The potential of spices and herbs to improve Public Health through improved diet quality and/or physiological outcomes

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Conflict of interest regarding this presentation:

I wish to declare a potential conflict of interest, and that I have received direct or indirect industry support in relation to part of the results presented here.

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A reason to season ...
part of hedonic liking of eating

- Over the centuries, herbs and spices have long been used to improve the colour, flavour, taste of food, and variety of meals.

An other reason to season ...
diet quality and potential health benefits

Over the last decade, research into the role of spices and herbs as contributors of active phytochemicals has dramatically increased, demonstrating that they contribute to :

- preserve food quality.
- promote healthy dietary habits
- protect against the risk of developing chronic diseases.

Quality of food
Healthy eating attitudes

Potential health benefits
Reduced risk of chronic diseases

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Spices , Herbs , Diet quality and Healthy eating attitude

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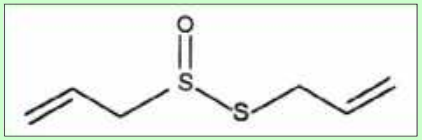
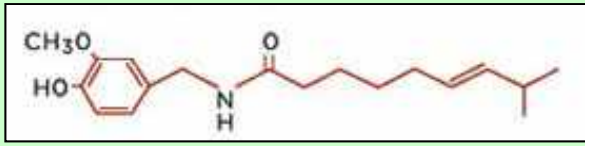
Spices and culinary herbs are rich in bioactive phytochemicals

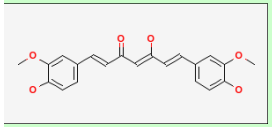
Sulfur components

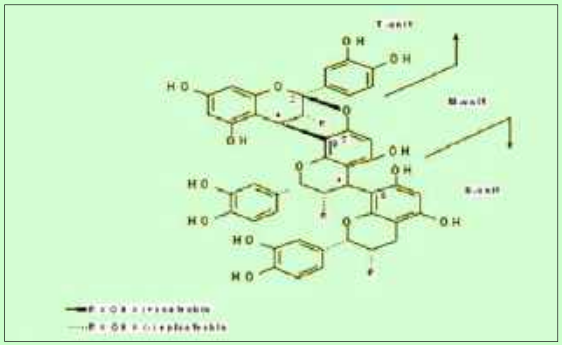
Allicin (garlic)



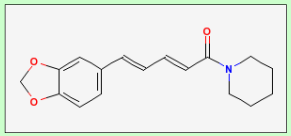


- **Polyphenols**
  - **capsaïcin et capsinoïds (*chilli pepper*)**
  - **curcumin (*turmeric*)**
  - **proanthocyanidins (*cinnamon*)**
  - **rosmarinic acid *(rosemary, sage, thyme*)**

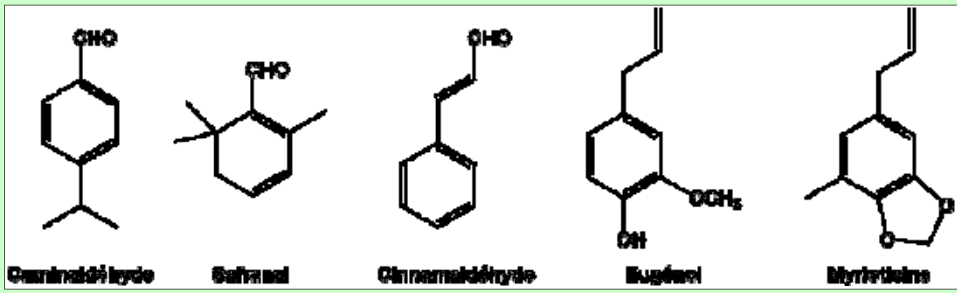




- **Alkaloïdes**
  - **piperine *(pepper)***



- **Carotenoïds**
  - **capsanthine (*paprika*), crocetine (*saffron*)**
- **Terpenes**
  - **anethole (*fennel, star anise*),**
  - **cinnamaldehyde (*cinnamon*),**
  - **eugenol (*cloves*)**
  - **carnosic acid (*sage, rosemary*)**
  - **Cuminaldehyde *(cumin)***



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Spices and herbs are rich in antioxidants

	Antioxidant content mmol/100 g[a)]	n	Min	Max
Allspice, dried ground	100.4	2	99.28	100.40
Basil, dried	19.9	5	9.86	30.86
Bay leaves, dried	27.8	2	24.29	31.29
Cinnamon sticks and whole bark	26.5	3	6.84	40.14
Cinnamon, dried ground	77.0	7	17.65	139.89
Clove, dried, whole and ground	277.3	6	175.31	465.32
Dill, dried ground	20.2	3	15.94	24.47
Estragon, dried ground	43.8	3	43.22	44.75
Ginger, dried	20.3	5	11.31	24.37
Mint leaves, dried	116.4	2	71.95	160.82
Nutmeg, dried ground	26.4	5	15.83	43.52
Oregano, dried ground	63.2	9	40.30	96.64
Rosemary, dried ground	44.8	5	24.34	66.92
Saffron, dried ground	44.5	3	23.83	61.72
Saffron, dried whole stigma	17.5	3	7.02	24.83
Sage, dried ground	44.3	3	34.88	58.80
Thyme, dried ground	56.3	3	42.00	63.75

[a)] mean value when n > 1

(Carlsen et al. Nutrition Journal 2010, 9:3)

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Spices and herbs preserve antioxidant capacity of food

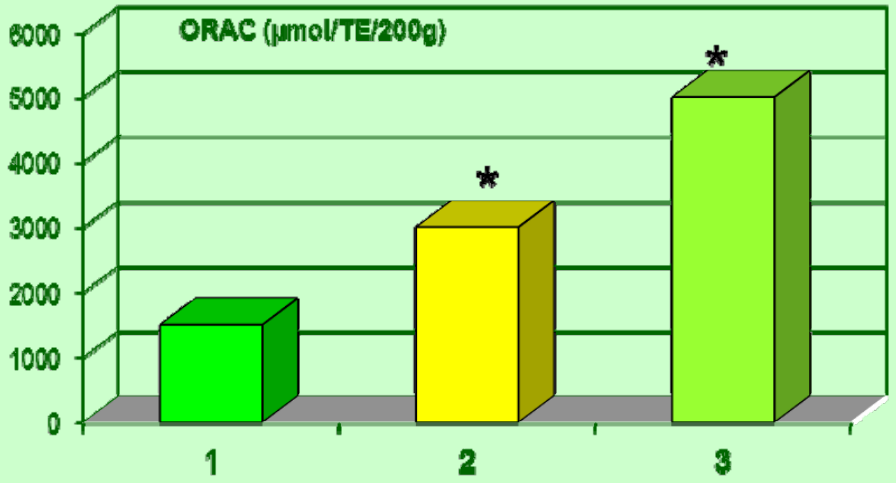
- Increased antioxidant power of salad

200 g of salad:

1) : lettuce + tomato.

