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Catherine has had an extensive and varied career in science. Since graduating from the University of Witwatersrand, South Africa, with a Masters in Microbiology she has worked as a consulting industrial microbiologist both in South Africa and New Zealand.

She enjoyed her time as a research associate for Genesis Research and Development, New Zealand, looking for novel therapeutics for new drug therapies. Since coming to Australia she has lectured in the fields of biochemistry, microbiology, pharmacology and laboratory techniques.

Over the years she has developed an interest in nutrition and the prevention of disease and she has combined this interest with her love of science in a PhD looking at the effects of dietary factors on nitric oxide and its functional outcomes in relation to cardiovascular disease, which is the leading cause of death in Australia.





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The UWA Institute of Agriculture

Heart health benefits of apples

By Catherine Bondonno

Supervisors: Prof Jonathan Hodgson;
Prof Kevin Croft; Assoc Prof Michael Considine





Heart health benefits of apples



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- 🍏 First study to show flavonoid-rich apples improve nitric oxide status and endothelial function
- 🍏 Cardiovascular health
- 🍏 Natural and low cost approach



Acknowledgements



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Supervisors:

Prof Jonathan Hodgson
Prof Kevin Croft
Dr Michael Considine

Clinicians:

Prof Ian Puddey
Prof Trevor Redgrave

Flow mediated dilatation:

Lisa Rich

Nurse:

Claude Backory

Lab measurements:

Robin Xingbin
Adeline Indrawan
Ewald Swinney
Aidilla Murbarak

Funding:

ARC Linkage
NHMRC
Australian National Apple
Breeding Program

Volunteers



Heart health benefits of apples





Heart health benefits of apples



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Cardiovascular disease (CVD):

- 🍏 Leading cause of death in Australia
- 🍏 Quality of life
- 🍏 Australia's economy
- 🍏 Epidemiological studies
- 🍏 Phytochemicals, esp **flavonoids**







Heart health benefits of apples



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Flavonoids:

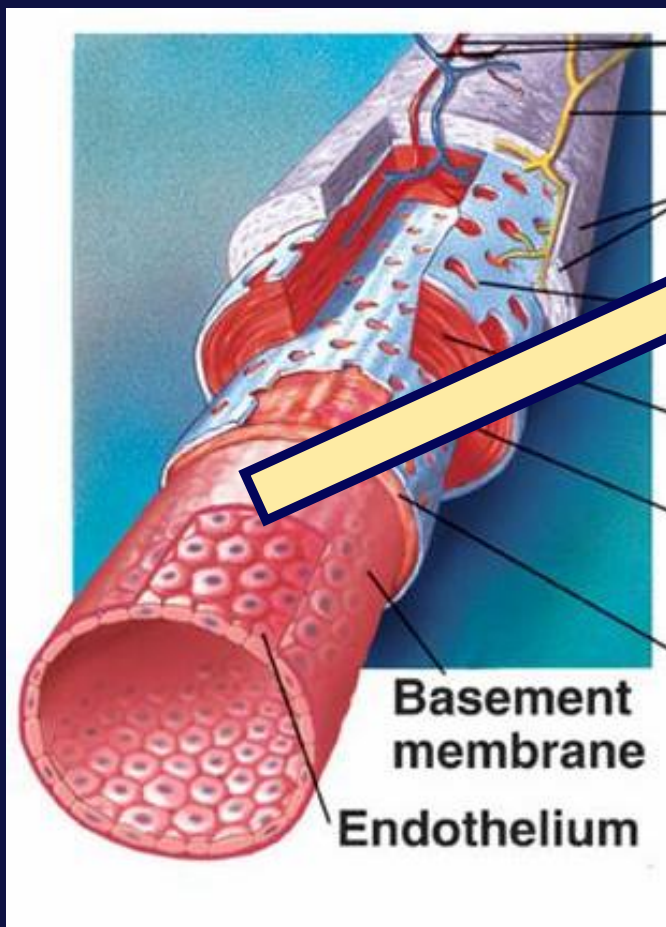
-  Phytonutrient
-  Secondary plant metabolites
-  Polyphenols
-  Positive effect on:
 - endothelial function
 - blood pressure
 - atherosclerosis
 - reduction in risk of CVD



