

Psychobiology behind the effect of ultraprocessed food consumption on energy intake

Kees de Graaf

EUFIC Symposium, 24 November 2020



Ultraprocessing and obesity

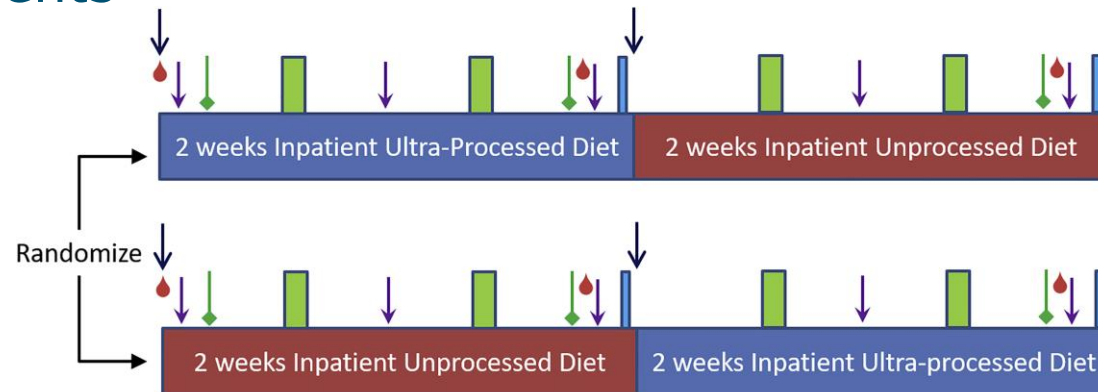
- Observational studies show that consumption of UPF is associated with obesity related chronic diseases
- Food processing → hundreds different ways
- No evidence on potential mechanisms presented
- Also true for in-home study of Hall et al (2019), although this study gives a hint



Cell Metabolism

Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of *Ad Libitum* Food Intake

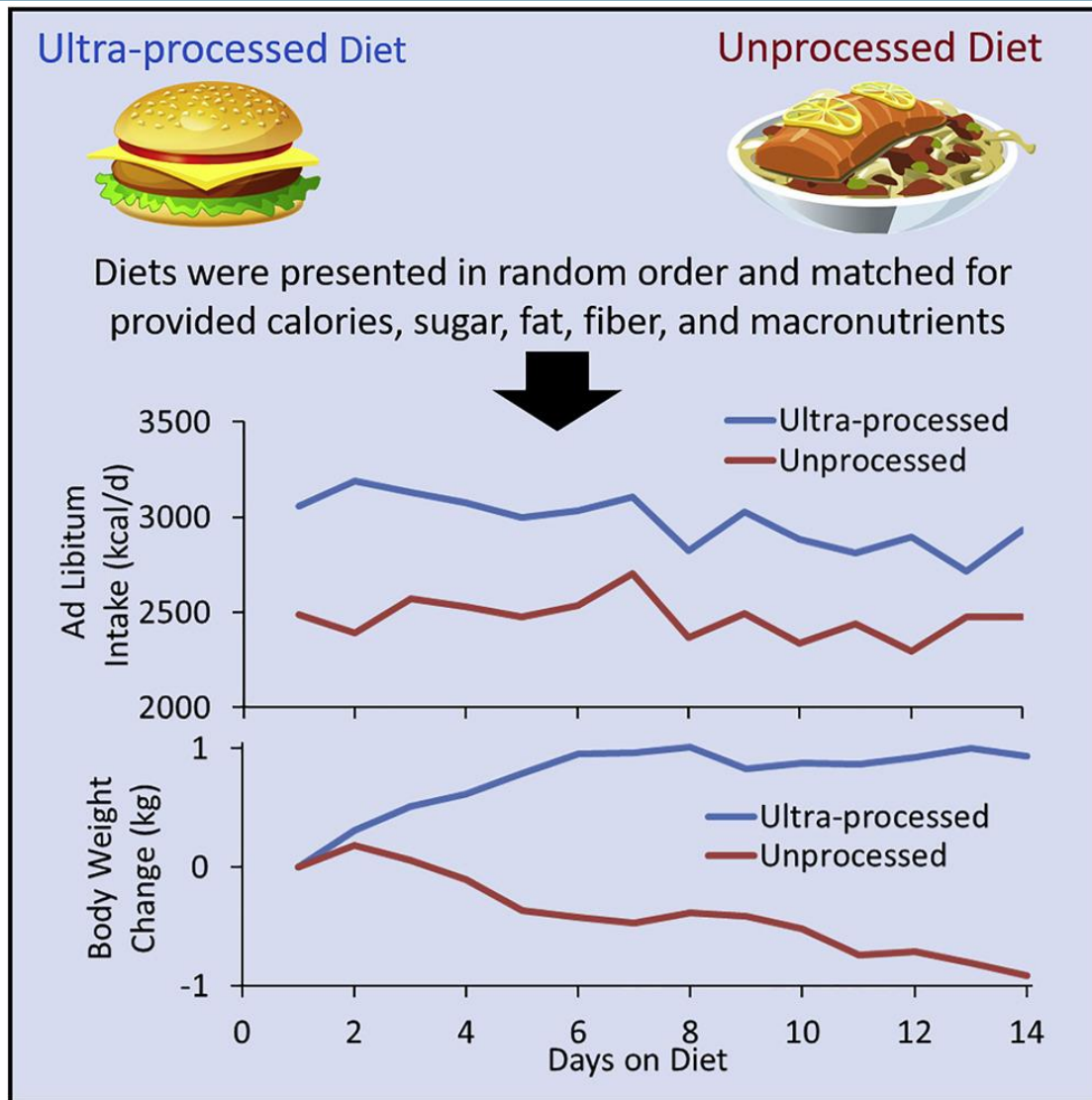
- 20 Subjects in metabolic ward received unprocessed or ultraprocessed diets for 14 days
- Diets were matched for available calories, fat, sugar, fibre and macronutrients



