varying doses of RS on a range of cardiovascular disease risk factors in subjects exhibiting signs of metabolic syndrome.

STUDY DESIGN

The study was a randomised, single-blind, placebo-controlled, parallel, 12-week intervention trial. Volunteers were screened and those with fasting insulin of >60pM who met the inclusion and exclusion criteria were recruited to participate. 20 participants (age:47.2±12.2 years, BMI:31.0±5.0) were randomised to either the control group (no added RS) or the high RS group (40g added RS). After an overnight fast, baseline measurements were taken as detailed in the methodology below. Participants then were asked to consume the starch sachets provided, every day for the duration of the intervention, at which point, all measurements were repeated. Participants were also asked to maintain their existing eating and exercise habits throughout the study and their food intake was recorded for two 7-day periods at the beginning and near the end of the study.

METHODOLOGY



Euglycaemic-hyperinsulinaemic clamp: Insulin infusion was started at a rate of 35 mU insulin/m^2 min-1 and the glucose concentration of whole blood was measured every 5 min by use of a glucose analyzer. The infusion of 20% glucose was adjusted as needed to "clamp" blood glucose concentrations at 5 mM for a period of 2 hours and the glucose utilisation rate was derived during the last 30 minutes (steady state) of the clamp.

Vascular compliance: A micromanometer-tipped probe coupled to a SphygmoCor device (SphygmoCor VW apparatus with Sphygmocor analysis software; SphygmoCor version 7.01 AtCor Medical Pty, Australia) was used to non-invasively record the pulse pressure wave in the carotid-radial and carotid-femoral regions by applanation tonometry.

Measurement of ectopic fat deposition and body composition: Magnetic resonance spectroscopy and magnetic resonance imaging using a 1.5T Phillips multinuclear system were used to determine both IHCL and IMCL, and whole body fat deposition respectively.

Other: 24 hour ambulatory blood pressure monitoring, blood sampling for measurement of metabolites, inflammatory markers and adipokines.

PRELIMINARY RESULTS

- No statistically significant differences between the groups were observed in fasting glucose, weight circumference, or BMI (data not shown).
- There was a statistically significant difference in increase in glucose utilisation (%) in the high RS group compared with the control group (18.64±13.0 vs -13.93±6.8) (*P*<0.05) (Figure 1)
- A decrease in peripheral vascular compliance (Carotid-radial) (%) was attenuated in the high (-1.4 ± 7.3) compared with the control (3.0 ± 3.6) although this did this did not reach statistical significance (*P* < 0.10) (Figure 2)

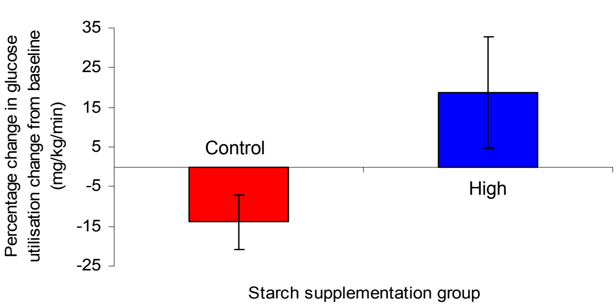


Figure 1: Percentage change in glucose utilisation following 12 weeks on either control or high-RS supplement (n = 10; *P* < 0.05)

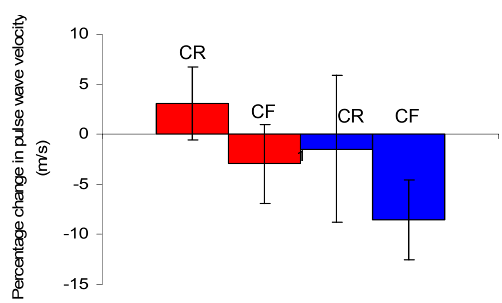


Figure 2. Percentage change in PWV following control or high-RS supplement for 12 weeks, n = 10, *P* < 0.10; CR, carotid-radial; CF,carotid-femoral

CONCLUSIONS

Consumption of 40 g per day of RS improved peripheral glucose utilisation in insulin resistant individuals compared with those who were in the control group. The effects on vascular compliance, as measured by pulse wave velocity were less marked and further analysis is underway to elucidate the precise mechanisms.

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4) Yki-Jarvinen, H. (2005) Fat in the liver and insulin resistance. *Ann Med* **37**, 347-56

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