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Endothelium:



Nitric Oxide
(NO)

S-
nitrosothiols
and nitrite

20-HETE
Endothelin-1





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Endothelial function and nitric oxide:

 Endothelial dysfunction

 Nitric oxide (NO)

 Dietary flavonoids

➡ augment NO status

➡ enhance endothelial function

➡ improve cardiovascular health



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Apples:

- 🍏 Source of flavonoids (esp. in skin)
- 🍏 Popular
- 🍏 Major contributor
- 🍏 (-) – epicatechin and quercetin glycosides
- 🍏 Improved endothelial function and NO status?



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Aim:

to investigate the acute effect of flavonoid-rich apples on endothelial function and NO status in healthy men and women





Participants



Healthy volunteers



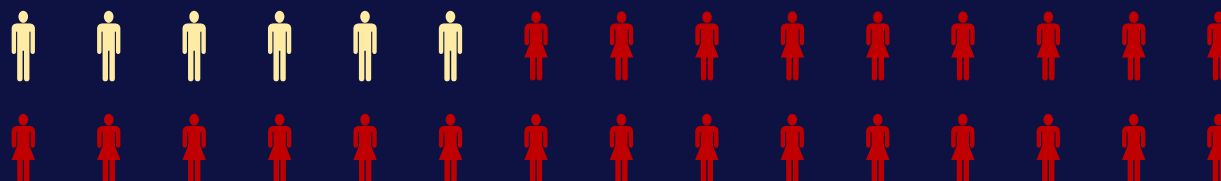
Exclusion criteria 



Telephone screening



Face to face screening





Baseline characteristics



	Mean \pm SD
Age (years)	47.3 \pm 13.6
Weight (kg)	66.4 \pm 10.8
Body Mass Index (kg/m ²)	23.6 \pm 3.4
Systolic blood pressure (mmHg)	112.2 \pm 11.5
Diastolic blood pressure (mmHg)	68.3 \pm 7.8
Total cholesterol (mmol/L)	5.1 \pm 0.7
Triglyceride (mmol/L)	1.0 \pm 0.4
High density lipoprotein cholesterol (mmol/L)	1.6 \pm 0.36
Low density lipoprotein cholesterol (mmol/L)	3.1 \pm 0.6
Fasting plasma glucose (mmol/L)	5.1 \pm 0.4



