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.

Contents
Perception of Capsain
Effects of Capsain on
- Energy-expenditure and Fat-oxidation: meta-analyses.
- Energy expenditure and Fat-oxidation, mediated by brown adipose tissue activation
- Energy intake and food choice
- Body-weight

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

Meta-analyses
Capsaicin: EE
Meta-analyses
RQ

Capsiate: EE
Meta-analyses
RQ

Ludy et al., Chem Senses 37:103-121, 2012.

Ludy et al., Chem Senses 37:103-121, 2012.
Meta-analyses

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


TRPV-1 receptor

Conclusion

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


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

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

Capsaicin contributed to prevention of overeating by a trend to decrease the ad libitum intake after addition of capsaicin to the diet (100%CAPS vs. 100%Control, P=0.06). Janssens et al., Appetite, 2014

Diet-induced thermogenesis (DIT) with 75%CAPS was not significantly lower than with 100%Control. DIT was significantly lower in 75%Control condition compared with 100%Control (P=0.05). Janssens et al., PlosOne2013

Capsaicin significantly increased fat oxidation RQ was more decreased in 75%CAPS than in 75%Control. Janssens et al., 2013

Satiety hormones

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

Ad libitum energy-intake

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

**Conclusion**

Janssens et al., PlosOne 2013, Appetite

**Table:**

<table>
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<tr>
<th></th>
<th>80%P</th>
<th>80%Caps</th>
<th>80%Pcaps</th>
<th>80%LC</th>
<th>100%LC</th>
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<td>1.9</td>
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<td>RQ</td>
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<tr>
<td>EB (MJ/d)</td>
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<td>-2.0*</td>
<td>-2.3*</td>
<td>-1.6#</td>
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</tbody>
</table>

Fullness

|          | 110  | 99    | 115  | 85   | 100   |

**Conclusion**

Addition of Capsaicin and Exchange of Carbohydrate with Protein

Counteract

Energy Intake Restriction Effects on Fullness and Energy Expenditure


**Body Weight**

Lejeune 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

**RQ and Fat-oxidation**

Lejeune et al., 2003

**Resting Energy Expenditure**

Lejeune et al., 2003
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

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.