

Cardiovascular - Protective properties of Fruit and Vegetable Extracts



J. Whitson¹, C.A. Hamilton¹, A. Crozier², E. Jardine¹, D Stewart³, G McDougall³, J.L.Reid¹, A.F. Dominiczak¹
¹BHS Glasgow Cardiovascular Research Centre University of Glasgow, ²Division of Biochemistry and Molecular Biology University of Glasgow, ³Scottish Crop Research Institute



INTRODUCTION

Epidemiological evidence strongly suggests that consumption of fruit and vegetables is associated with a reduced risk of cardiovascular disease and cancer.

This study investigates the antioxidant properties and effects of a range of plant extract polyphenols (PEP) on endothelial function and platelet aggregation.

Raspberry extracts (RE) containing a mixture of polyphenols, and 2 purified polyphenols Quercetin-3'-sulphate (QS) and Quercetin-3-glucuronide (QG) were examined together with ascorbic acid (AA) as a positive control.

AIM

The aim of this study is to test if the PEP improve endothelium function by decreasing super oxide levels, increasing nitric oxide bioavailability and decreasing platelet aggregation.

This could explain the protective effect of diets rich in fruit and vegetables against cardiovascular disease.

METHODS

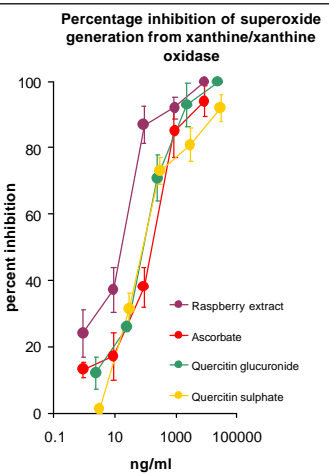
- Scavenging capacity of PEP for superoxide (O_2^-), generated from xanthine/ xanthine oxidase, was measured by lucigenin chemiluminescence.
- Scavenging capacity of PEP for O_2^- in thoracic and abdominal arteries of female stroke prone spontaneously hypertensive rats (SHRSP) was similarly measured.
- Nitric Oxide (NO) bioavailability was measured in carotid artery rings from SHRSP in the presence and absence of PEP. It was expressed as the increase in contractile response to phenylephrine (0.001-10 μ moles/l) in the presence of the nitric oxide synthase inhibitor L-NAME (100 μ moles/l).
- ADP dependent platelet aggregation was measured in an aggregometer in platelet rich plasma from healthy human volunteers in the presence and absence of PEP or vehicle.
- Concentrations of AA, QS and QG are in μ g/ml. Concentrations of RE are expressed as μ g/ml polyphenols.

CONCLUSIONS

- These studies confirm that the plant extracts examined can scavenge O_2^- and increase nitric oxide bioavailability.
- In addition RE showed a reduction in platelet aggregation.
- The beneficial effects of PEP on NO bioavailability and platelet aggregation could not be related directly to their efficacy as O_2^- scavengers suggesting that additional properties of PEP also need to be considered.

- RE appear to have the greatest cardiovascular protective effects but the active ingredients are yet to be fully identified and their in vivo bioavailability confirmed.
- In contrast QS and QG have been identified in plasma and are strong candidates to contribute to the cardiovascular protective properties of vegetables.

RESULTS



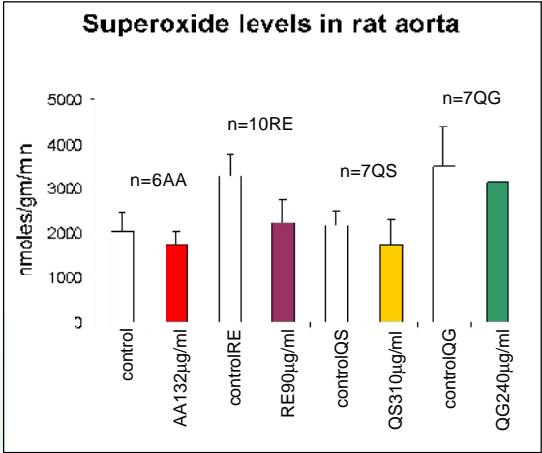
EC₅₀ Values For Scavenging O_2^- By PEP

Plant Extract	EC ₅₀ mg/ml	n	95% confidence interval
Ascorbic Acid	0.178	6	0.082-0.383
Raspberry Extract	0.026	6	0.012-0.059
Quercetin Sulphate	0.046	5	0.020-0.103
Quercetin Glucuronide	0.011	3	0.006-0.022

QG and RE have the greatest O_2^- scavenging effect and are significantly more potent than AA.