2) : lettuce + tomato + lemon.

3) : lettuce + tomato + culinary herbs.



(Ninfali et al. Br J Nutr 2005, 93:257-266)

- Preservation of alpha-tocopherol in sunflower oil by herbs and spices

(Beddows et al., Int J Food, Sci Nutr, 2000, 51(5):327-39).

100 mg/kg : Rosemary, thyme, sage, oregano, curcumin.

- Antioxidant protection of edibles oils

(Cheung et al., Plant Food Hum Nutr, 2007, 62(1):39-42).

- Increased β–carotene bioavailability in vegetables

(Veda et al., J Agric Food Chem, 2008, 56(18):8714-9)

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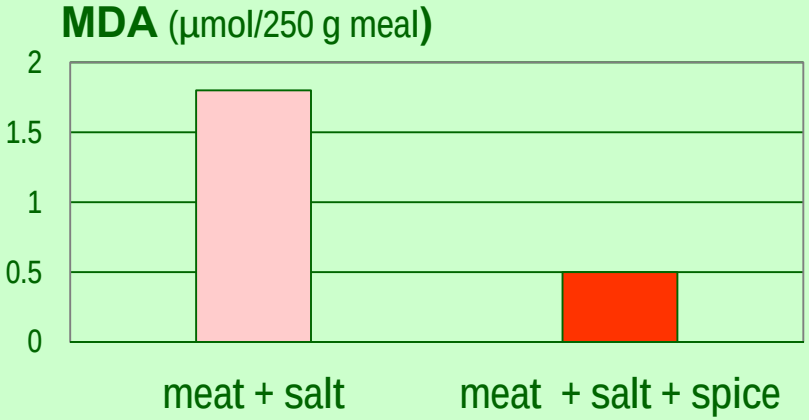
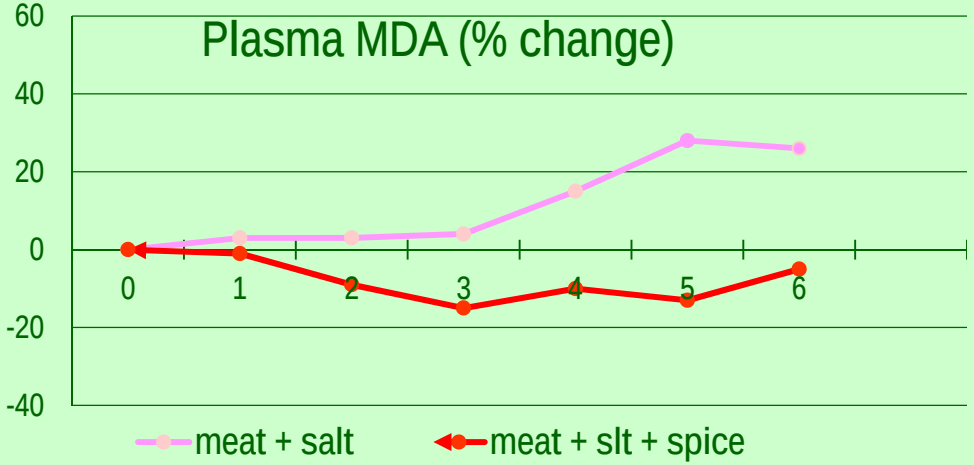
Spices and herbs reduce fat oxidation during meat grilling

- 11 healthy volunteers,
- [burger] *vs* [burger + spice mixture] during cooking

Urinary MDA

Plasma MDA as % change from baseline.





Spice mixtures
(11.25 g/250g meat)
- *cloves,*
- *cinnamon,*
- *oregano,*
- *rosemary,*
- *ginger,*
- *black pepper,*
- *paprika,*
- *garlic.*

MDA (*malondialdehyde*) production in grilled spiced meat is reduced by 71%

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Li Z.et al. Am J Clin Nutr 2010;91:1180-4.

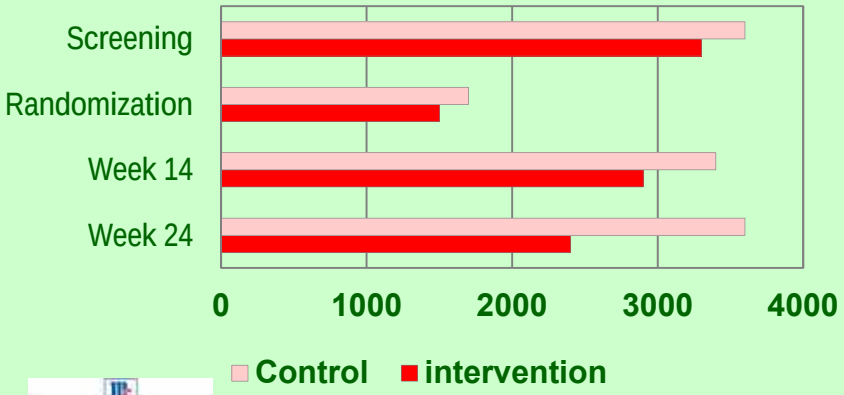
Spice and herbs , a potential help for reducing sodium intake: the SPICE clinical trial

Multifactorial behavioural intervention with spices and herbs for facilitating adherence to the recommended sodium intake as 1500 mg/d (US Dietary Guidelines).

Intervention group vs self-directed control group after 4 weeks low Na diet

Intervention group: counseling sessions, cooking demonstrations, use of familiar and non familiar spices and herbs, self monitoring of sodium intake, strategy for eating with family or outside....

