Spices in life and health
Spices and common belief – true?

- “Everybody knows that”…
- “We have always done it this way”…

Trepanation
Proposed health benefits of spices

- Potentially serious diseases
  - Cardiovascular disease and diabetes
  - Cancer
  - Infections
  - Inflammatory diseases

- Other health problems
  - Gastrointestinal disturbances
  - Skin conditions
  - Pain
But – how certain can we be?

- Quantity
  - of knowledge
- Quality
  - of investigations
- Diversity
  - within the spice world
Published reports about spices

- What is listed in Pubmed
  - Covers all medical articles since 1966
    » some journals back to the 19th century

- "Spices and health" – 304 hits
- "Piper nigrum and health" – 11 hits
- "Berries and health" – 8845 hits

- In other words – limited information
Can we use data from animals?
... or from cell cultures?
Food and health – 2 principles

- The Principle of Protection of the Plant
- The Principle of Homology – protective for all living species

- Fruit and vegetables
  - Roots
  - Berries
  - Nuts
  - Spices?
Spices – origin

- Leaf – bay leaf
- Buds – clove
- Bark – cinnamon
- Root – ginger
- Berries – grains of pepper
- Seeds – cumin
- The stigma of the flower – saffron
Chemical composition

- Phenolic acids, flavonoids, sterols, and cumarins etc
- Essential oils – with terpenes, monoterpenes, and sesquiterpenes etc
  - > 70 different components

- But we know more than we think …
Antioxidant activity in food

- **Meat**
  - Rosemary (or extract), oregano, sage, thyme oil, black cumin,

- **Fish**
  - Clove, rosemary, oregano, thyme, sage,

- **Oil**
  - Oregano, rosemary, sage, ginger, thyme, black cumin extract
Antibacterial activity in food

- **Meat**
  - Cinnamon ext, oils from mustard, oregano, clove, rosemary, sage, coriander, cilantro

- **Fish**
  - Cinnamon powder, oils from oregano, clove, thyme, mint

- **Fruits**
  - Apple juice – cinnamon
  - Melon, kiwi – carvacrol
Important health problems

- Cardiovascular disease
- Cancer
- Gastrointestinal dysmotility
- Pain
- Infections
The Interheart study

- Smoking
- Diabetes*
- High blood pressure
- Abdominal adipositas*
- High blood lipids*

- Stress
  - At work
  - At home
  - With the economy
  - Life events <1 year

- Fruit & vegetables
- Exercise
- Alcohol
  - Better with age

*= spices may have an impact

Lancet -04, 25 000 patients, 50 countries
The metabolic syndrome

- Insulin resistance (diabetes: 5%)
- Overweight 25%
- High blood pressure 10%
- Elevated blood lipids 10%

→ Affects around 10%
+ Increased risk of cancer (1/3 food)
Atherosclerosis results in

- Myocardial infarction
- Stroke
- Aortic aneurysm
- Peripheral ischemia
WHO estimates

- 30 % of all cancer
- 90 % of diabetes
- 80 % of all cardiovascular disease

can be prevented by better food habits, no smoking and enough exercise.
Spices and the heart

- Cardiovascular health
  - Diabetes – accelerates atherosclerosis
  - Lipid metabolism
  - Platelet aggregation

1. Lipid deposition
2. Lipid oxidation
3. Platelet aggregation
Ginger – common belief

- Impaired blood circulation, elevated cholesterol
- Bad appetite, nausea / vomiting, obstipation, indigestion, diarrhoea, gases, malabsorption, reflux
- Inflammation, cough, cold, flue, arthritis, asthma, fever, tendinitis, muscle pain, ischias, distorsions, fungal infections
- Anemia, impaired libido, dysmennorhea, hematoma, cramp
Ginger – *zingiber officinalis*

1. Better glucose and lipid control in diabetic rats
2. Reduces lipid peroxidation in rats…
3. Platelet inhibitor, better than aspirine tested in vitro on platelets

1. Lipid deposition 2. Lipid oxidation 3. Platelet aggregation
Oxidation – a matter of ageing

- Antioxidants protect the tissue from degrading; rusting
- For example, oxidation of cholesterol makes it harmful
**Pepper – piper nigrum**

