Chocolate, red wine, peanuts – health foods or indulgences?

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Functional Foods

- Chocolate, red wine and peanuts can all be considered as functional foods!
  - Functional Foods: foods that provide health benefits beyond simple nutrition

- What do they have in common?
  - Bioactive nutrients which have been associated with heart health
What’s in chocolate?

- Cocoa solids, cocoa butter, vegetable oils, milk powder

3kJ/100g

- 0% energy from fat
  - High in stearic acid (~30%)

Minerals
- Zinc, potassium, magnesium

Polyphenols
- Catechins, flavonol glycosides, anthocyanins, procyanidins
  - Theobromine, caffeine
What’s in red wine?

• 10-14% alcohol ~285kJ/100ml

• Contains >9000 different polyphenols¹
  • Anthocyanosides
  • Proanthocyanidins
  • Catechins
  • Stilbenes

¹German and Walzem Annu. Rev. Nutr. 2000. 20:561-93
What's in a peanut?

High Energy Density
~2376kJ/100g

>80% MUFA

Arginine
(precursor to nitric oxide which dilates blood vessels)
What's in a peanut?

- Monounsaturated fat
- Arginine
  (precursor to nitric oxide which dilates blood vessels)
- Fibre
- Plant sterols
- Folate
- Vitamin E
- Polyphenols

So how do these foods provide a heart health benefit?
Endothelial function - maintaining blood vessel health

Blood Flow Shearing Forces → NO-dependent Vasodilators

L-arg → eNOS → NO → Ca++ → NO → GC → cGMP

Smooth Muscle Cell

Relaxation → Vasodilation

http://www.cvphysiology.com
Hypertension

Insulin resistance

Endothelial Dysfunction

- Smoking
- High fat diet
- Ageing
- Oxidative stress

So what happens when the endothelium becomes dysfunctional?

Endothelial dysfunction

Gupta et al. AIDS 2010; 4(9): 1377-1380
**Action of polyphenols**

**How polyphenols improve blood vessel function**

- **eNOS expression** (via stimulation of Ca^{2+})
- **NO bioavailability** (by reducing its degradation mediated by reactive oxygen species)
- **synthesis of vasoconstrictors** (endothelin-1)
- **expression of adhesion molecules**
- **inflammatory status**
- **proliferation and migration of smooth muscle cells**
- **platelet aggregation**

**Relaxation → Vasodilation**

**Endothelial function = CV health**

What is the evidence?

http://www.youthserviceslitigation.com/articles/mental-health-research/
The benefits of cocoa flavanols

Traditionally consume >5 cups of flavanol-rich cocoa per day

Urbanisation = Cocoa consumption = Protection against age-related hypertension

### Zutphen Elderly Study

470 elderly men, 15-year follow up

#### Amount of cocoa/chocolate consumed

<table>
<thead>
<tr>
<th>Adjusted Relative risk</th>
<th>Lowest (&lt;0.5 g/d)</th>
<th>Middle (0.5-2.25 g/d)</th>
<th>Highest (&gt;2.25 g/d)</th>
<th>P for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Mortality</td>
<td>1.0</td>
<td>0.70</td>
<td>0.50</td>
<td>0.0004</td>
</tr>
<tr>
<td>All cause mortality</td>
<td>1.0</td>
<td>0.73</td>
<td>0.53</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

#### Stockholm Heart Epidemiology Program

1169 non-diabetic individuals after MI

#### Frequency of cocoa/chocolate consumption (50g) and CVD

<table>
<thead>
<tr>
<th>Hazard Ratio</th>
<th>never</th>
<th>&lt;1/mth</th>
<th>≥1/week</th>
<th>2 +/week</th>
<th>P for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Mortality</td>
<td>1.0</td>
<td>0.73</td>
<td>0.56</td>
<td>0.34</td>
<td>0.01</td>
</tr>
<tr>
<td>All cause mortality</td>
<td>1.0</td>
<td>0.89</td>
<td>0.96</td>
<td>0.94</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Cocoa and endothelial function

Acute response 2hrs after single dose

Chronic response measured > 10hrs after previous dose

BP also decreased following HF chronic supplementation

Chocolate Conclusion

• Cocoa polyphenols can provide CV benefit through a range of mechanisms:
  – antioxidant
  – anti-inflammatory
  – anti-atherogenic activity

• If dietary cocoa polyphenol intake is due to chocolate its high energy content needs to be taken into account.

The benefits of red wine polyphenols
Red wine and endothelial function

Acute administration of Red grape polyphenol extract (600mg)

30 male patients with CHD

Flow-mediated dilatation (FMD) at baseline, 30, 60, and 120 min after the ingestion of the extract of red grapes or placebo. *P<0.001 versus baseline; **P<0.001 versus corresponding FMD at 60 min after the ingestion of the extract of red grapes.