24 hour urinary sodium excretion (mg/day)



	Screening	Random assignement	Week 14	Week 16
< 2300 mg/d, %				
control	20	85	20	25
intervention	35	85	40	55
1500 mg/d, %				
control	0	55	10	5
intervention	10	75	25	25

Study participants meeting goals per 2000 kcal diet (Na values adjusted for the number of hours of urine collection

Anderson C et al. Am J Clin Nutr, 2015, 102(3):671-9

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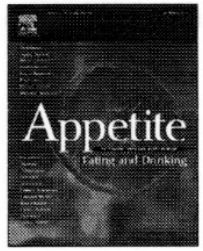
Herbs and spices enhance consumer liking of low-salt tomato soup

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet



Research report

Enhancing consumer liking of low salt tomato soup over repeated exposure by herb and spice seasonings ☆

Sameer Khalil Ghawi, Ian Rowland, Lisa Methven *

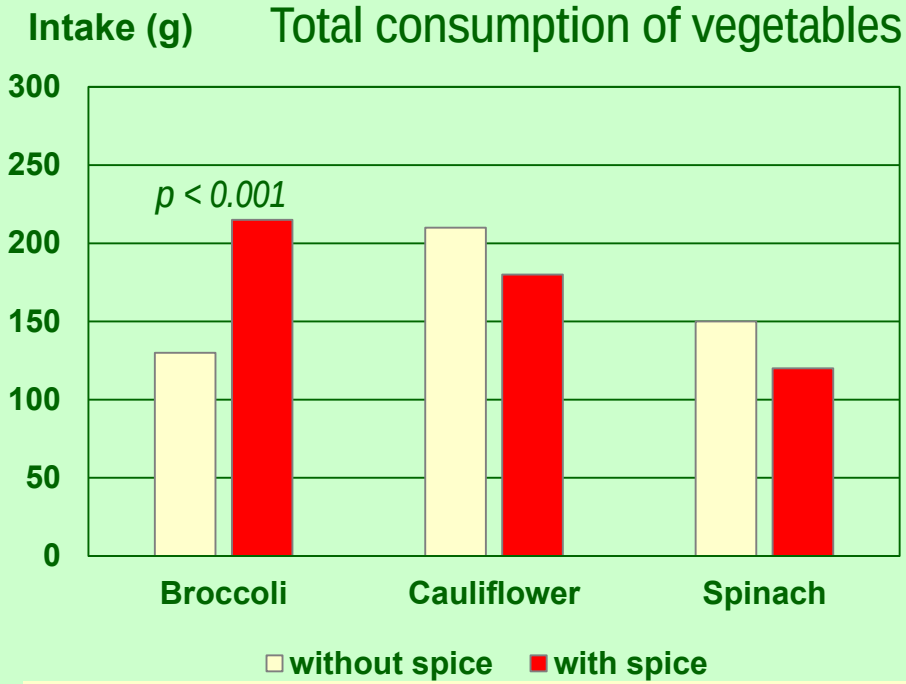
Department of Food and Nutritional Sciences, University of Reading, Whiteknights, Reading RG6 6AP, UK

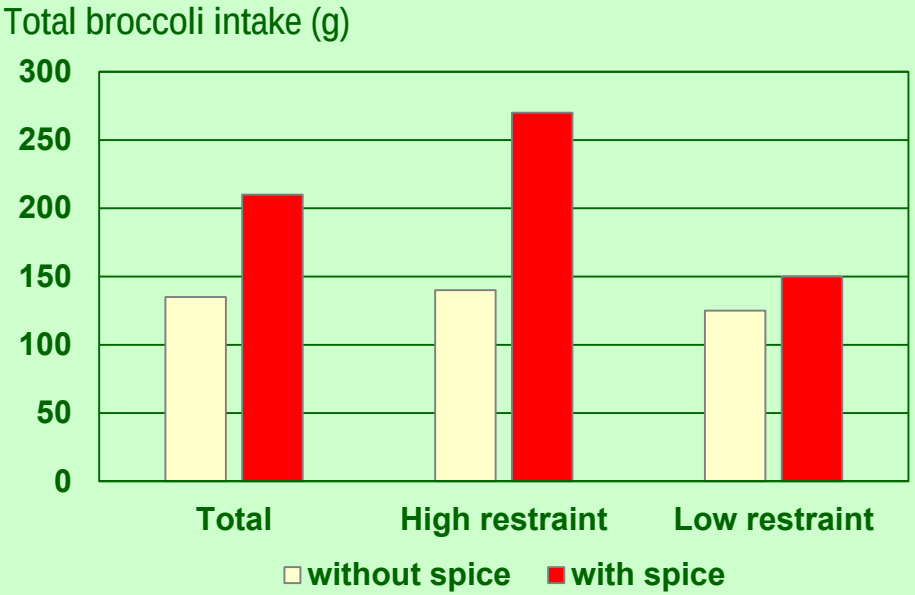
Ghawi SK et al. Appetite, 2014, 81:20-29

Adding spices may increase vegetable consumption: a prospective randomized pilot study in healthy adults

*87 overweight healthy subjects (IMC 25-30), 30-60yrs, less than 3 servings/d vegetables, assigned in random order to eat broccoli,cauliflower or spinach with or without added spices

* High vs low restraint eaters (TFEQ)*





- High restraint eaters consumed 91 % more spiced broccoli.
- Rate of eating spiced broccoli was 50 % greater.

Increasing the intake of healthy food such as broccoli among restraint eaters by adding spices to improve acceptability and taste is a useful strategy for consumption of vegetables containing phytochemicals with a bitter taste.

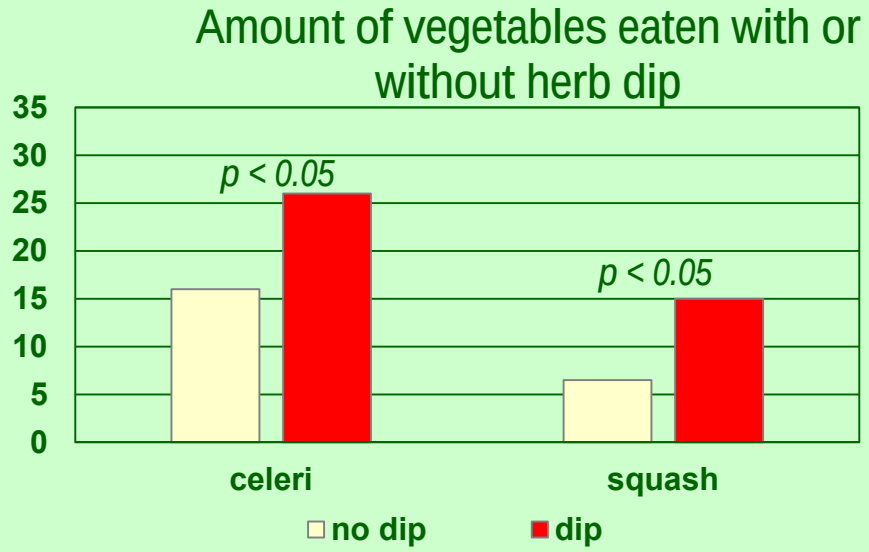
Li Z. et al, Food and Nutrition Sciences, 2015,6,437-444

** Three Factor Eating Questionary*

Adding herbs and spices to a reduced-fat dip increases intake of vegetable in preschoolers

