

12th European Nutrition Conference FENS 2015
 Nutrition and health throughout life-cycle - Science for the European consumer
 Berlin | Germany | October 20 - 23

The effect of red pepper on energy metabolism and satiety

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Conflict of interest regarding this presentation:

I wish to declare a potential conflict of interest, in that I have received direct support from MacCormick Science Institute in relation to one of the studies presented here.

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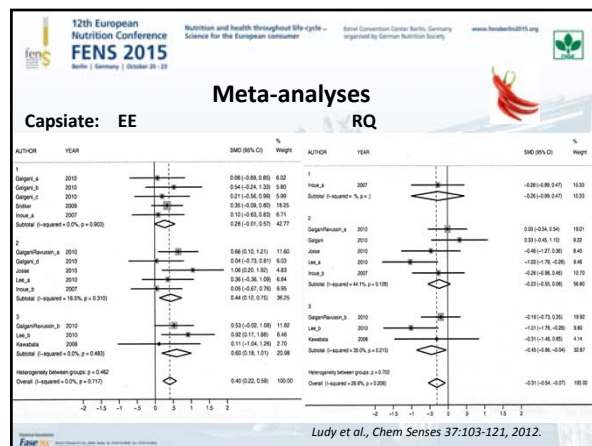
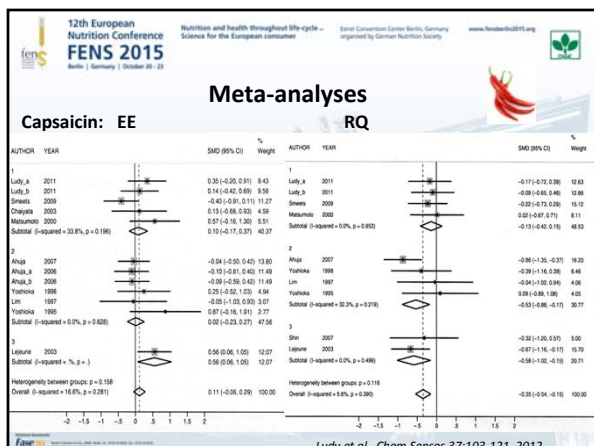
- Energy-expenditure and Fat-oxidation: meta-analyses.
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Perception of Capsaicin

Capsaicin is the pungent principle of red pepper.
 Receptor: Transient receptor potential vanilloid receptor 1 (TRPV1, see also Zsombok, 2013), expressed in

- sensory neurons in the brain -> taste
- involved in the pain pathway -> pungency
- sensed in heat receptor neurons in the brain -> heat




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Meta-analyses

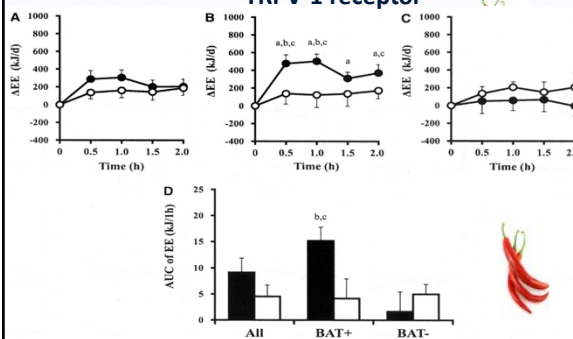
Conclusion: Capsaicin and capsiate augment *energy expenditure* and enhance *fat-oxidation*, especially at high doses.
 The magnitude of these effects is *small*.

Ludy et al., *The effects of Capsaicin and Capsiate on Energy Balance: Critical Review and Meta-analyses of Studies in Humans. Chem Senses* 37:103-121, 2012.



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TRPV-1 receptor



Yoneshiro and Saito, *Am J Clin Nutr* 2012;95:845-50.

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TRPV-1 receptor

Conclusion

- Capsinoid ingestion increases EE through the activation of BAT in humans.

Yoneshiro et al., *Am J Clin Nutr.*, 2012.




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Effects of Capsaicin on energy intake

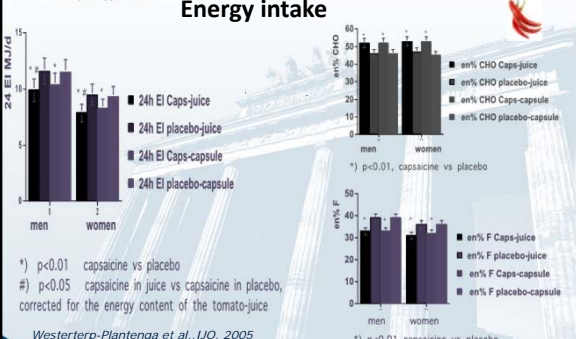
- During 4 weeks, on 2 consecutive days/week:
 - breakfast, lunch, dinner *ad lib* in the lab
 - boxes with snacks *ad lib* for the intervals
- meals and boxes consisted of similar high fat and low fat foods (hedonics: 78 ± 7 mm VAS)
- Before each meal randomly a 2-day-treatment:
 - 0.9 g (40 000 SHU) red pepper vs. placebo in:
 - tomato juice
 - 2 capsules

Westerterp-Plantenga et al., *Sensory and gastrointestinal satiety effects of capsaicin on food intake. International Journal of Obesity*, (2005) 29, 682-688.



