

Dark chocolate as a functional food

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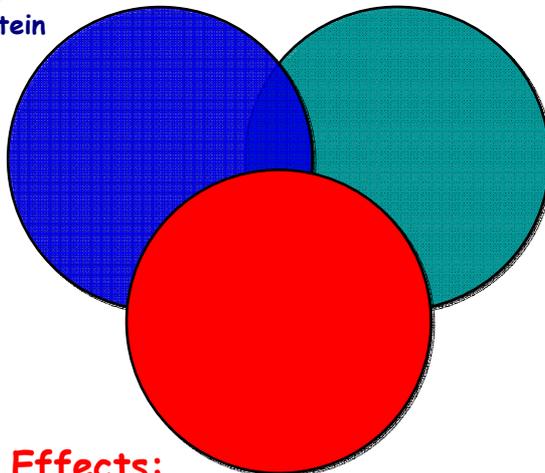
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The Concept of Functional Food

Nutrition:
fat/carbs/protein
vitamins
minerals

Palatability:
taste
sensation



Functional Effects:

Disease reduction (e.g. decreased heart disease)
Healthy aging (e.g. improved cognitive function)

Jeanne Louise Calment 1875 - 1997



1995 - aged 120

Does chocolate influence longevity?

**Claimed to eat up to 1 kg of
chocolate per week !**

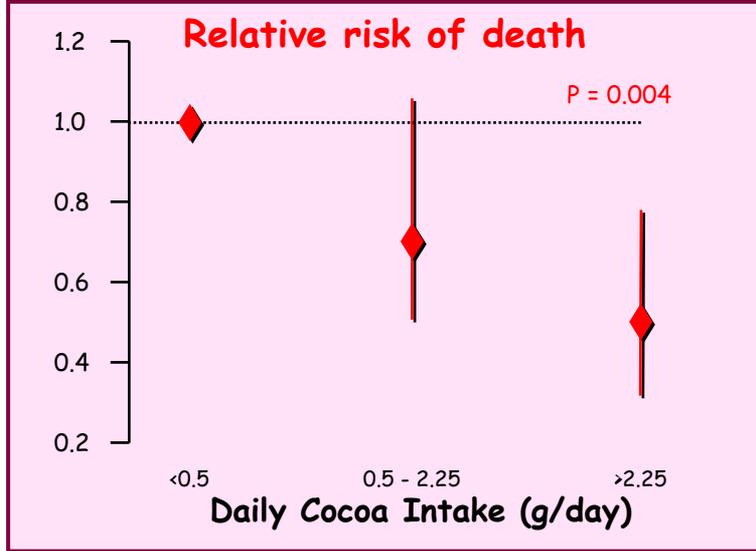
**Could the health benefits of dark
chocolate classify it as a
functional food?**

- **Evidence from population studies**
- **The key polyphenols in cocoa**
- **The effects of cocoa polyphenols on
blood vessel function**
- **What affects chocolate "quality" ?**



Zutphen Elderly Study: Reduced cardiovascular mortality in men consuming daily cocoa products

(Buijsse et al., Arch. Intern. Med. 2006; 166:411-417)

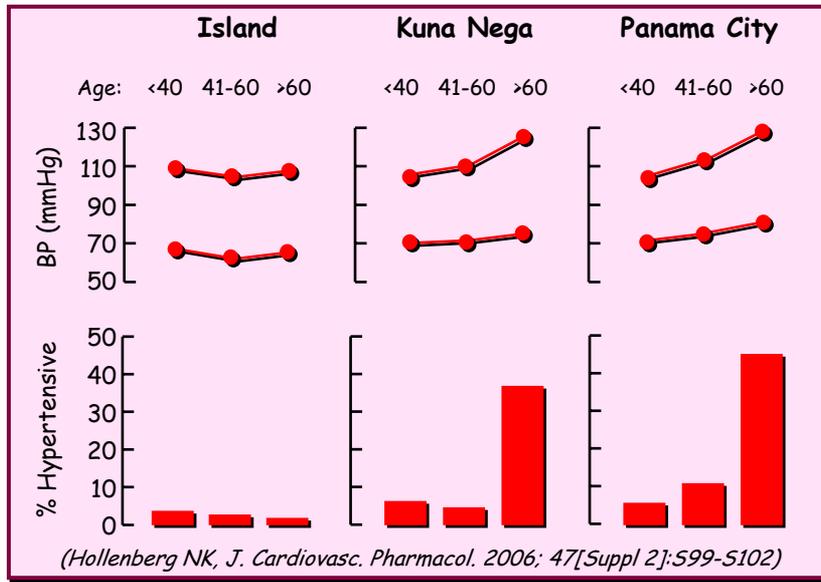


The Kuna Conundrum

Kuna Indians living on the San Blas Islands of Central America do not show age related increases in blood pressure, whereas those moving to the mainland do. This is thought to be due to their habit of drinking an average of 5 cups of cocoa a day.