- Reduces oxidative stress by lowering lipid peroxidation (rats, human LDL)
- Reduces to some extent oxidative damage in diabetes (rats)
Important health problems

- Cardiovascular disease
  - Diabetes
- Cancer
- Gastrointestinal dysmotility
- Pain

- Infections
  - Not only in developing countries
Obesity and mortality
Diabetes risk and obesity (BMI)
Obesity Trends* Among U.S. Adults

BRFSS, 1985

(*BMI ≥30, or ~ 30 lbs overweight for 5’4” woman)
Obesity Trends* Among U.S. Adults BRFSS, 2004

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)
The global diabetes epidemic

WHO.
Cinnamon – common belief

- Gastrointestinal pain, gases, diarrhoea, nausea,
- Cold, sinusitis, cough, fever, flue, arthritis, fungal infection, infection in the skin, tonsillitis, bronchitis
- Stress, chronic fatigue syndrome
- Tooth / head / muscle pain, wounds, impaired libido, nose bleeding
Cinnamon and diabetes

- 1, 3 and 6 gram daily for 6 weeks decreased blood glucose and blood lipids in human diabetic patients
- The effect lasted even after a 20 days washout period
Effect of cinnamon on b-glucose

Khan-03. 60 patients
Effect of intake of 6 g cinnamon

Hlebowicz-07, 14 healthy, one meal w porridge
Important health problems

- Cardiovascular disease
- Cancer
- Gastrointestinal dysmotility
- Pain

- Infections
  - Not only in developing countries
Cancer – a long complicated process
Spices in cancer protection

- Rosemary (ursolic acid, carnisol etc)
  - protects DNA from oxidative damage
  - slows down cancer cell growth rate

- Turmeric (curcumin, effect like TNF)
  - induces apoptosis (=programmed cell death)
  - inhibits metastasis and angiogenesis

- Pepper (capsaicin)
  - promotes apoptosis
  - antiproliferative via anti-stress mechanism
Pepper and cancer

- Antiproliferative and stimulates apoptosis, but furthermore:
  - Activates oxidative defence systems in lung cancer (mice)
  - 50% longer survival in mice with cancer, effects on GI and lung
Ginger and cancer

- Inhibition of cancer cell growth
  - Pancreas, colon, ovarian, breast, skin cancer cell lines
  - Inhibition of cell growth
  - Apoptosis (= programmed cell death)
  - Block of angiogenic signals = inhibits growth of metastatic tumours
Important health problems

- Cardiovascular disease
- Cancer
- Gastrointestinal dysmotility
- Pain
- Infections
  - Not only in developing countries
Gastrointestinal complaints

- Irritable bowel syndrome – 15%?
- Helicobacter pylori and ulcers – varying
- Diarrhoea

(Duggan-06; England and Wales)
Ginger and gastrointestinal tract

- Inhibits ileal contractility in rats (IBS?)
- Reduces diarrhoea in mice
- Used in nausea and vomiting during pregnancy
- Inhibits helicobacter pylori growth (ulcers)
Chili – *capsicum*

- Reduces adipose tissue in rodents
  - Activation of the sympathetic nervous system
- Protects against ulceration in the stomach
  - Dose dependent (alcohol, aspirine; humans)
- Relief of neuropathic pain
  - Effectively absorbed from the skin

Kawada-86, Watanabe-87, Mozsik-05, Reyes-Escogido-11
Inhibition of acid by capsicin

Nerve stimulation and NO secretion => protection: Increased blood flow and enhanced gastric emptying

Mozsik-05; 84 humans
Capsaicin and pain treatment

+ • In topical creams to treat post-herpetic neuralgia, musculoskeletal pain, diabetic neuropathy, osteoarthritis and rheumatoid arthritis

- • Its actual efficacy is still in doubt due to the small number of participants and diverse definitions of pain used in studies

Reyes-Escogido -11
Pepper and GI tract

- Influences GastroIntestinal motility in a complex way, increases secretion but reduces experimental diarrhoea.