- Preschoolers 3 – 5 yrs

	Response to Tasting							
	Yummy		Just OK		Yucky		Refused	
Condition	n	%	n	%	n	%	n	%
Vegetable alone	11	31	5	15	12	36	6	18
Vegetable plus plain dip	17	49	8	25	6	18	3	9
Vegetable plus herb dip	22	64	6	18	4	13	2	6



Savage JS et al. J Acad Nutr Diet, 2013, 113(8):1090-5

Herbs and spices improve liking of lower-fat foods

Journal of Food Science
A Publication of the Institute of Food Technologists

S: Sensory & Food Quality

The Influence of Herbs, Spices, and Regular Sausage and Chicken Consumption on Liking of Reduced Fat Breakfast and Lunch Items

Sarit Polsky[1,2], Jimikaye Beck[3,*], Rebecca A. Stark[3], Zhaoxing Pan[4], James O. Hill[3] and John C. Peters[1,2]

Article first published online: 12 SEP 2014

DOI: 10.1111/1750-3841.12643

Issue

Journal of Food Science
Volume 79, Issue 10, pages S2117–S2126, October 2014

Polsky S et al. J Food Sci, 2014, 79(10):S2117-26

In summary:

Improves acceptability of reduced salt foods

Preserves antioxidant capacity of edible oils

Eating Spicy

Helps adherence to recommended sodium intakes

Reduces fat oxidation during meat grilling

Increases liking of low fat foods

Enhances vegetable consumption

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Spices, Herbs and Human Health

Neuroprotection

Cardiovascular health

Spices and herbs

Cancers

Energy expenditure
Fat oxidation
Weight management

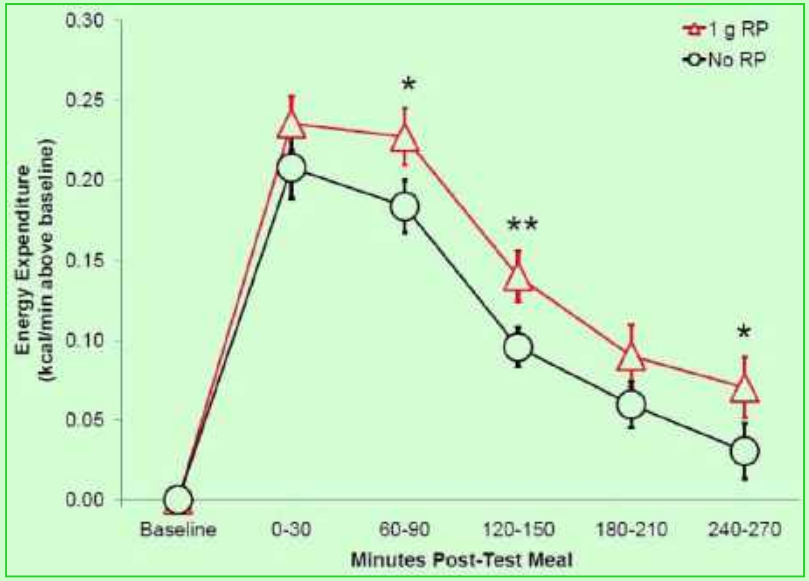
Microbiote

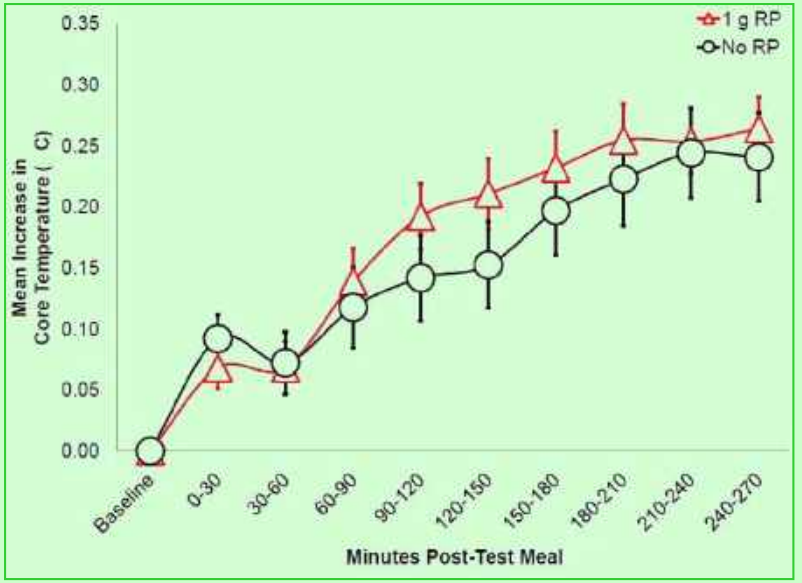
Inflammation

Insulin signaling
Glucose homeostasis

Red pepper at hedonically doses : effects on energy expenditure and thermogenesis

- healthy lean individuals, BMI : 22.6 ± 0.3 kg.m$^{-2,}$
- test load with 1 g RP / meal *





changes in energy expenditure
(*measured over the 270 min after test load*)

changes in mean core body temperature
(*measured over the 270 min after test load*)

⇨ Red pepper consumption at hedonically acceptable doses increases energy expenditure and thermogenesis.

*) mean acceptable dose : Europe, USA 1 g/d,. Asia, South America7 g/d.

Ludy MJ et Mattes R. Physiol Behav 2011;102:251-58.