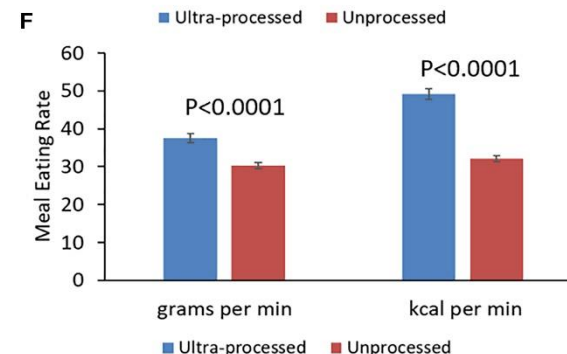
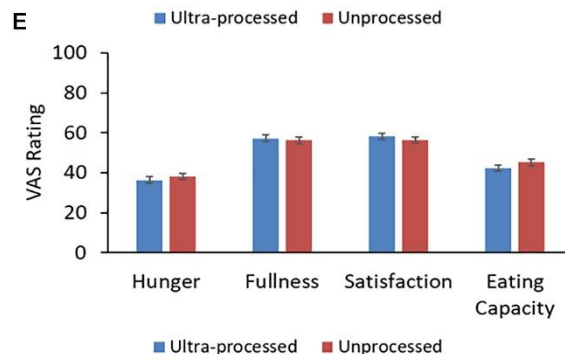
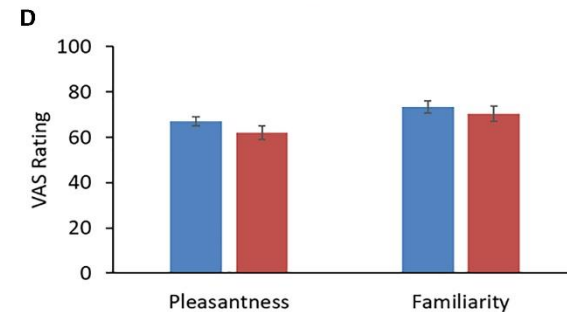
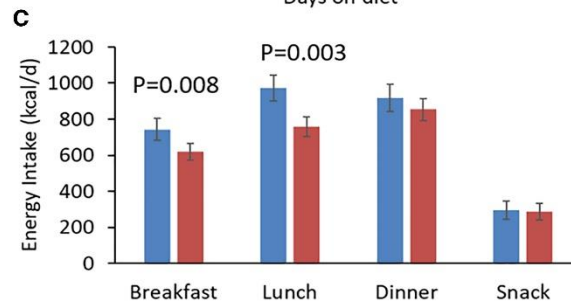
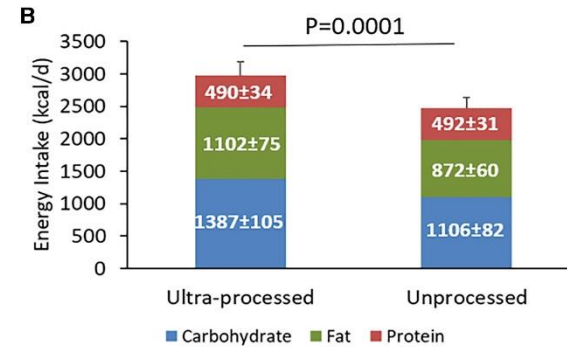
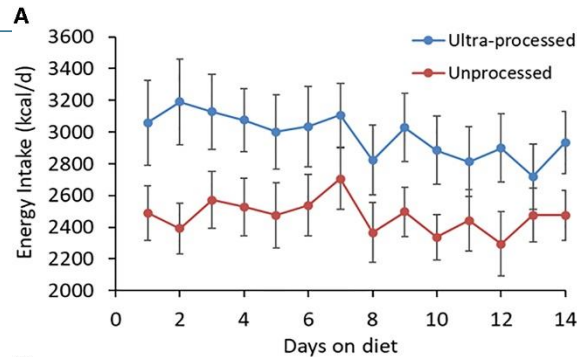
↓ DLW Fasted Blood ↓ DXA ↓ MRI MRS 24hr Chamber OGTT