Study design



Randomised, controlled, cross-over trial



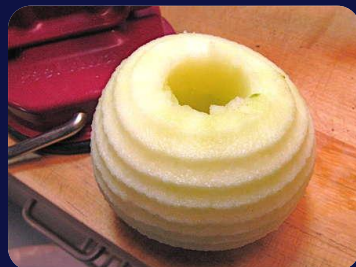
High flavonoid active



Low flavonoid control



Low flavonoid control



High flavonoid active





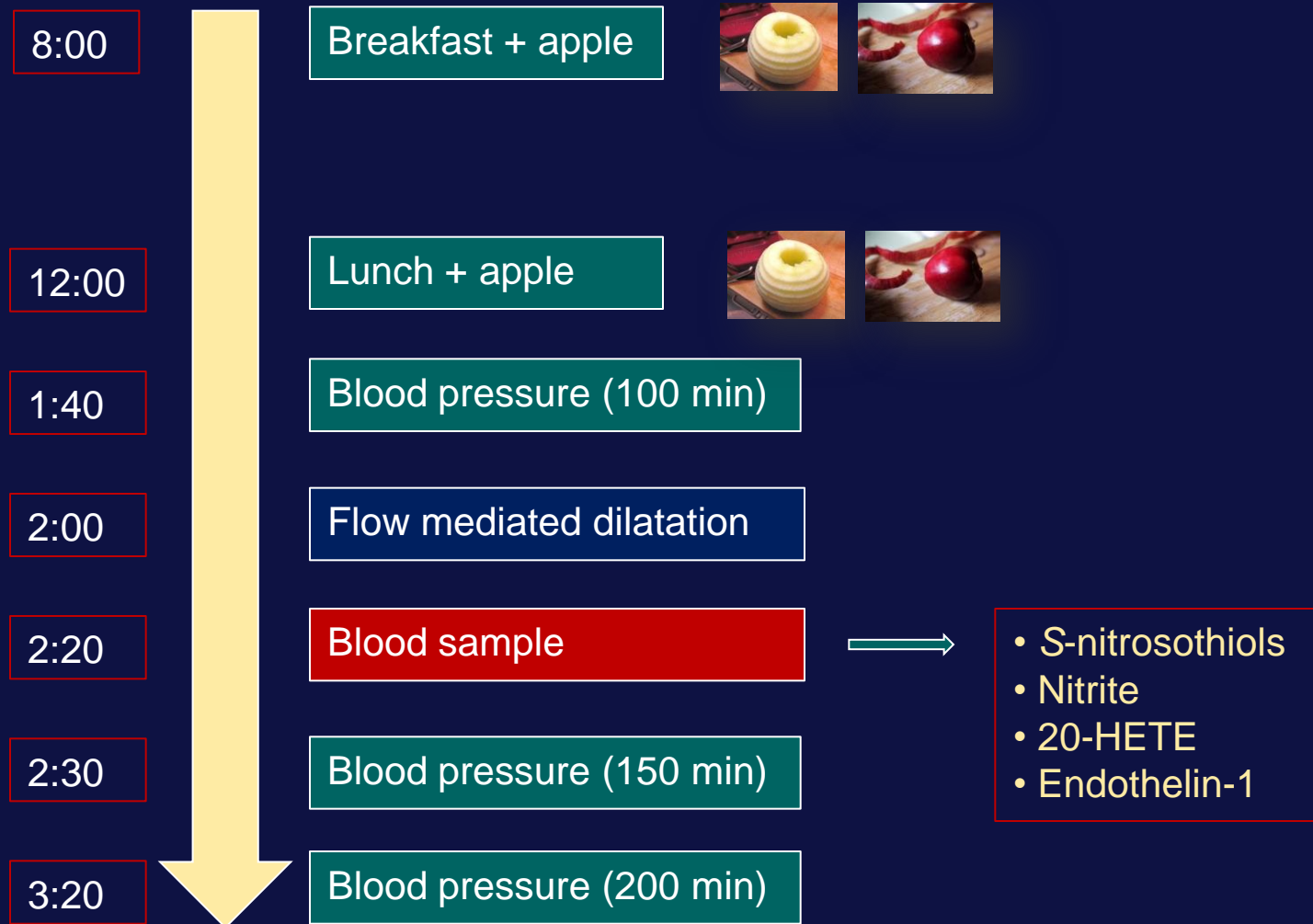
Flavonoid composition of apple



Polyphenol	Apple control (apple flesh) mg/dose (500 kJ)	Apple active (apple flesh+skin) mg/dose (500 kJ)
Quercetin glycosides	2	180
Free Quercetin	<0.1	4
Total Quercetin	2	184
(-)-Epicatechin	2	180
Chlorogenic acid	44	44