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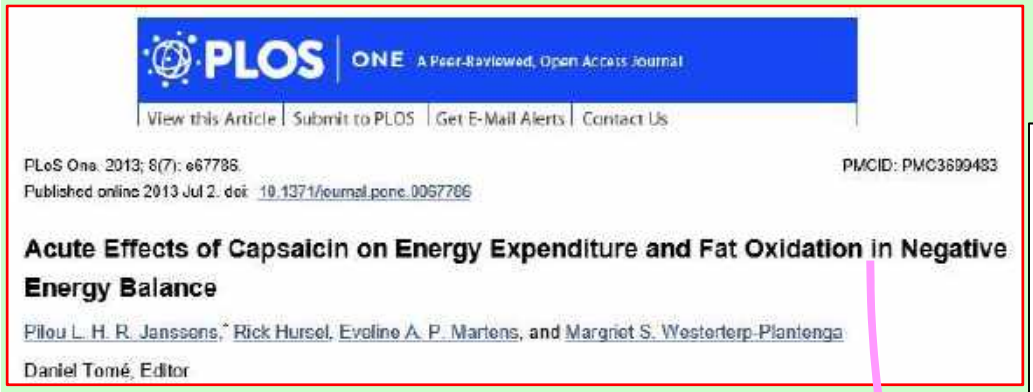
Capsaicin, energy balance and weight maintenance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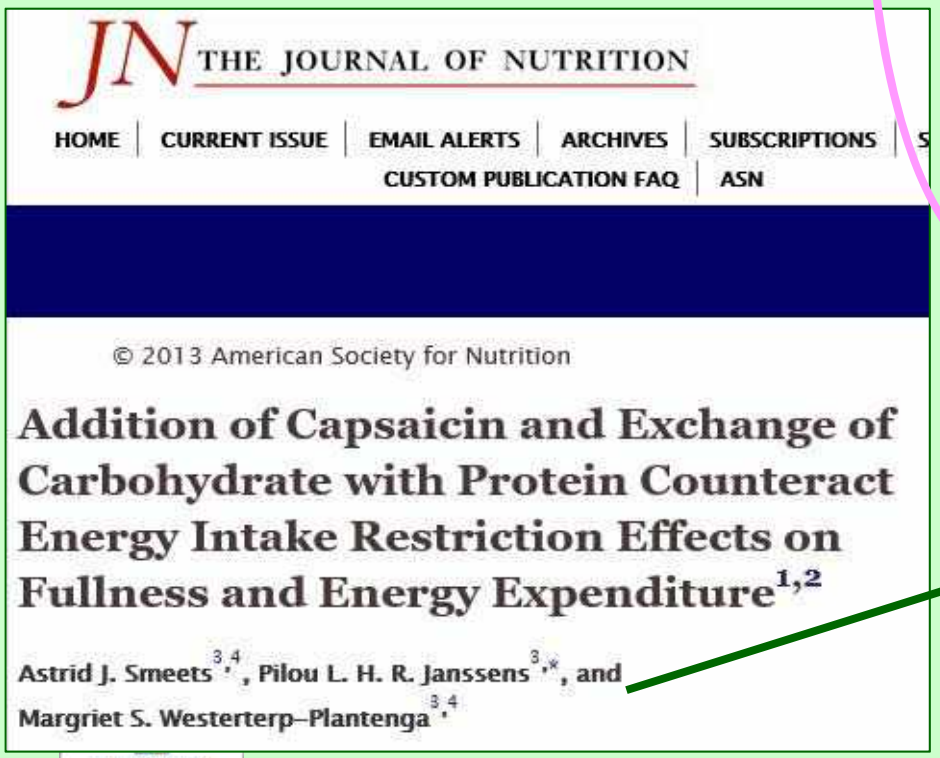
PLoS One. 2013; 8(7): e67786. PMCID: PMC3699483
Published online 2013 Jul 2. doi: 10.1371/journal.pone.0067786

Acute Effects of Capsaicin on Energy Expenditure and Fat Oxidation in Negative Energy Balance

Pilou L. H. R. Janssens,* Rick Hursel, Evoline A. P. Martens, and Margriet S. Westerterp-Plantenga

Daniel Tomé, Editor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Addition of Capsaicin and Exchange of Carbohydrate with Protein Counteract Energy Intake Restriction Effects on Fullness and Energy Expenditure[1,2]

Astrid J. Smeets[3,4], Pilou L. H. R. Janssens[3,*], and Margriet S. Westerterp–Plantenga[3,4]

Lejeune MP, Kovacs EM, Westerterp-Plantenga MS. Effect of capsaicin on substrate oxidation and weight maintenance after modest body-weight loss in human subjects. Br J Nutr. 2003 Sep;90(3):651-59.

*Westerterp-Plantenga MS, Smeets A, Lejeune MP. Sensory and gastrointestinal satiety effects of capsaicin on food intake. International Journal of Obesity, (2005) 29, 682–688.

*Smeets AJ, Westerterp-Plantenga MS. The acute effects of a lunch containing capsaicin on energy and substrate utilisation, hormones, and satiety.Eur J Nutr. 2009 Jun;48(4):229-34.

*Janssens PL, Hursel R, Martens EA, Westerterp-Plantenga MS , Acute effects of capsaicin on energy expenditure and fat oxidation in negative energy balance. PLoS One. 2013 Jul 2;8(7):e67786.

*Smeets AJ, Janssens PL, Westerterp-Plantenga MS. Addition of capsaicin and exchange of carbohydrate with protein counteract energy intake restriction effects on fullness and energy expenditure. J Nutr. 2013 Apr;143(4):442-7.

*Janssens PL, Hursel R, Westerterp-Plantenga MS , Capsaicin increases sensation of fullness in energy balance, and decreases desire to eat after dinner in negative energy balance. Appetite. 2014 Jun;77:44-9.

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Herbs and spices: from the weight management to the prevention of the metabolic syndrome….

Spices and herbs consumption

- Satiety and mood
- Energy expenditure
- Thermogenesis
- Body composition

→ Energy balance and weight management

- Dyslipidemia
- Hypertension
- Insulin resistance
- Oxidative stress
- Inflammation

→ Obesity related metabolic effects

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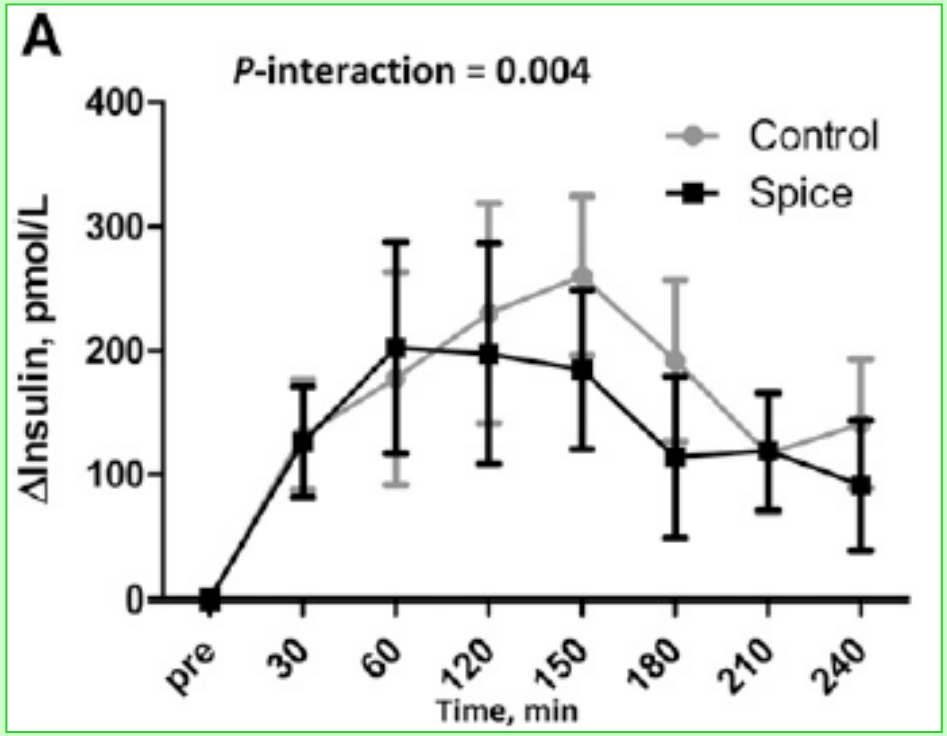
Spices blend* decreases the magnitude of post-prandial increases in circulating insulin

- healthy overweight men, BMI 25 – 27



* <u>spices blend</u> = 14 g

- black pepper,
- cinnamon,
- cloves,
- garlic,
- ginger,
- oregano,
- paprika,
- rosemary,
- turmeric.