Red wine and endothelial function—resveratrol

Resveratrol (3,4',5-trihydroxystilbene)

- Polyphenol found in skin of red grapes/red wine, peanuts skins and dark chocolate
- Resveratrol content per serve
  - red wine/grape juice > cocoa/chocolate > roasted peanuts

Resveratrol studies with cell culture and animal models show improved endothelial function

- ↑ eNOS in vitro acutely
- ↑ NO levels and ↓ endothelin-1 level leading to a higher FMD response in rabbits after 12 weeks

2 Leikert et al Circulation 2002;106:1614-1617;
Acute FMD response to resveratrol

19 overweight/obese volunteers with mildly elevated BP

Resveratrol dose (mg)

FMD response (%)

0 30 90 270

+2.5 +2.4 +3.4

Red wine polyphenol extract (600mg)¹
Cocoa flavanols (902mg)²
Tea (450ml)³
EGCG (300mg)⁴


The Heart Foundation **does** recommend the following.

- Drink as part of a healthy balanced diet,
  
  -- cocoa made from **raw cocoa powder**.

The Heart Foundation **does not** recommend the following for the prevention or treatment of CVD.

- Consuming milk or dark **chocolate**
- Drinking **red wine** or other types of alcoholic drinks.

_NHF position statement: Antioxidants in food, drinks and supplements for cardiovascular health. Updated August 2010 (2010)_
Hazel handed in her notice, because she was tired of working for peanuts......

What about peanuts?
Physicians Health Study

21,454 men 40-84 years
began 1982 - diet questionnaire in 1983
17 year follow-up - 201 sudden deaths

Frequency of all nut consumption

<table>
<thead>
<tr>
<th>Relative Risk</th>
<th>&lt;1/mth</th>
<th>1-3/mth</th>
<th>1/wk</th>
<th>&gt;2/wk</th>
<th>P for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Heart Disease</td>
<td>1.0</td>
<td>0.89</td>
<td>0.90</td>
<td>0.7</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(0.9-1.2)</td>
<td>(0.9-1.0)</td>
<td>(0.5-0.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudden Death</td>
<td>1.0</td>
<td>0.98</td>
<td>0.85</td>
<td>0.64</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.7-1.4)</td>
<td>(0.6-1.3)</td>
<td>(0.4-1.0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nurses Health Study
86,016 women aged 34-59 years
began 1976 - diet Questionnaire in 1980
14 year follow-up - 1255 major CHD events

Frequency of all nut consumption

<table>
<thead>
<tr>
<th>Relative Risk</th>
<th>Almost never</th>
<th>1-3/mth to 1/wk</th>
<th>2-4/wk</th>
<th>&gt;5/wk</th>
<th>P for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Heart Disease</td>
<td>1.0</td>
<td>0.91 (0.8-1.0)</td>
<td>0.78 (0.6-0.9)</td>
<td>0.66 (0.47-0.93)</td>
<td>0.005</td>
</tr>
<tr>
<td>Fatal Coronary Heart Disease</td>
<td>1.0</td>
<td>0.76 (0.6-0.9)</td>
<td>0.60 (0.4-0.96)</td>
<td>0.60 (0.3-1.1)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

- adjusted for other diet components, risk factors
- nut eaters were leaner and drank less alcohol

Hu FB. BMJ 1999;317:1341-1345
Peanuts and endothelial function

- **No study** to date has tested the effects of peanuts on endothelial function.
- ARC-Linkage grant between PCA and UniSA established to do this.
  - 2010-2013, (Coates, Berry, Howe, Buckley, Bryan)
- Studies in walnuts and pistachios have reported improvements in endothelial function.
  - **Pistachios**: 4wk, 20% E in healthy men, 30% relative increase (P=0.002)\(^1\)
  - **Walnuts**: acute consumption (+4hrs), 40g walnuts vs 25g olive oil in 12 healthy subjects and 12 patients with hypercholesterolemia improved FMD (P=0.006)\(^2\)

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\(^1\) Sari et al 2010 Nutrition;26(4):399-404;
Peanuts are better than NCEP low fat diets (Step 1, 2) for improving blood lipid profiles.

Peanuts and Obesity

Does nut consumption lead to excessive energy intake?

Can this contribute to obesity and diabetes?

Energy Intake of Peanut Users and Nonusers

<table>
<thead>
<tr>
<th></th>
<th>Men Kcal</th>
<th>Women Kcal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>2570</td>
<td>1727</td>
</tr>
<tr>
<td>Nonusers</td>
<td>2215</td>
<td>1546</td>
</tr>
</tbody>
</table>

Mean BMI of Peanut Users and Nonusers

<table>
<thead>
<tr>
<th></th>
<th>Men BMI</th>
<th>Women BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>26.3</td>
<td>25.7</td>
</tr>
<tr>
<td>Nonusers</td>
<td>26.6</td>
<td>26.1</td>
</tr>
</tbody>
</table>

*P<0.05
Summary

• Cocoa and peanuts could be incorporated into a healthy diet for cardiovascular health

• Red wine is not recommended as a way to increase intake of polyphenols

• Low energy density foods enriched with these bioactive compounds may be an effective way to increase polyphenol intake without increasing
  • Energy
  • Saturated fat
  • Refined sugar
  • Alcohol
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