Study day plan





Flow mediated dilatation



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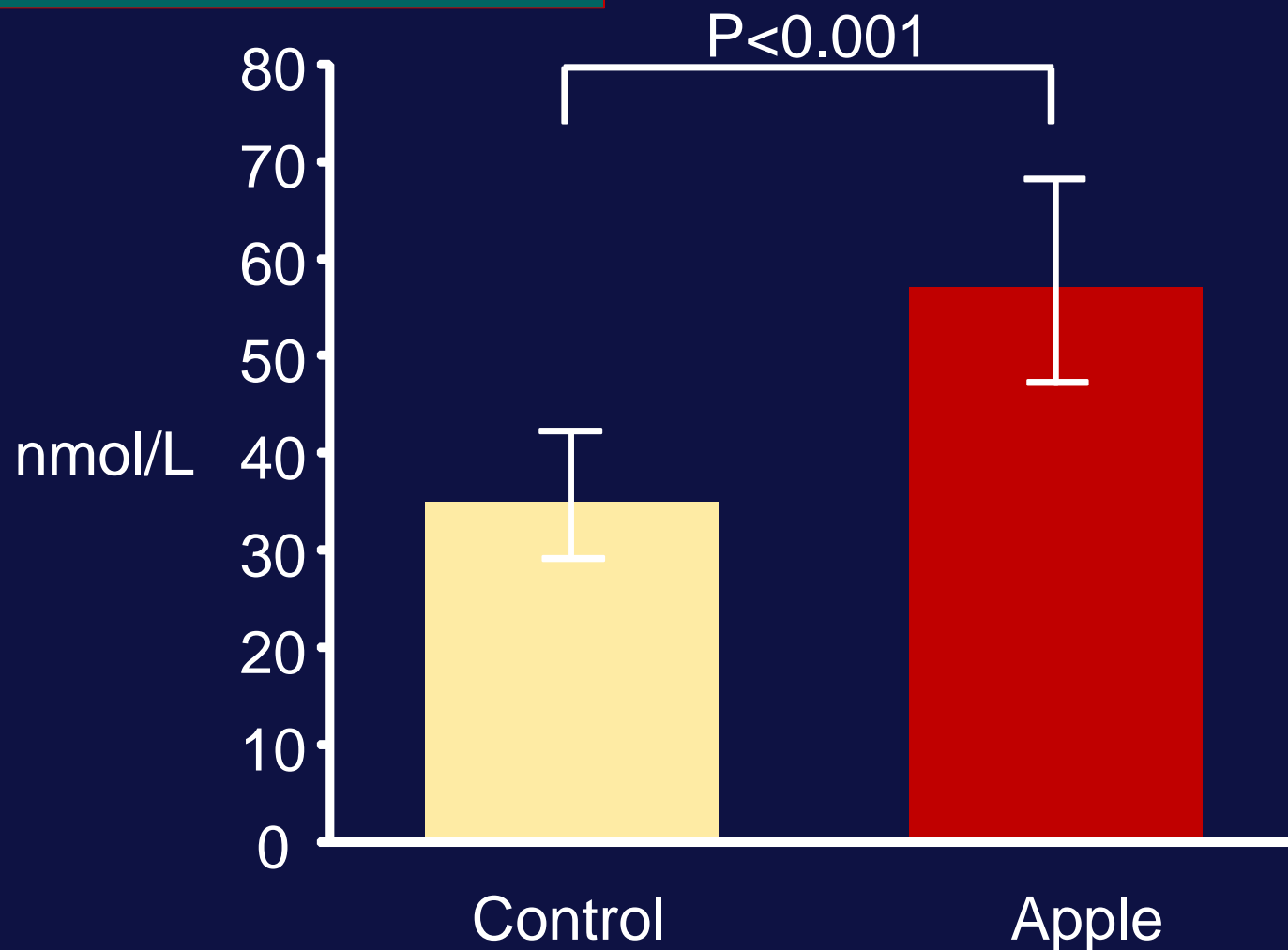