Main results: UPF > 500 kcal, 2 kg weight difference



No differences in liking, satiety; protein intake, 50% difference in energy intake rate, 48 kcal/min vs 31 kcal/min



A calorie is not a calorie



1575 kCal



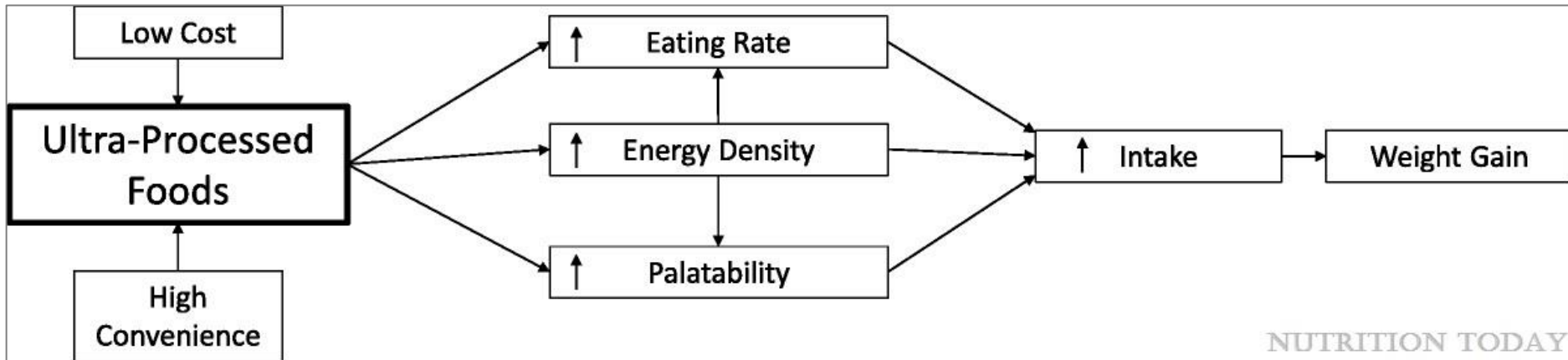
1575 kCal



FIGURE 1

[Properties of Ultraprocessed Foods That Can Drive Excess Intake](#)

Rolls, Barbara J.; Cunningham, Paige M.; Diktas, Hanim E.
Nutrition Today55(3):109-115, May/June 2020.
doi: 10.1097/NT.0000000000000410