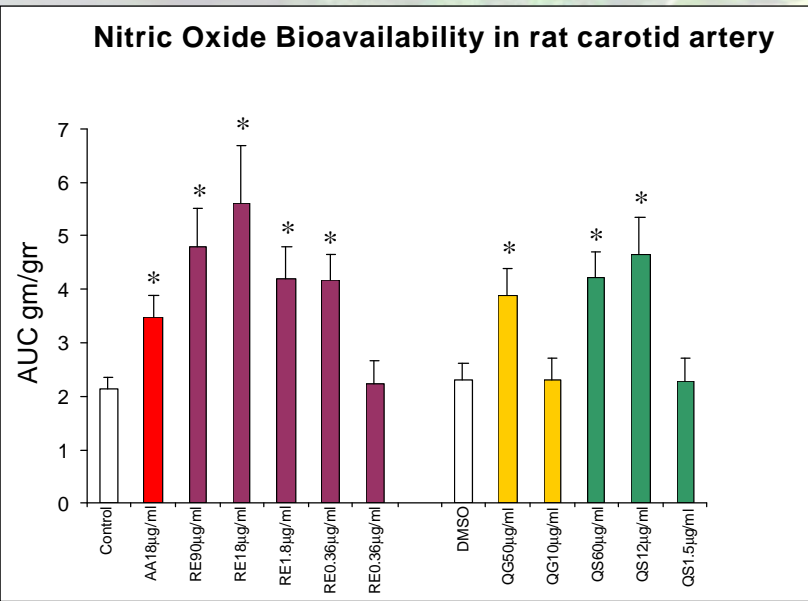
RE p = 0.0073 and QG p = 0.0109.

No significant difference was found between QS, RE and QG.

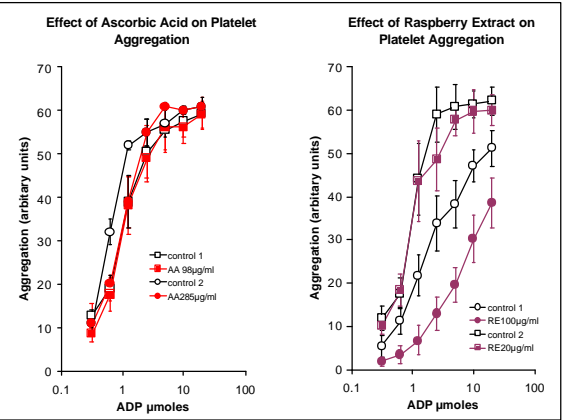


Although there was a trend for PEP to lower O_2^- levels in tissues no significant effects were observed.

This suggests the PEP are more efficient at scavenging extra-cellular O_2^- and this may relate to their relatively poor lipid solubility.



All PEP improved NO bioavailability in a concentration dependent manner.
* Indicates significant increase in NO bioavailability compared to appropriate controls.
n= 6-10 per group



Inhibition of Platelet Aggregation by PEPs

Plant Extract	n	Polyphenols mg/ml	EC ₅₀ PEP mg/ml	EC ₅₀ vehicle mg/ml	p Value
Ascorbic Acid	6	235	0.02316	0.4981	0.1548
Raspberry Extract	7	100	1.617	7.512	0.0011
Quercetin Sulphate	7	340	0.8976	2.186	0.1366
Quercetin Glucuronide	7	260	1.047	0.6571	0.7006

The results show that 100 μ g/ml RE is the only PEP to show a significant reduction in platelet aggregation.