Nitric Oxide Status



Plasma S-nitrosothiols

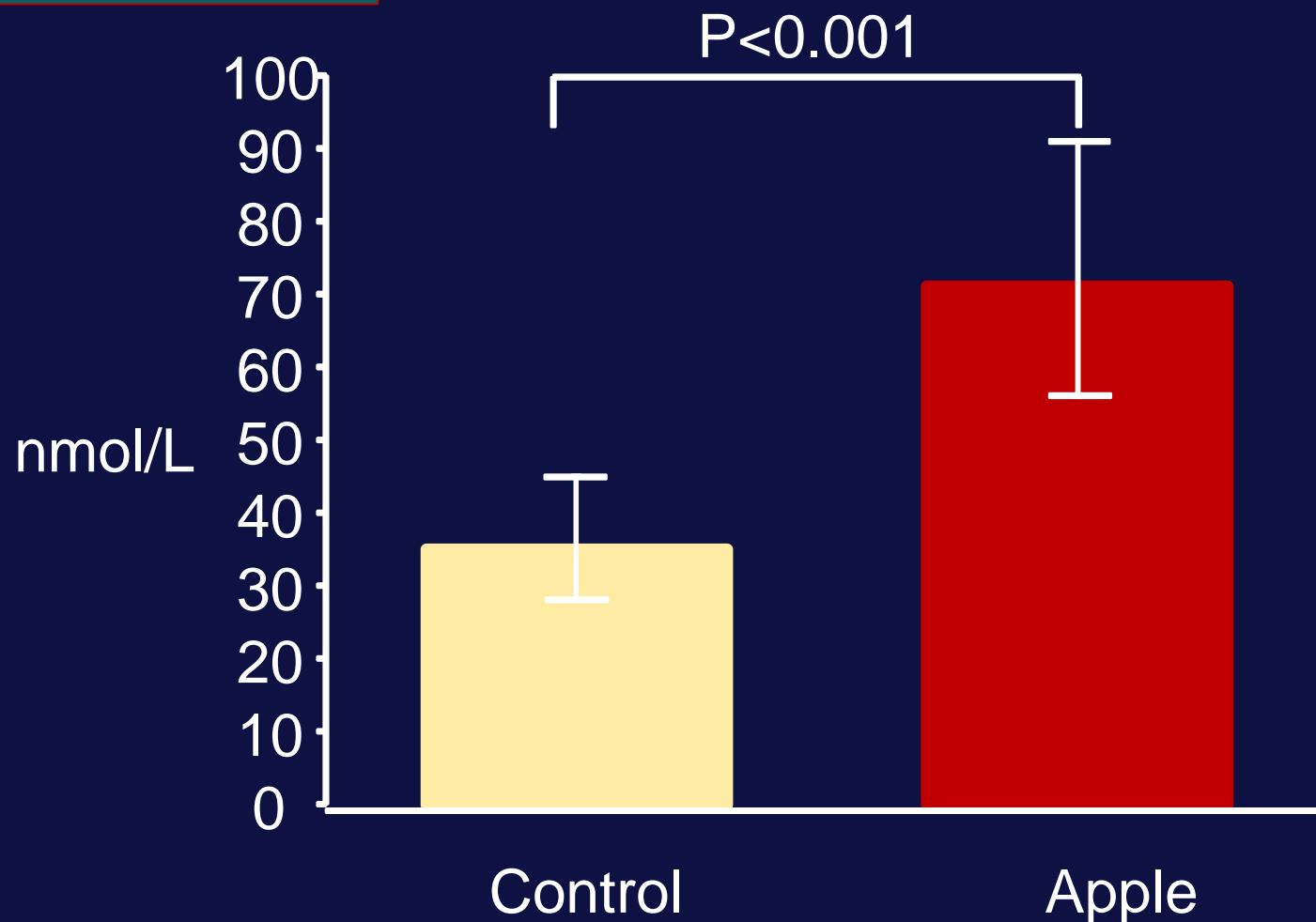