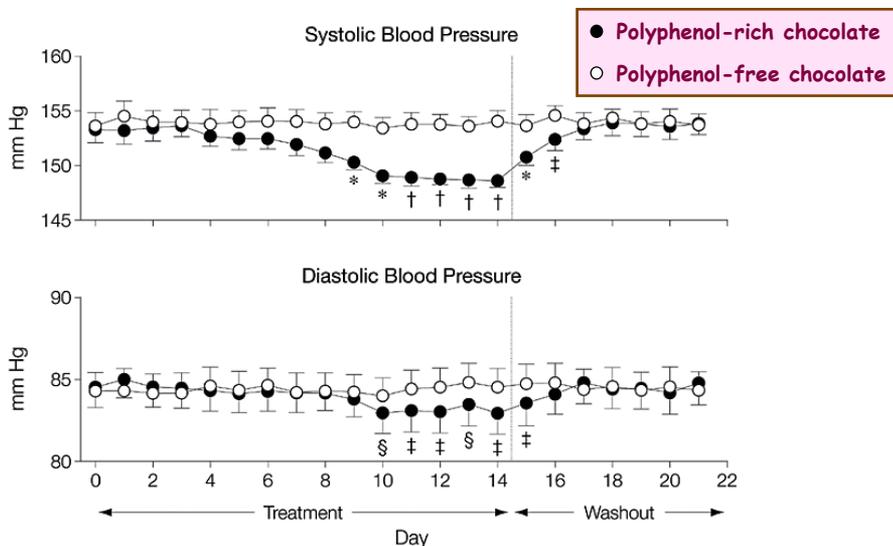


Effect of urban migration on blood pressure in Kuna Indians



Time Course of Blood Pressure During a 14-Day Diet With PRC or PFC

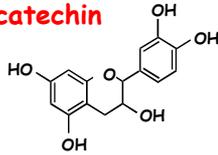
(Taubert et al., *JAMA* 2003;290:1029-1030)



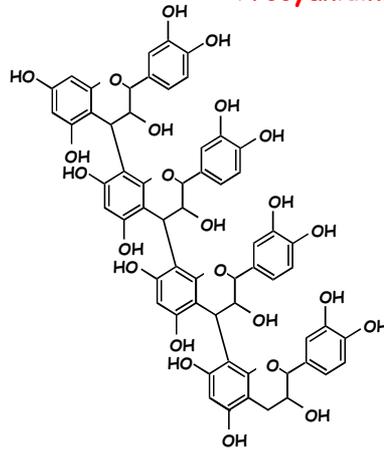
The main polyphenols in chocolate

Flavonoids (Flavan-3-ols)