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

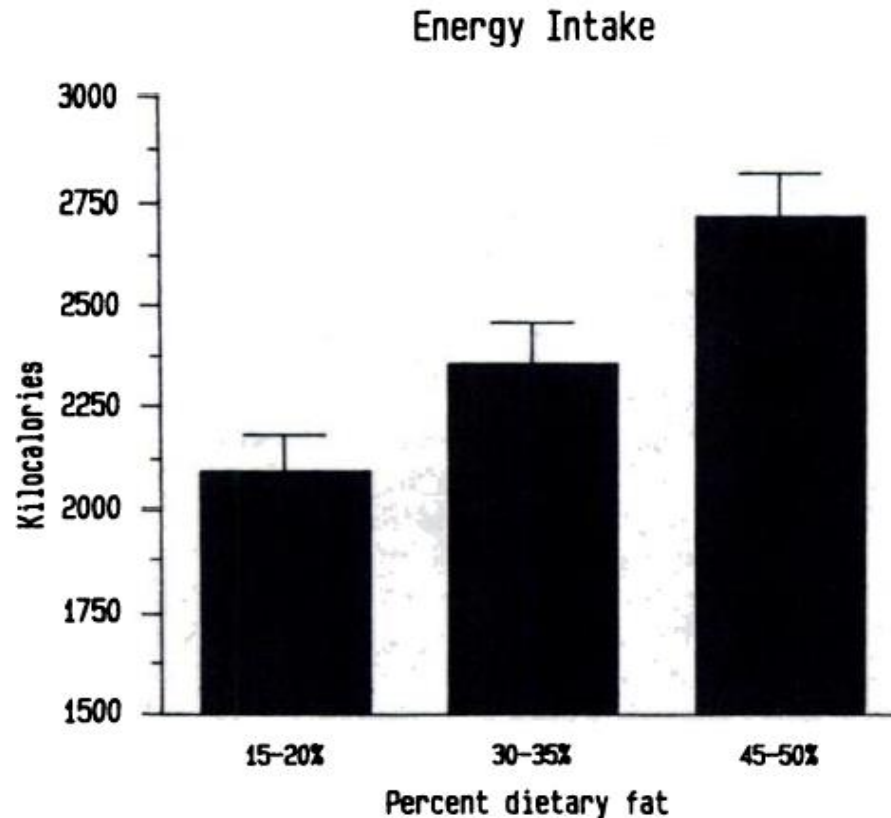


FIG 1. Mean daily energy intake per 14-d dietary treatment + SEM
F test for diet effect: $p < 0.0001$.



Slow Food: Sustained Impact of Harder Foods on the Reduction in Energy Intake over the Course of the Day



Dieuwerke P. Bolhuis^{1*}, Ciarán G. Forde², Yuejiao Cheng¹, Haohuan Xu¹, Nathalie Martin², Cees de Graaf¹

- 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



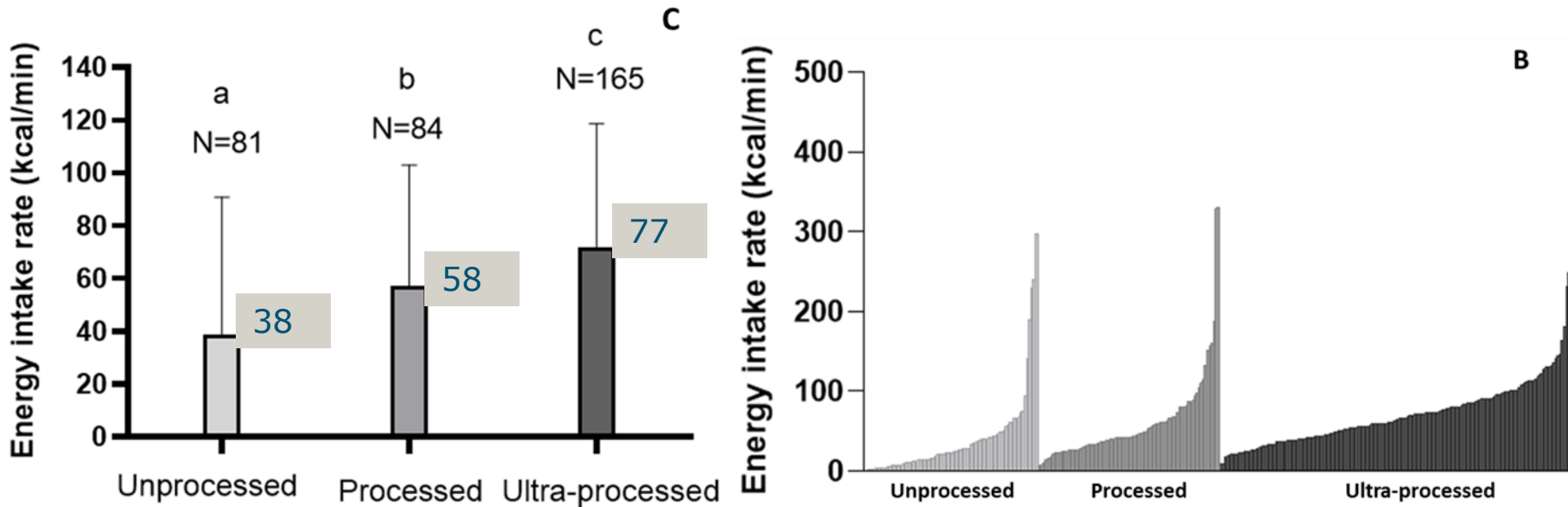
Consuming 1 kg grape juice / grapes

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



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 ?