Nitric Oxide Status

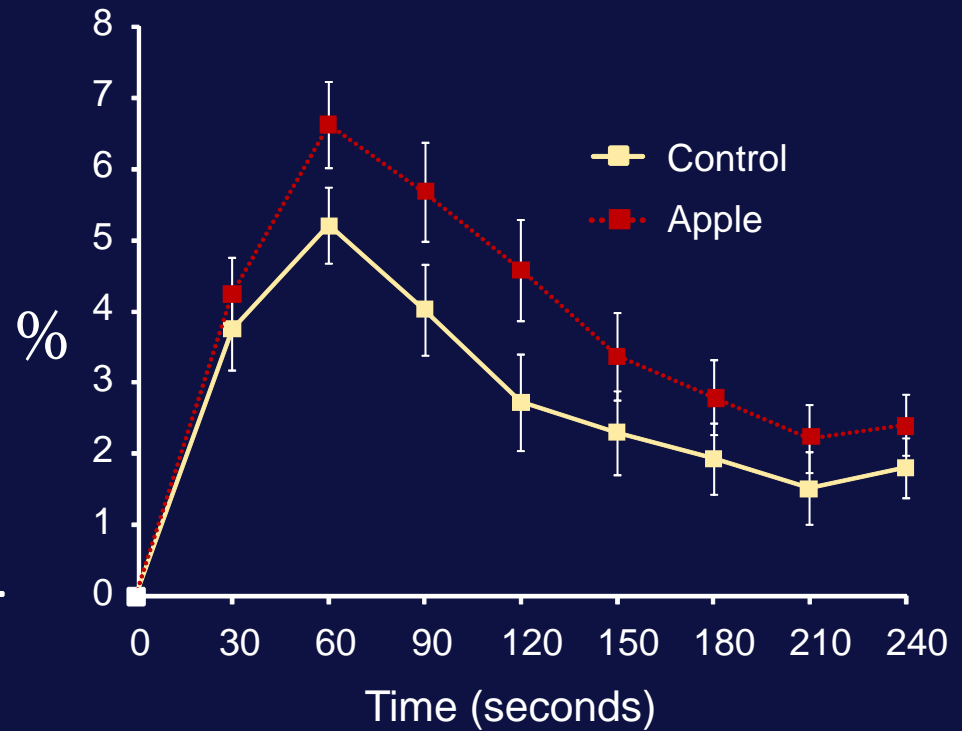
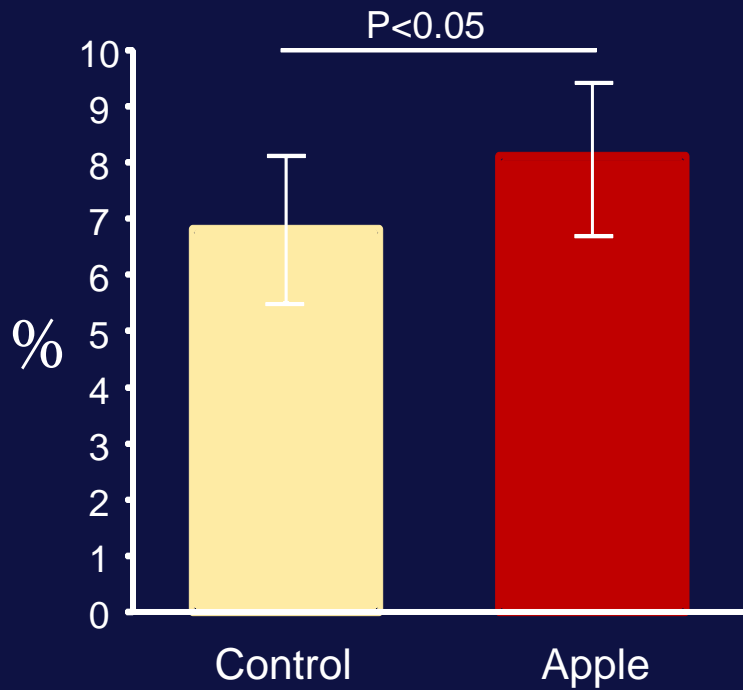