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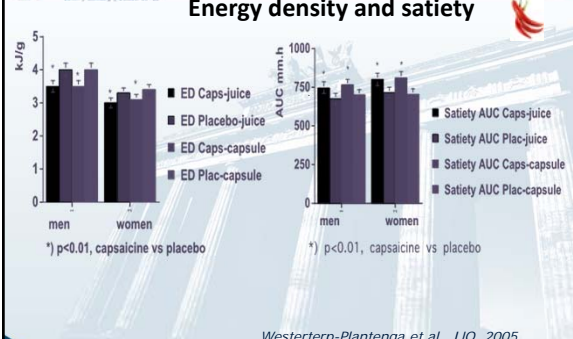
Energy intake



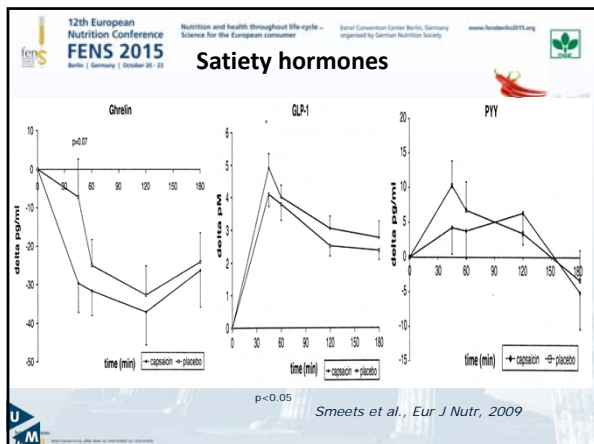
Westerterp-Plantenga et al., *IJO*, 2005

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Energy density and satiety



Westerterp-Plantenga et al., *IJO*, 2005



Satiety and Energy Intake

Summary and Conclusion

Energy intake over 2 days was lower after red pepper intake before each meal:
 10 ± 2% lower after capsules
 16 ± 3% lower after red pepper in juice.

Reduction in Energy intake was related to food choice:
 En % CHO increased and En % F decreased, while satiety was increased.

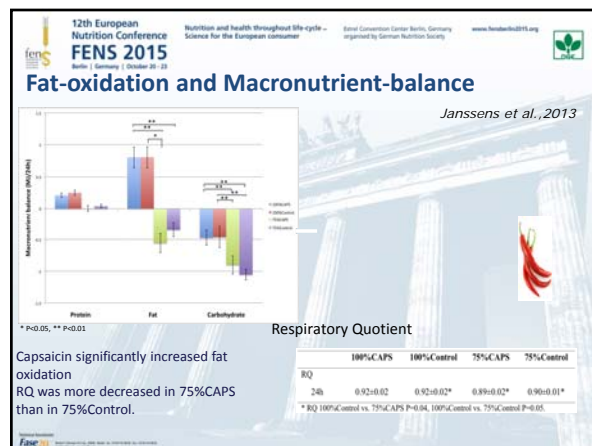
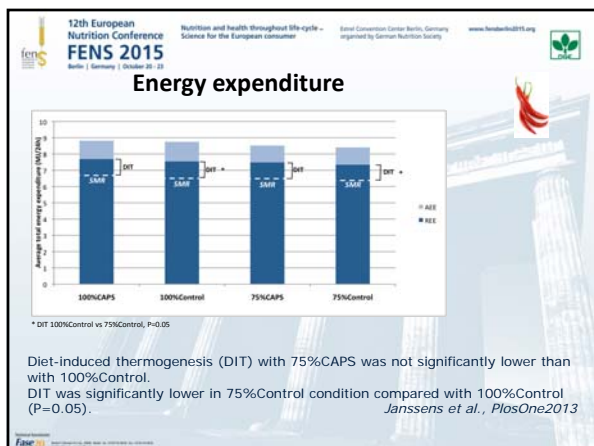
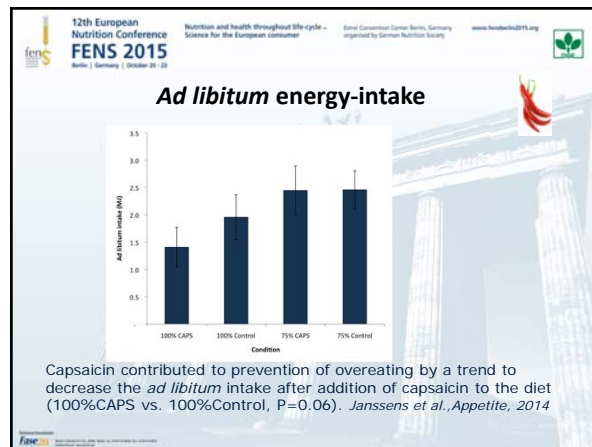
Satiety was underscored by larger increase in GLP-1- and decrease in ghrelin-concentrations.

