Psychobiology behind the effect of ultraprocessed food consumption on energy intake

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Ultraprocessing and obesity

- Observational studies show that consumption of UPF is associated with obesity related chronic diseases

- Food processing → hundreds different ways

- No evidence on potential mechanisms presented

- Also true for in-home study of Hall et al (2019), although this study gives a hint
20 Subjects in metabolic ward received unprocessed or ultraprocessed diets for 14 days

Diets were matched for available calories, fat, sugar, fibre and macronutrients
Main results: UPF > 500 kcal, 2 kg weight difference

Diets were presented in random order and matched for provided calories, sugar, fat, fiber, and macronutrients.

Hall et al, Cell Metabolism 2019
No differences in liking, satiety; protein intake, 50% difference in energy intake rate, 48 kcal/min vs 31 kcal/min

Hall et al, Cell Metabolism 2019
A calorie is not a calorie

Source: Barbara Rolls
A proposed model showing some of the properties of ultraprocessed foods that could underpin the association of ultraprocessed foods with higher energy intake and weight gain.
Ad libitum energy intake at different levels of fat (energy density), with equal liking

![Energy Intake Graph]

**Figure 1.** Mean daily energy intake per 14-d dietary treatment + SEM
F test for diet effect: $p < 0.0001$. 

Lissner, Am J Clin Nutr 1988
• 50 Ss → lunch with hamburger and rice salad, either hard or soft version of it → ad libitum intake
• Assessment of energy intake compensation throughout the remainder of the day
Consuming 1 kg grape juice / grapes

2 kilos of grapes

1 kilo juiced into grape puree  |  1 kilo divided into 100 gr batches
Energy intake rate as a function of NOVA classification of 330 foods (CH, NL, UK, SG)

Forde, Mars & de Graaf,
Highest intake rates in the Netherlands

- **Liquids**
  - Full-fat chocolate milk 420 kcal/min
  - Fruit-breakfast drink 330
  - Apple juice 297

- **Solids**
  - Sausage roll 182 kcal/min
  - Wafer with syrup 164
  - Meat ball 156
  - Yellow Cake 154

Van den Boer, et al, Foods 2017
Discussion

- Clear relationship between UPF consumption and obesity
- Not caused by processing per se, but probably through differences in energy intake rate
- Mechanism: lack of oro-sensory stimulation with soft/fast energy dense foods
- Strong need for a strong experimental study that separates processing from energy intake rate
- Develop tools to improve the satiating efficiency of foods/kcal without giving up on the reward value → help people to eat less
Implications for consumers

- Avoid liquid calories
- Slow down, small bites, choose foods to chew on
- Eat less, enjoy more
- From other fields → eat with attention
Thank you for your attention

Questions ?