⇨ may help to normalize post-prandial glucose homeostasis.

Skulas-Ray A et al. J Nutr 2011 Aug;141(8):1451-7.

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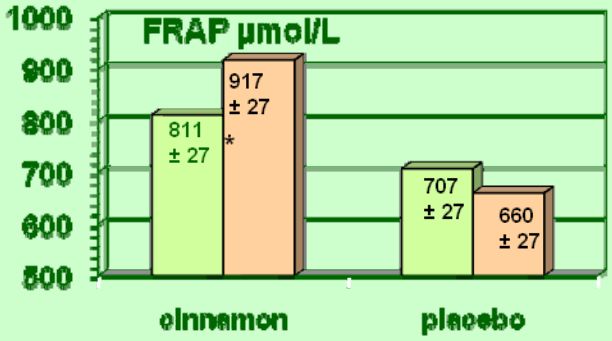
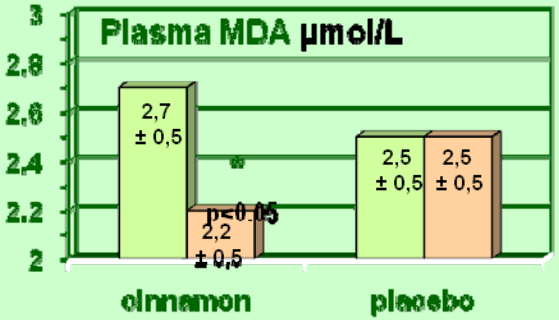
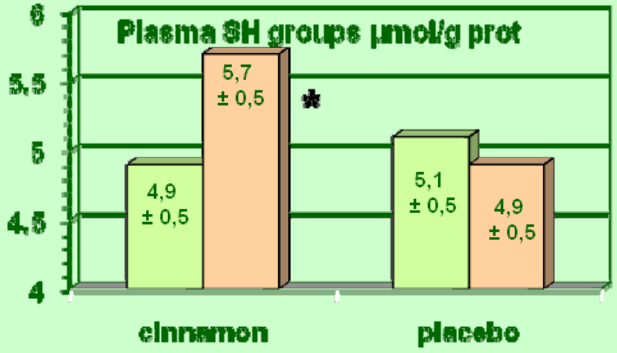
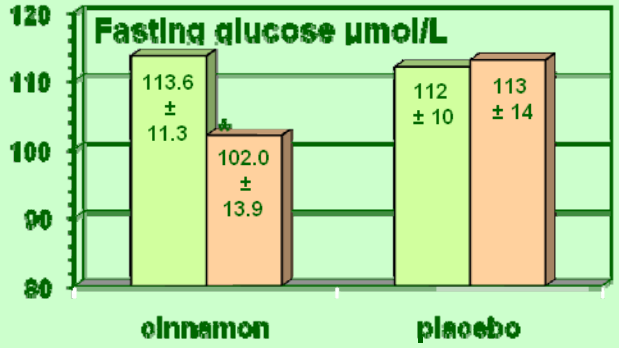
Cinnamon regulates glycaemia and oxidative stress:

- 24 men; 18 – 40 yrs ; 25 < BMI < 30
- 250 mg/d cinnamon extracts (1g cinnamon powder) 12 weeks