Conclusion: Capsaicin reduces energy intake over at least two days.

Smeets et al., Eur J Nutr, 2009, Westerterp-Plantenga et al., IJO, 2005

Effects of Capsaicin on energy-intake, energy-expenditure and fat-oxidation, in relation to energy balance

- Randomized crossover design, 48h.
- Four experimental conditions
 - 100% CAPS
 - 100% Control
 - 75% CAPS
 - 75% Control
- 2.56 mg capsaicin (1.03 g of red pepper) 39.050 SHU/meal
- Fifteen subjects (7 female and 8 male) *Janssens et al., 2013, 2014*



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Conclusion

In a 25% negative energy balance, a dosage of 2.56 mg capsaicin per meal (40 000 SHU) helps to prevent

- Hunger and overeating
- Decrease of energy expenditure

And

- A dosage of 2.56 mg capsaicin per meal promotes fat-oxidation.

Janssens et al., PlosOne 2013, Appetite

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Capsaicin and Protein

Comparison with 100% Control:

	80%P	80%Caps	80%Pcaps	80%C	100%C
TEE (MJ/d)	10.4*	10.0	10.3*	9.6#	10.1
SMR (MJ/d)	7.1	7.1	7.1	6.9#	7.2
DIT (MJ/d)	1.2*	1.0	1.3*	0.8#	1.0
AEE (MJ/d)	1.9	1.9	1.9	1.9	1.9
RQ	0.86*	0.86*	0.85*	0.87#*	0.89
EB (MJ/d)	-2.1*	-2.0*	-2.3*	-1.6#	0
Fullness %	110	99	115	85	100

Smeets et al., J.Nutr. 143:442-447, 2013

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Conclusion

Addition of Capsaicin and Exchange of Carbohydrate with Protein

Counteract

Energy Intake Restriction Effects on Fullness and Energy Expenditure

Smeets et al., J.Nutr. 143:442-447, 2013

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Body Weight

jeune M et al., Effect of capsaicin on substrate oxidation and weight maintenance after modest body-weight loss in human subjects. British J Nutr (2003), 90, 651-659

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RQ and Fat-oxidation

Lejeune et al., 2003

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Resting Energy Expenditure

P = 0.07

Lejeune et al., 2003

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Summary and Conclusion

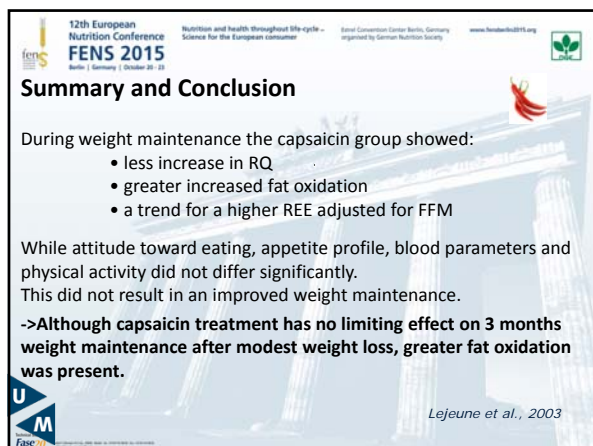
During weight maintenance the capsaicin group showed:

- less increase in RQ
- greater increased fat oxidation
- a trend for a higher REE adjusted for FFM

While attitude toward eating, appetite profile, blood parameters and physical activity did not differ significantly. This did not result in an improved weight maintenance.

->Although capsaicin treatment has no limiting effect on 3 months weight maintenance after modest weight loss, greater fat oxidation was present.

Lejeune et al., 2003



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Conclusion and discussion

Intake of Capsaicin (Capsiate, Capsinoids)

- is perceived by the TRPV-1 receptor.
- reduces Energy Intake through sensory, food-choice and satiety mechanisms.
- increases Energy Expenditure mediated by brown adipose tissue.
- increases Fat-Oxidation.

Effects are present in negative Energy Balance.
 Effects do not lead to body-weight loss.