- Stimulates bile acid secretion and pancreatic secretion when given regularly (rats).
Important health problems

- Cardiovascular disease
- Cancer
- Gastrointestinal dysmotility
- Pain

- Infections
  - Inflammation
  - Immune regulation
Staphylococcus aureus
Multi resistant Staph; England, Wales

Health Protection Agency; www.hpa.org.uk/infections/topics_az/staphylo/lab_data_staphyl.htm
Multi resistant staph; Sweden
“...whenever I get these symptoms and go to a doctor, he gives me the same medicine and charges me 10 rupees. So why not just buy the medicine?”

Dua V et al. 1994
Transfer of resistant E. coli India => UK

Figure 1: Numbers of carbapenemase-producing Enterobacteriaceae referred from UK laboratories to the UK Health Protection Agency’s national reference laboratory from 2003 to 2009
Antimicrobial effect of spices

- Methanol extract
  - Turmeric (Curcuma longae)
  - Ginger (zingiber)
  - Linseed (semen lini)

- Inhibitory effect
  - Staph aureus
  - Gastrointestinal infections
  - Pseudomonas
  - Listeria
  - Streptococcus
Spices and inflammation

- Inflammation – balance
  - Break down and repair
  - Through prostaglandins and cytokines
- Anti-inflammatory effect
  - Through flavonoids, carnisol etc
- Rosemary, sage, quercetin, curcumin
  - Curcumin same effect as indometacain
    » same group of medicine as aspirine
Ginger and inflammation

- Anti-inflammatory and analgesic effects in mice and rats
- Modifies the immune system in rats

- Antimicrobial effect (fungi, bacteria, gastrointestinal infections, staphylococci and bacteria responsible for periodontitis)
Arthritis in animals

- Curcumin and capsaicin
  - delays onset
  - lower the incidence
  - lower the severity
Autoimmune disorders increase

Coeliac disease

Diabetes type 1

Lohi-07; Finland
Morbus Crohn (Europe, USA)
Ginger and immune response

- Anti-inflammatory and analgesic effects in mice and rats
- Downregulates immune function both innate; macrophages, neutrophils (1\textsuperscript{st} line of defence) and adaptive immunity; cellular as well as antibody mediated (2\textsuperscript{nd} line of defence)
Age pyramid in Europe 2008-60

Source: Eurostat, EUROPOP2008 convergence scenario
Orally administered cinnamon to mice prone to develop Alzheimer reduced the amount of amyloid polypeptides responsible for the disease.
Cinnamon and Alzheimer

- The aqueous extract is the active part
- The exact molecule or mode of action yet unknown
- The amount of cinnamon required is around 10 g daily
Fruit and vegetables – in general

- Cardiovascular system
  - Reduced blood pressure
  - Better blood glucose control
  - Reduced risk of cardiovascular disease

- Cancer
  - Gastrointestinal, lungs and others

- Other
  - Cataract, several other conditions
Do spices have the same effects?

- Many studies carried out in animals or in cell cultures
  - Some human studies in recent years
- The exact mode of action yet unknown
  - We begin to understand some of them
- The active substances not yet identified
  - Although we know many of them already
**Rosemary – rosmarinus officinalis**

- Phenolic compounds with antioxidant effect
  - caffeic acid and rosmarinic acid
- Therapeutic potential in treatment of atherosclerosis, ischemic heart disease, asthma, peptic ulcer, inflammatory diseases, cataract, and poor sperm motility
- Relaxes smooth muscle in trachea & intestine
- Has anti-tumourogenic activity
- Reduces production of leukotrienes in leucocytes
- Active against gram-positive pathogenic bacteria and fungi

al-Sereiti-99, Lugman-07
Verified health benefits of spices

- Potentially serious diseases
  - Cardiovascular disease
  - Cancer
  - Infections
  - Inflammatory diseases

- Other health problems
  - Gastrointestinal disturbances
  - Skin conditions
  - Pain
It is necessary to find out more!

- ESA – 52 spices, Wikipedia – 186 spices
- There is a library of potential ”medical food” in our own kitchen