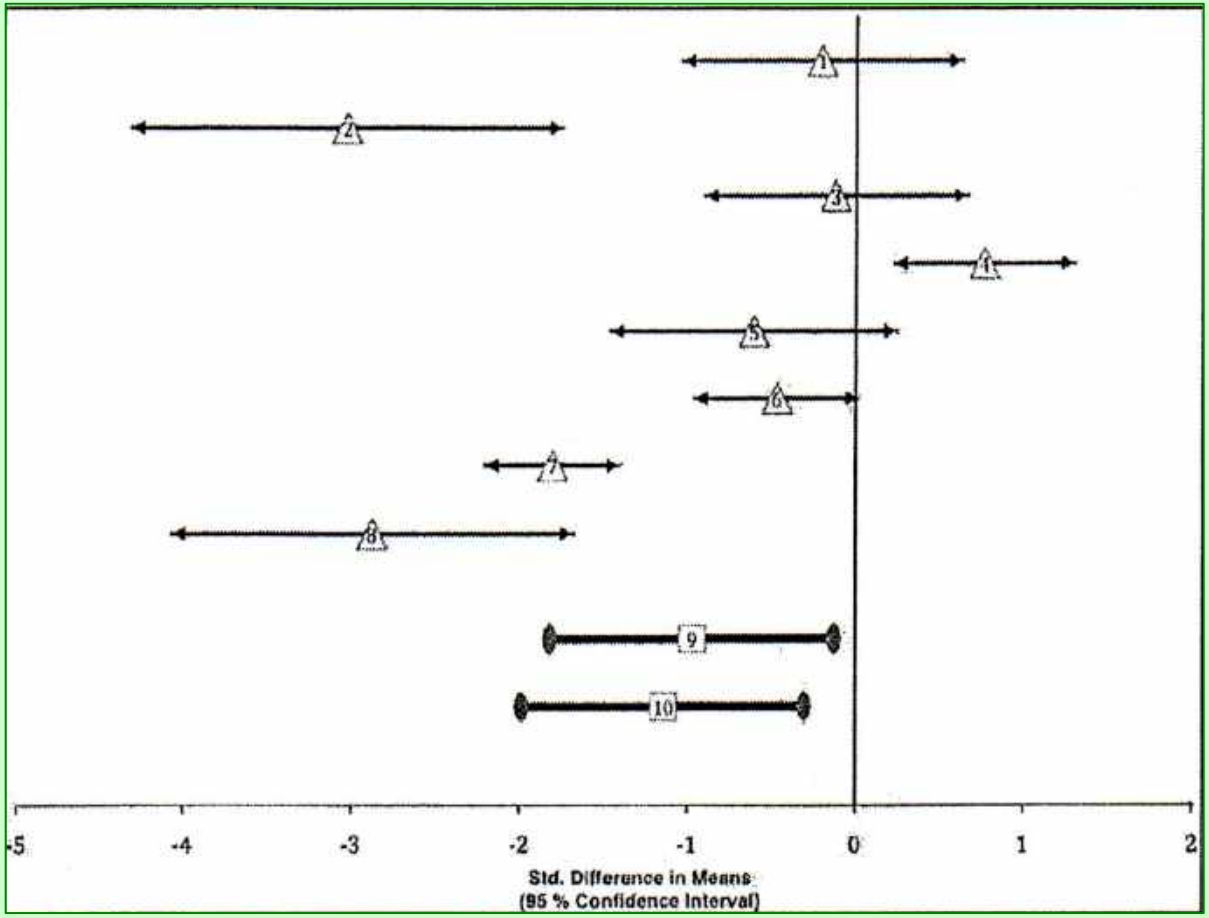




Positive correlation between MDA and fasting glucose : r = 0.74, p < 0.001

Roussel AM , Anderson RA et al., J Am Coll Nutr. 2009 28(1):16-21.

Cinnamon decreases glycaemia in overweight or type 2 DM people : meta analysis



1. Tang, 2008
2. Khan, 2003
3. Vanschoonbeek, 2006
4. Blevins, 2007
5. Ziegenfuss, 2006
6. Mang, 2006
7. Stoecker, 2010
8. Roussel, 2009
9. overall cinnamon
10. cinnamon extract

Standardized differences in fasting blood glucose (FBG) means

Davis et al. J Med Food 2011;14(9):884-9.

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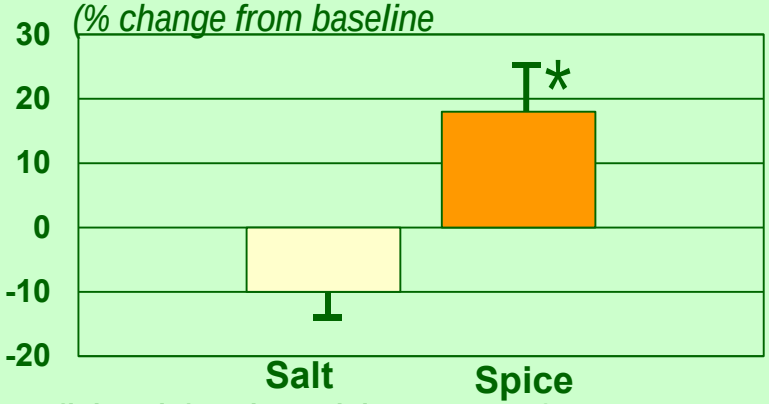
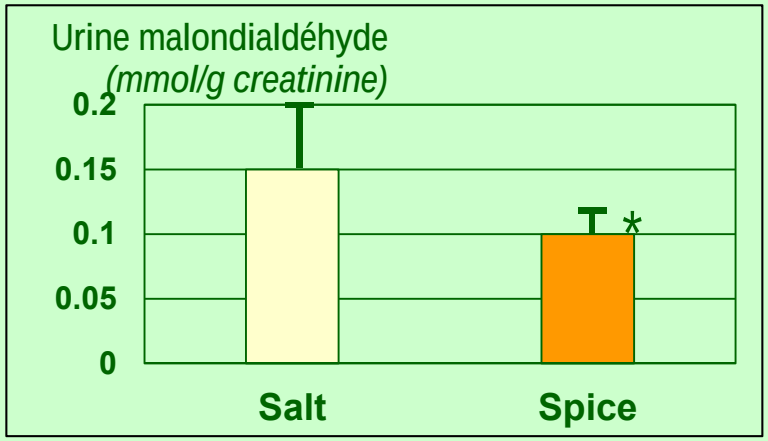
Potential cardiovascular benefits of spices on post-prandial endothelial dysfunction

- Randomized cross over study, DT2 patients, 35 – 70 yrs,.
- 2 test meals:
  - ground beef seasoned with salt (10 % fat),
  - ground beef seasoned with spices (10 % fat):
    - *11.25 g / 250 g*
    - *cloves: 4 %*
    - *cinnamon: 4 %*
    - *oregano: 26 %*
    - *rosemary: 4 %*
    - *ginger: 11 %*
    - *black pepper: 7 %*
    - *paprika: 30 %*
    - *garlic powder: 13 %.*

Peripheral arterial tonometry
(% change from baseline

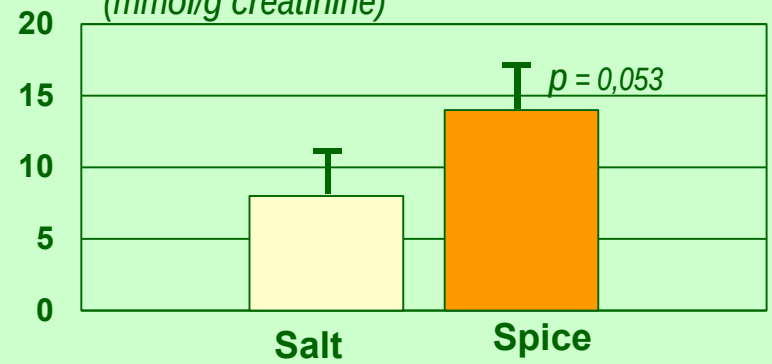


Postprandial peripheral arterial tonometry (*2 h score change after eating a burger with salt or spice*) (*n = 18; *: p<0,05*)



Urinary excretion of malondialdehyde (*6 h after eating a burger with salt or spice*) (*n = 18 ; *: p<0,05*)

Urine nitric oxide (NO)
(mmol/g creatinine)



Urine nitric concentration (NO) (sum of urinary nitrate and nitrite) (*after eating a burger with salt or spice*) (*n = 18 ; *: p<0,05*)

Li Z et al., Diabet Med, 2013, 30(5):590-5

Several culinary herbs and spices with potential antiinflammatory activity to alleviate the effects of inflammation

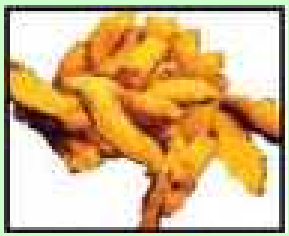
Oregano
(*Origanum vulgare*)

Red pepper
(*Capsicum frutescens*)

Black pepper
(*Piper nigrum*)

Thyme
(*Thymus vulgaris*)

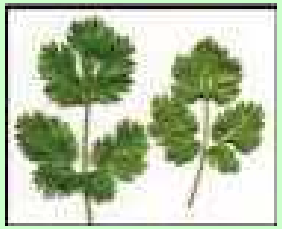
Rosemary
(*Rosmarinus officinalis*)



Turmeric
(*Curcuma longa*)

Ginger
(*Zingiber officinale*)

Cardamom
(*Elettaria cardamomum*)



Coriander
(*Coriandrum sativum*)

Cloves
(*Syzygium aromaticum*)

Aggarwal BB et al. EBM 2009;234:825-49.
Park AB ezt al. Int J Food Sci Nutr 2011; 62:577-84.
Jungbauer et al. Maturitas 2012; 71:227-39.
Marcasson W. J Am Diet Assoc 2011; 110:1780.
Muller et al. Food Chem 2010; 122:987-96.

