ESSEN Congress Geneva 2014

BEYOND GASTRONOMY: FUNCTIONAL FOOD WITH A SWISS FLAVOR

CHocolate: the bitter taste of health improvement

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CHocolate
The Bitter Taste of Health Improvement

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Cocoa

- Theobroma cacao
- Drink of Gods (Xocoatl)
  - theo = God
  - broma = drink
- Mexico (Maya, Incas, Aztecs)
- Aphrodisiac
Overview Cocoa and Chocolate Market

By courtesy of S. Scheiber, Bühler Ltd., Chocolate Processing

Chocolate Market World
Countries with highest Consumption and Growth

Consumption (2012, kT)

Forecast Growth Consumption (2014-17, kT)

By courtesy of S. Scheiber, Bühler Ltd., Chocolate Processing

Source: Euromonitor (2013)
Chocolate

- Preparation of Theobroma cacao seeds, roasted and grinded
- Flavoured, e.g. with vanilla

- Rich source of flavanoids, i.e. antioxidants
- Theobromine, caffeine, phenethylamine
Chocolate – Healthy?

- Kuna Indians (Panama)
  - low rates of hypertension & cardiovascular disease
  - Cocoa intake: unprocessed beverage ≈ 230 ml/d
  - High polyphenol intake (flavanols)

Flavanol content
- Cocoa beans 10.0%
- Cocoa powder (Kuna) 3.6%
- Dark Chocolate 0.5%
- Milk chocolate <0.5% or nihil

Kuna Indians - Blood Pressure

FIG. 1. Blood pressure and prevalence of hypertension among island-dwelling and mainland Kuna Indians. Reprinted with permission from Hollenberg (102).

Chocolate – Health Effects

- Stroke ↓
- Coronary heart disease ↓
- Hypertension ↓
- Caries ↓ (glycoproteins, caseine, various polyphenols)
- Mood ↑ (serotonin, the calming transmitter ↑)
- Cognition ↑

- Blood Cholesterol ➔ (stearic acid: neutral cholesterolemic response)
- Obesity ➔

Fernandez-Murga et al. Maturitas 2011;69:312-21
Chocolate – Health Effects

- Functional food
- Modulator of cardiovascular risk
- Mechanism: antioxidant properties by polyphenols

Flavonoids
Content of Flavanols

<table>
<thead>
<tr>
<th>Source</th>
<th>Flavanol content (mg/kg fresh wt or mg/L)</th>
<th>By serving (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate (50 g)</td>
<td>460–610</td>
<td>23–30</td>
</tr>
<tr>
<td>Beans (200 g)</td>
<td>350–550</td>
<td>70–110</td>
</tr>
<tr>
<td>Apricot (200 g)</td>
<td>100–250</td>
<td>20–50</td>
</tr>
<tr>
<td>Cherry (200 g)</td>
<td>50–220</td>
<td>10–44</td>
</tr>
<tr>
<td>Grape (200 g)</td>
<td>30–175</td>
<td>6–35</td>
</tr>
<tr>
<td>Peach (200 g)</td>
<td>50–140</td>
<td>10–28</td>
</tr>
<tr>
<td>Blackberry (100 g)</td>
<td>130</td>
<td>13</td>
</tr>
<tr>
<td>Apple (200 g)</td>
<td>20–120</td>
<td>4–24</td>
</tr>
<tr>
<td>Green tea (200 mL)</td>
<td>100–800</td>
<td>20–160</td>
</tr>
<tr>
<td>Black tea (200 mL)</td>
<td>60–500</td>
<td>12–100</td>
</tr>
<tr>
<td>Red wine (100 mL)</td>
<td>80–300</td>
<td>8–30</td>
</tr>
<tr>
<td>Cider (200 mL)</td>
<td>40</td>
<td>8</td>
</tr>
</tbody>
</table>
Chocolate – Health Effects

- Protective modulation of
  - blood pressure
  - lipid profile
  - platelet activation
  - sensitivity of insulin

Concrete Example

- Zutphen Elderly Study
  - Mean diastolic & systolic pressure ↓ (p=0.03)
    in highest tertile of cocoa intake
  - Cardiovascular & all cause mortality reduced by half

Atherosclerosis – Oxidized LDL

➢ Flavanols
  ➢ Inflammation ↓
  ➢ Antioxidative capacity ↑
  ➢ Vascular dilation ↑
  ➢ Blood pressure ↓
  ➢ Lipid profile balanced
  ➢ Platelet activation ↓
  ➢ Insulin resistance ↓

Blood Pressure

In pre- and hypertensive individuals (dark vs white / high vs low flavanol)

- 3.2±1.9 mmHg
- 2.0±1.2 mmHg

Fig. 5. Result of the meta-analysis of the effect of chocolate/cocoa on systolic and diastolic blood pressure (from Ried et al. [80], with permission).

