New research on health effects of cocoa, grape and oat polyphenols

Alison Coates, PhD, RNutr
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Cocoa, grape and oat polyphenols

- Polyphenols are bioactive nutrients derived from foods
  - Flavanols in cocoa
  - Resveratrol from grapes and wine
  - Avenanthramides from oat (Avena sativa) plants
- Evidence of cardiovascular health benefits rapidly developing

Mechanism of action

Cardioprotective
- Enhanced nitric oxide bioavailability leading to improved endothelial function
- Lipid lowering
- Inhibition of LDL oxidation (antioxidant)
- Inhibition of platelet aggregation
- Suppresses proliferation of smooth muscle cells
- Anti-inflammatory
- Reducing insulin resistance

Cardio-protective effects of cocoa

Meta-analysis included 24 papers, n=1106 participants

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Weighted Mean Diff</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mmHg)</td>
<td>↓1.63 (0.13-3.12)</td>
<td>P=0.033</td>
</tr>
<tr>
<td>LDL-C (mmol/L)</td>
<td>↓0.077 (0.004-0.149)</td>
<td>P=0.038</td>
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<tr>
<td>HDL-C (mmol/L)</td>
<td>↑0.046 (0.0028, 0.089)</td>
<td>P=0.037</td>
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<tr>
<td>HOMA-IR (units)</td>
<td>↓0.94 (0.59-1.29)</td>
<td>P&lt;0.001</td>
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<tr>
<td>FMD (%)</td>
<td>↑1.53 (0.67-2.40)</td>
<td>P&lt;0.001</td>
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</table>

No change in total cholesterol, triglycerides or C-reactive protein

* A nonlinear dose-response relationship was found between Cocoa and FMD (P = 0.004), with maximum effect observed at a flavonoid dose of 500 mg/d

# Acute and chronic benefits of chocolate or cocoa on FMD

<table>
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<tr>
<th>Study or Subgroup</th>
<th>Mean Difference</th>
<th>SE Difference</th>
<th>Weight</th>
<th>P Value</th>
<th>Total Flow % Increase</th>
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| Brotman 2009 (56) | 1.5 ± 0.16 | 0.13 | 1.5 | 0.001 | 0.001 | 100.00%
| Ipwe 2009 (59)  | 2.68 ± 0.17 | 0.17 | 1.0 | 0.001 | 0.001 | 100.00%
| Gualtieri 2008 (44) | 3.1 ± 0.16 | 0.16 | 1.0 | 0.001 | 0.001 | 100.00%
| Fassbender 2008 (44) | 4.0 ± 0.16 | 0.16 | 1.0 | 0.001 | 0.001 | 100.00%
| McFarlane 2008 (50) | 3.3 ± 0.16 | 0.16 | 1.0 | 0.001 | 0.001 | 100.00%
| MacKinnon 2007 (50) | 3.2 ± 0.16 | 0.16 | 1.0 | 0.001 | 0.001 | 100.00%
| Gualtieri 2006 (44) | 3.9 ± 0.16 | 0.16 | 1.0 | 0.001 | 0.001 | 100.00%
| Overall Mean     | 3.4 ± 0.16 | 0.16 | 1.0 | 0.001 | 0.001 | 100.00%

Test for overall effect: Z = 10.0 (P < 0.0000)

Test for between-differences: CH² = 8.13, d.f. = 7 (P = 0.082), P = 0.69 %

### Acute

(3.15% (2.04-4.33%)

### Chronic

1.34%

(1.00-1.68%)

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## Effects of chocolate or cocoa on Insulin Sensitivity

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## Acute Resveratrol & FMD

- 19 overweight/obese men or post-menopausal women with untreated borderline hypertension (systolic BP: 130-160 mmHg or diastolic BP: 85-100 mmHg)
- Double-blind, randomized crossover comparison with 1 week intervals
- 3 doses of pure synthetic trans resveratrol (resVida™ 30, 90, 270 mg) and a placebo

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**Acute Cocoa supplementation dose dependently increases FMD in Health Older Adults**

- **Dose of Cocoa**: 0 g (placebo), 2 g, 5 g, 13 g, 26 g
- **Procyanidin content**: O mg, 69 mg, 180 mg, 465 mg, 1095 mg
- **Total Polyphenols**: 330 mg, 420 mg, 420 mg, 840 mg, 1470 mg

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**Acute Resveratrol & FMD**

![Graph showing FMD response (%)](image1)

- FMD response (%): +1.9, +2.4, +1.5, +3.7
- Red wine polyphenol extract (600mg)
- Cocoa flavanols (902mg)
- Tea flavanols (450mg)
- EGCG (300mg)

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**Grape Polyphenols & Blood Pressure**

- 61 healthy, older adults (mean age 61.4 ± 8.4 years), clinic BP:135 ± 9 / 82 ± 8 mm Hg
- Triple cross-over study with 4 week treatment periods: 0, 280 mg and 560 mg red wine polyphenols added to dairy drinks

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<td>143 ± 2</td>
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<td>143 ± 2</td>
</tr>
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<td>560 mg</td>
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- Systematic Review (Yang et al 2011, PLoS One) concluded that published evidence to date (Sept 2010) is not sufficiently strong to justify recommending resveratrol for administration to humans, beyond doses which can be obtained from dietary sources


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**Chronic Resveratrol & FMD**

- 34 patients with MetS, parallel, randomised study (no placebo used)
- Modified Resveratrol supplement containing 100mg trans resveratrol (Longevinex)
  - This is a slow release formulation

![Graph showing FMD response] (image2)

- FMD increased from 4.4 ± 2.4 to 10 ± 3.4 %


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**Oat polyphenols and vascular function**

**Aim:** To determine if daily consumption of a wild green oat extract (WGOE) in healthy older adults would result in sustained improvements in endothelial function (both peripheral and cerebral)

- 37 healthy, overweight older adults (67 ± 0.8 years and BMI: 26.4 ± 0.6 kg/m²)
- Wild green oat extract tested in chronic cross-over study

![Flowchart showing study design] (image3)

- Exclusion criteria: Aged < 60 years, Smoker, Cardiovascular disease, Uncontrolled hypertension, Stroke, Diabetes

- Full publication currently under review
Polyphenols and cognitive function

- Polyphenol rich food has also been proposed to help preserve cognitive function
- Action may be through reducing oxidative processes and enhanced neurotransmitter functioning
- Possibly also due to improved cerebral circulation\(^1\) and direct action on central nervous system enzymes\(^2\)
- Recent data from asymptomatic subjects at high cardiovascular risk (n = 447; 52% women; age 55-80 y) enrolled in PREDIMED study
  - Urinary polyphenol excretion was associated with better scores in verbal memory\(^3\)
- Cognitive performance of 2574 middle-aged French adults
  - High total polyphenol intake was associated with some cognitive functions including better language and verbal memory\(^4\)

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Summary

- Evidence for acute and chronic effects of cocoa, grape and oat polyphenols on vascular function dependent on
  - Dose
  - Mixture of polyphenols
  - Population tested
- Recent evidence of effects on cerebral blood flow indicate possible benefits for mood and cognition
- More dose response studies needed

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- Mars Inc
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http://www.unisa.edu.au/nutritional-physiology/