**Health Benefits of Fruit Polyphenols**

*Clinical evidence of fruit-derived polyphenol action in the postprandial state and effects on blood pressure.*

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**Postprandial State after 1 meal**

Modern / Western meal induces glucose spikes and prolonged elevation of lipids

![Graph showing glucose and lipids levels over time](image)

**Glucose drink increases ROS and NF-kappa B activity**

*Dhindsa et al. 2004*

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**40% fat meal induces:**

- Marked increases in inflammatory markers
- Marked increases in platelet aggregation

*Hyson et al. 2002*
Hyperglycemia / Hyperlipidemia

Insulin Resistant

IRS-1

Endothelial Dysfunction

Insulin Resistance

Endothelial Dysfunction

Western diet, Postprandial challenges ‘Everyday’ and Disease Risk

Disease and Disease Complications
Metabolic Syndrome, Atherosclerosis, Diabetes, Hypertension, Stroke

Inflammation
Common problem in multiple diseases

Pulmonary diseases

Cancer

Cardio- and Cerebro-Vascular diseases

Neurological diseases

INFLAMMATION

Autoimmune diseases

Arthritis

Diabetes

Atheromas contain multiple cell types that critically influence atherogenesis

Vascular cells
--Endothelium
--Smooth muscle cells

Inflammatory cells
--Macrophages
--T lymphocytes
--Mast cells

In vitro work supporting Anti-inflammatory effects of polyphenols

Cytokines
IL-6
IL-1b
TNFα
Chemokines
MCP-1
MIF
PGs
LTs
Etc

Polyphenols

PRR

free fatty acids

AGE

IPA = tissue plasminogen activator
uPA = urokinase-type plasminogen activator
Pai-1 = plasminogen activator inhibitor
SMC = smooth muscle cell

Adapted from Jungbauer and Medjakovic, Maturitas 2012


American Heart Association
Learn and Live
Modified / Oxidized LDL

LDL Readily Enter the Artery Wall Where They May Be Modified

Vessel Lumen

- Oxidation of Lipids and Apo B
- Hydrolysis of Phosphatidylcholine to Lysophosphatidylcholine
- Aggregation
- Other Chemical Modifications

LDL

Intima

Modified LDL (oxidized LDL)

Pro-Inflammatory


Slide Source: Lipids Online

LDL and Inflammation

Vessel Lumen

- Adhesion Molecules
- Cytokines
- MCP-1
- Modified (ox) LDL

Monocyte

Macrophage


Studying Polyphenols

- Whole food
  - Raw
  - Processed
    - juice, concentrate, formulation
- Extracts
  - Grape seed
  - Tomato
  - Spices
  - Essential oils
- Purified compounds
  - Resveratrol
  - Anthocyanins
  - Curcumin
  - Lycopene

- Cell culture
- Animal models
- Human
  - Epidemiology
  - Clinical
    - Safety/tolerability
    - Bioavailability
    - Efficacy

EVIDENCE.....
**Strawberry** prevents meal-induced increase in oxidized LDL (oxLDL) in overweight men and women

*Burton-Freeman et al. JACN 2010*

**Strawberry** attenuates postprandial inflammatory response in Overweight men and women

*Edirisinghe et al. BJN 2011*

**Strawberry** reduces the postprandial insulin requirement for glucose control in overweight men and women

*Edirisinghe et al. BJN 2011*
Strawberry and fibrinolysis (PAI-1) after 6 weeks feeding: Response to high fat meal challenge in OW men and women

Wine blocks meal-induced activation of pro-inflammatory transcription factor, NF-κB

PF-extract supplementation (vs placebo) 4 weeks on MCP-1 after LPS challenge

Oxidized LDL is decreased with GSE after 4 weeks supplementation in MS patients
Effect of purple grape juice on flow-mediated vasodilation

14 d Pts. CAD

15.0
10.0
5.0
0.0
-5.0

% FMD

Baseline
Grape Juice


Mechanism of activation of e-NOS by polyphenolics elucidated using GSE

Ca\(^{2+}\)/CaM: Calcium calmodulin complex, cGMP: cyclic GMP, sGC: soluble guanyl cyclase

GSE and change in blood pressure

GSE Dose

300 mg/day
150 mg/day
Placebo

Systolic
Diastolic

*** P<0.001, n=8

Effect of removing antioxidant capacity of polyphenolics

Summary

- We spend most of our life in a postprandial state
- Exaggerated postprandial responses are linked with disease risk
- Certain polyphenol-rich foods have clinical evidence for attenuating postprandial responses and maintaining system balance
- GSE polyphenols appear to have a role in lowering blood pressure

Where do we go from here?

Studying Polyphenols

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  - Raw
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    - juice, concentrate, formulation
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  - Tomato
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  - Essential oils
- Purified compounds
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Combating inflammation through diet

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