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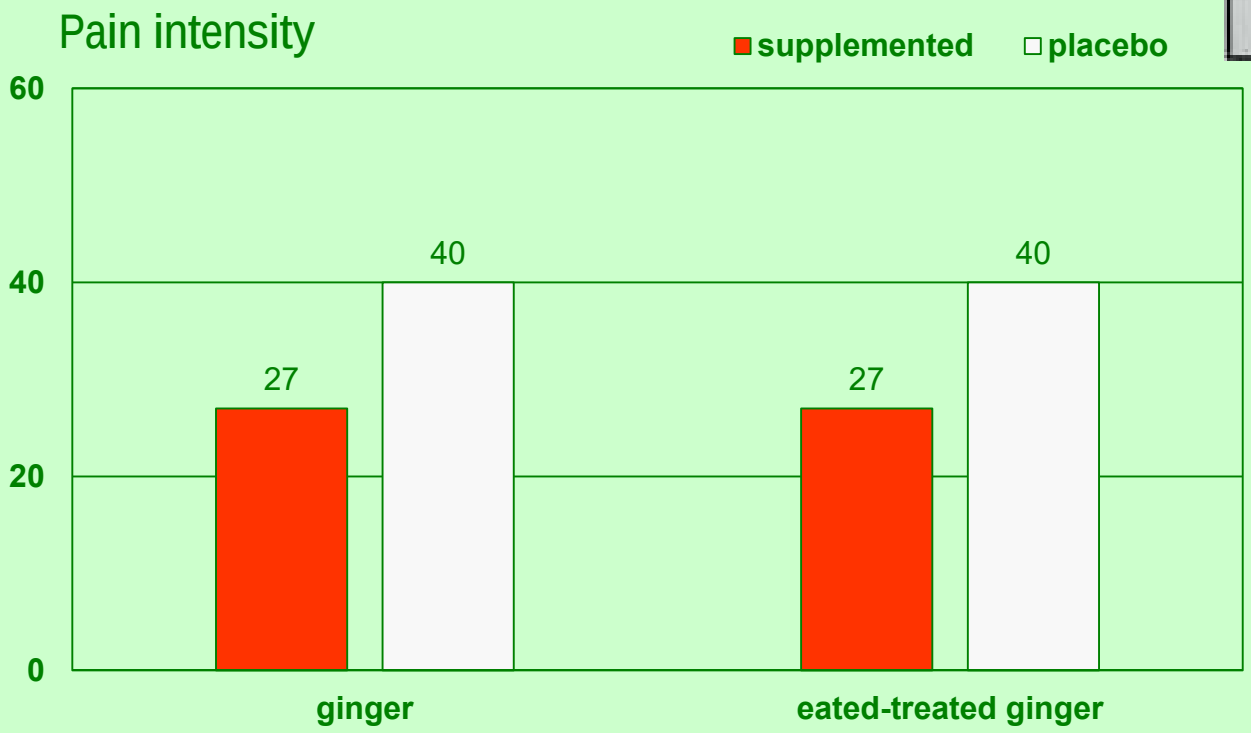
Ginger reduces muscle pain induced by exercise

- 11 days of raw or eated-treated ginger supplementation (2g/d)
- Pain intensity 24H after eccentric actions on the elbow flexors is reduced in both supplemented groups vs placebo



Black CD et al., Journal of Pain, 2010,11(9):894-903

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In summary,

Addition of herbs and spices to the diet are reported to

- act in preserving food quality
- improve healthy eating attitudes, especially in young people: salt reduction, higher acceptability of low fat food, increased vegetable consumption
- generate substantial health effects on

  Energy balance and Weight management, Insulin sensitivity, Cardiovascular health and Inflammation....

- BUT

This promising area of research needs further studies:
Clinical studies in more areas (cognition, microbiote..)
Determination of efficient hedonical intakes
Bioavailability,
Mechanisms of action

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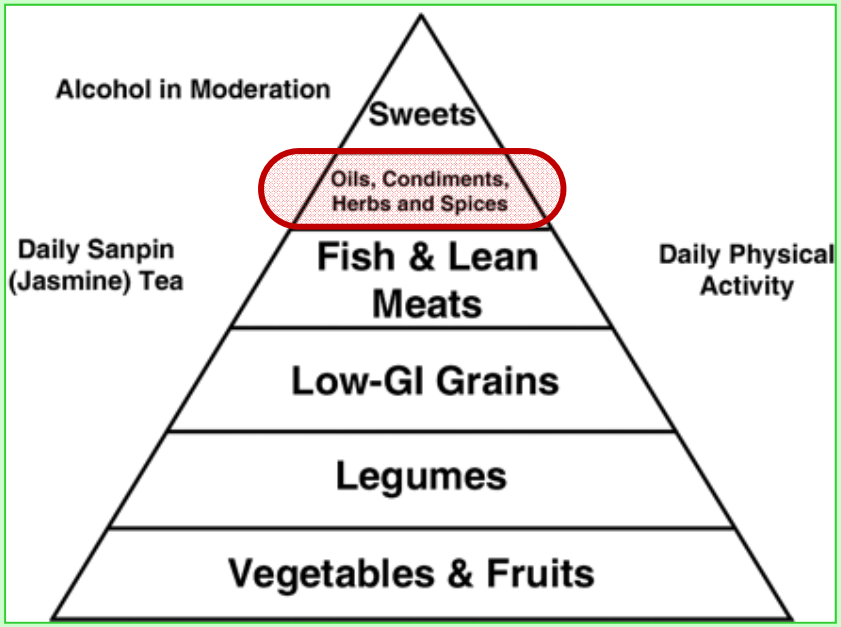
Should spices and herbs be part of nutritional recommendations??



Willcox DC et al. J Am Coll Nutr 2009;28(4):500S-516S.

Traditional Okinawan diet food pyramid

⇨ **Interestingly, herbs and spices are already present in Okinawan diet food pyramid and part of Australian recommendations**

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Thanks for your attention !

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