Plasma nitrite





Flow mediated dilatation

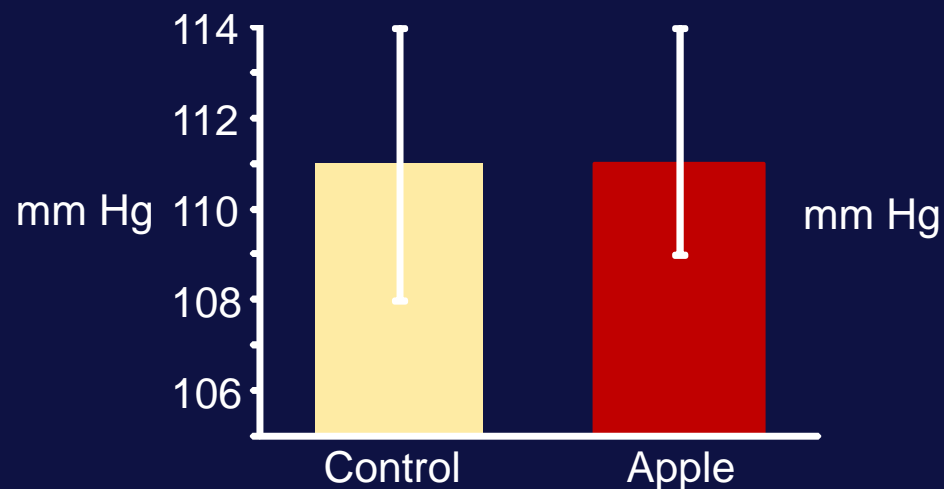




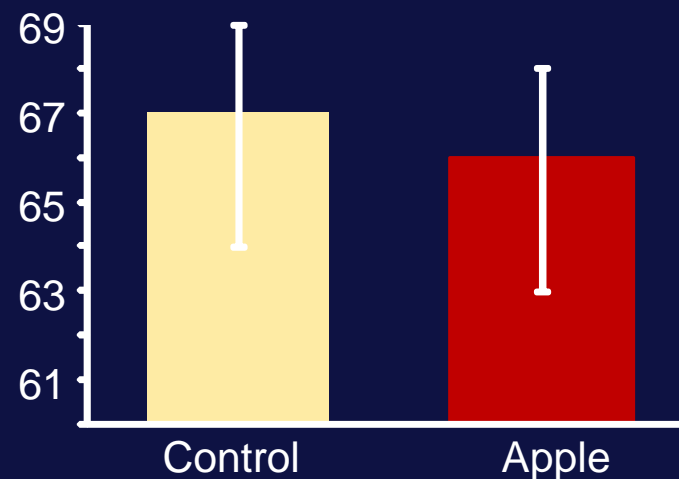
Blood pressure



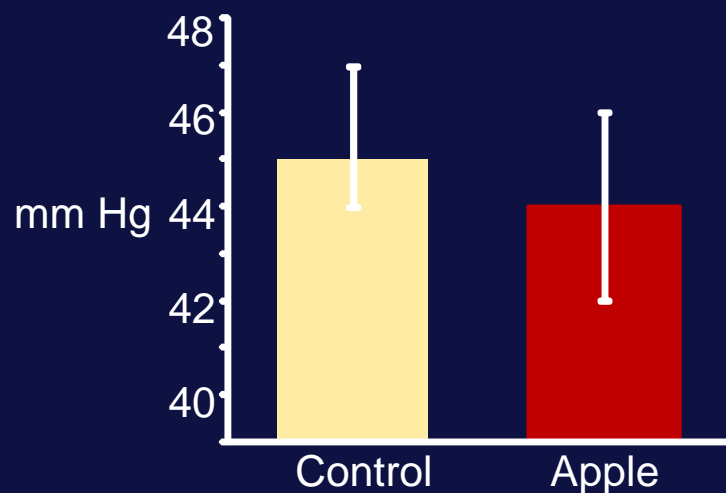
Systolic blood pressure



Diastolic blood pressure



Pulse pressure

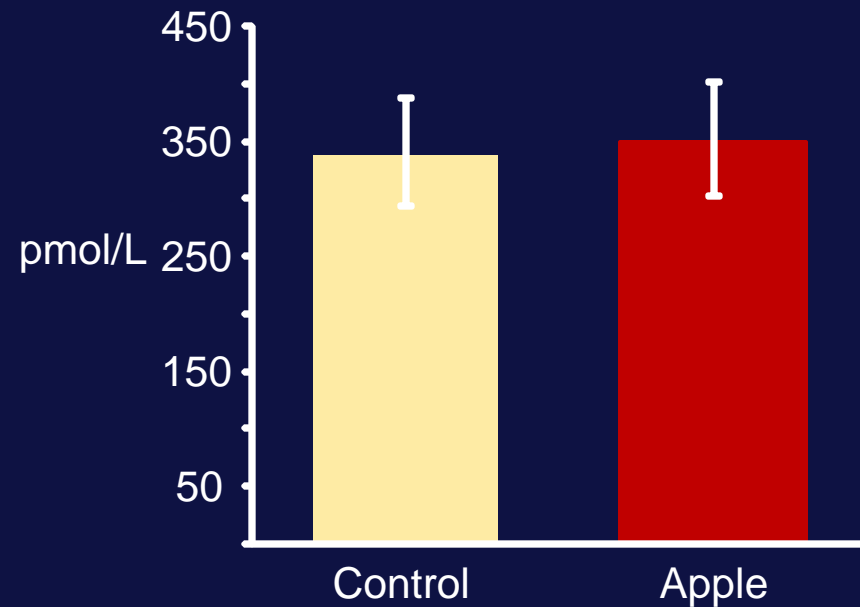




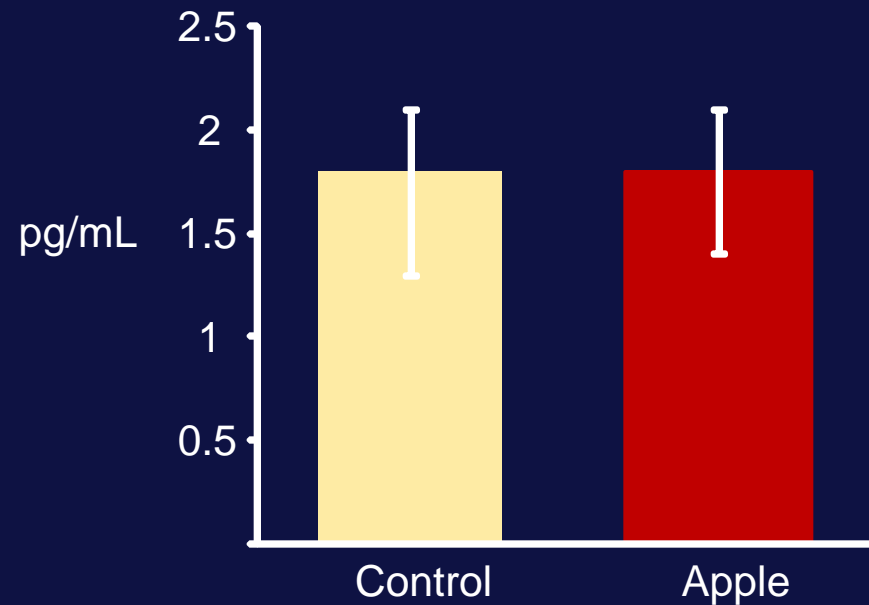
20-HETE and Endothelin-1



20-HETE



Endothelin-1





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Conclusions:

- 🍏 Flavonoid-rich apples improve nitric oxide status and endothelial function
- 🍏 Factors which may benefit cardiovascular health
- 🍏 Natural and low cost approach to reducing the cardiovascular risk profile of the general population