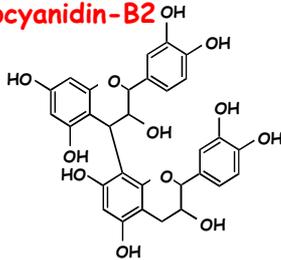
Epicatechin



Procyanidins



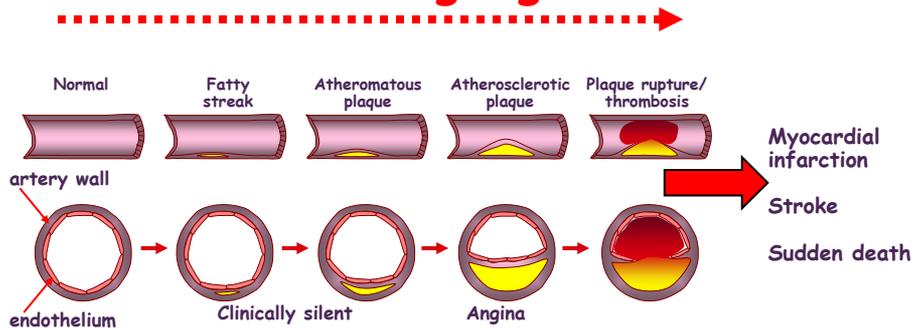
Procyanidin-B2



Tetra-epicatechin

The silent process of heart disease

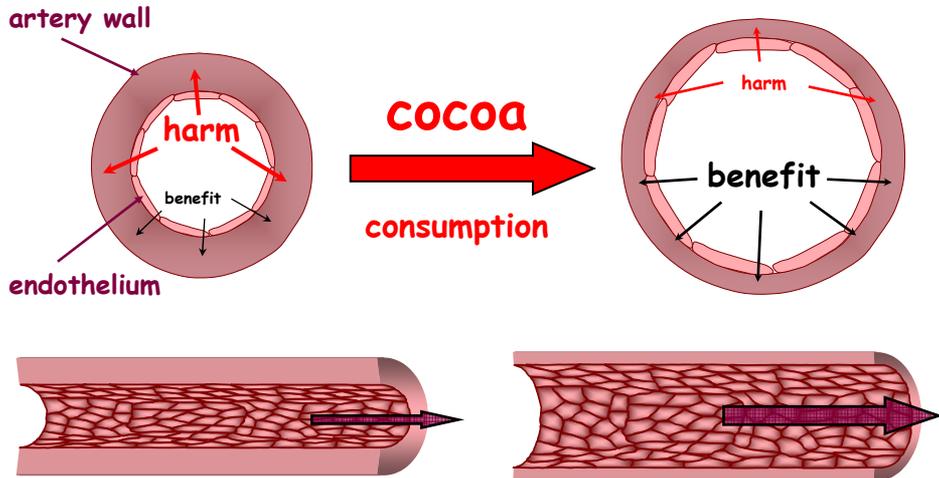
Increasing Age



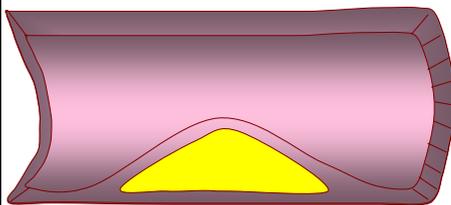
Cocoa flavonoids improve blood vessel function

Vascular/Endothelial dysfunction:
vasoconstriction, increased blood pressure,
remodelling, atheroma prone

Improved function:
vasodilatation, lower blood pressure,
atheroma resistant



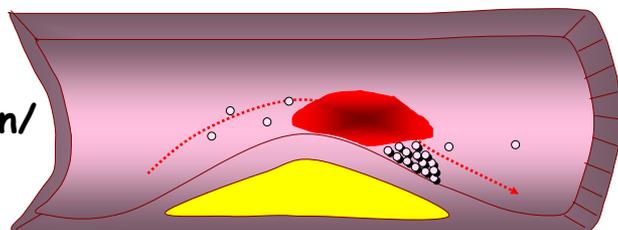
Anti-thrombotic effects of flavonoids



Flavonoids induce anti-thrombotic defences:

- Endothelium produces anti-thrombotic enzymes (plasminogen activators)
- Inhibit platelet adhesion

Platelet adhesion/
prothrombotic



What effects chocolate "quality"?

Manufacture destroys the protective polyphenols & creates an unhealthy food

Origin and Variety (Forastero > Criollo: up to 50% difference)

Fermentation, Drying (up to 90% loss)

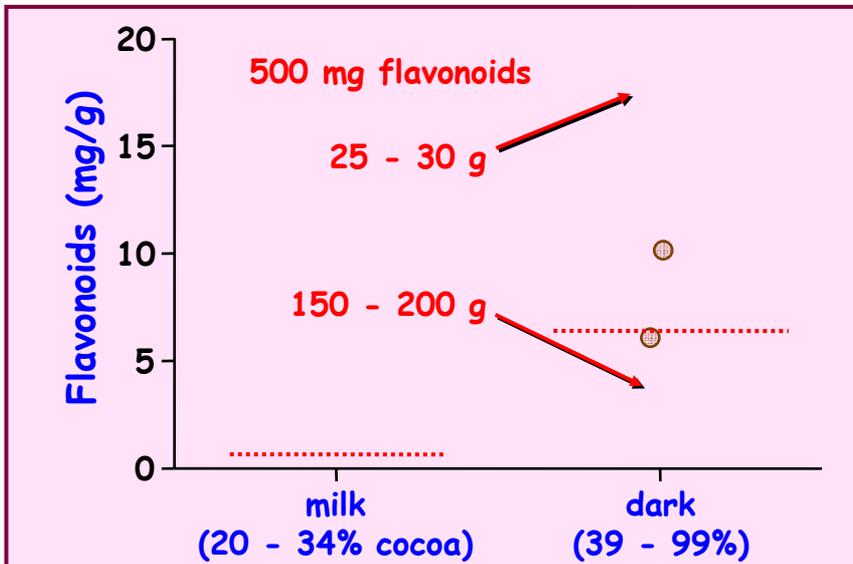
Roasting, Alkalisiation, Conching (further losses)

Chocolate contains <5% of the flavonoids found in freshly harvested cocoa beans

High level of added sugar 20 - 40g/100g

Added dairy fat in milk chocolate

Relative amounts of flavonoids in representative chocolate products



Statement of % cocoa solids on chocolate bars is misleading

1. Includes relative amount of cocoa mass or cocoa liquor
2. % solids may also include added cocoa butter (which contains no flavonoids)

Conclusion - Chocolate bars need labelling for flavonoid content !

Summary

- Consumption of cocoa products lowers blood pressure and reduces heart disease
- Experimental studies confirm potent effects on blood vessel function
- Actions due to flavonoid constituents

The Future

- More detailed clinical trials
- Better labelling with flavonoid content
- Assessment of the ideal daily amount, from the perspective of total flavonoids, as well as from chocolate consumption