Stroke

- Swedish men (n=37,103)
- FFQ
- Follow-up 10.2 yrs
- Highest quartile (63 g/wk) vs lowest (0 g/wk)
- 90 % milk chocolate!

Larsson SC et al. Neurology 2012;79:1223-9
Dark Chocolate: An Obesity Paradox?

- 30 g dark chocolate (80% cocoa), 12 normal weight women
  - Satiety ↑
  - Hunger ↓

- 100 g dark chocolate 2 h before ad libitum meal vs milk chocolate
  - Food & energy intake by 8% ↓
  - Satiety scores ↑

Dark Chocolate: An Obesity Paradox?

- High frequency of chocolate consumption, n=1018, healthy female lower BMI

Chocolate Consumption 1/\alpha\; Body Weight

Dark Chocolate: An Obesity Paradox?

- Epicatechin/Quercetin (antiobesity effect)
  - Adipose tissue lipolysis ↑
  - Fatty acid synthesis ↓
  - Fat oxidation ↑

- Caffeine
  - Weight reducing effect

Adverse Effects of Chocolate?

- Gastrointestinal complaints
- Migraine headaches
- Jitteriness
  - Not been shown

- Caffeine effects
  - Tachyarrhythmias
  - Sleep disturbances
  - Medication interaction, e.g. with oral anticoagulation

- Theobromine effects
  - Heart burn

Cognitive Function

Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

Messerli FH. *N Engl J Med* 2012;367:1562-4
Cognitive Function

Flavanol-rich preparations increase cognitive performance
....and significantly decrease mental fatigue
More CNS Effects

- Flavanols
  - Protect from neurodegeneration
  - Increase brain perfusion
  - Decrease neuroinflammation
  - Modulate neuronal function

Anti-Parkinson?

Anti-Alzheimer?

Anti-Stroke?
The Bitter Taste…….
The Bitter Taste

- Cocoa Companies Supporting Civil War in Ivory Coast (Global Witness)
- On average, cocoa farmers earn less than $2 per day, an income below the poverty line (West Africa)
- Most of the children labouring on cocoa farms are between the ages of 12 and 16
- On cocoa farms, 10% of child labourers in Ghana and 40% in the Ivory Coast do not attend school
- In addition to the hazards of using machetes, children are also exposed to agricultural chemicals
The Bitter Taste…slightly sweeter…?

- Majority of organic cocoa originates from Latin America
- At this time, neither slavery nor child labour have been documented on these cocoa farms

http://www.foodispower.org/slavery-chocolate/
Fairtrade standards are designed to tackle poverty and empower producers in the poorest countries in the world.

The standards apply to both producers and traders.

Today 20% of worldwide Cacao certified

Fairtrade label increases the price for the production of a chocolate bar by
More Bitter Taste……..

- Chocolate contains palm oil
  - Palm oil plantations $\rightarrow$ Deforestation
  - $\rightarrow$ Mammal species endangered
  - $\rightarrow$ Biodiversity decreases
  - $\rightarrow$ Poverty, child labour
Aphrodisiakum im 19. Jahrhundert als Getränk
We all love chocolate...
...well known fact that dietary flavonoids found in chocolate can be beneficial to our health... But who knew that they could also help you to win a Nobel Prize?

Swiss-born Professor Franz Messerli, M.D.... at Roosevelt Hospital and Columbia University in New York City published a study linking scientific success to chocolate consumption.

With an annual chocolate consumption of 26.2 lbs per person, Switzerland ranks number 1 in worldwide chocolate consumption. Switzerland also has the highest number of Nobel laureates per capita.

Dr. Messerli... significant linear correlation between a nation’s chocolate consumption and the number of Nobel Prizes per 10 million citizens.
More scientific........?

- However, addition of „healthy“ dark chocolate to a well-balanced calorically appropriate diet offers a pleasurable and palatable option with little burden for many people...

- Moderate chocolate consumption appears to have a favourable risk/benefit profile for obese individuals...

- Only the dose makes the poison... (Paracelsus, 1493-1541)

- Environmental and social problems...

Open Questions

- White versus dark?
- Cocoa or different ingredients?
- Observational studies?
- No RCT with hard endpoints?
- Confounders?

YOUR QUESTIONS?
Aphrodisiac im 19. Jh. als Getränk