The Calories-Must-Be-Bad Bias:

How the Belief that Calories are Unhealthy Increases the Choice Share of Less Nutritious Options

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Main findings

- **Individuals tend to believe that all calories are bad**, and insufficiently realize that nutrient-dense foods may also contain many calories.
- In turn, **calorie posting can reduce the perceived nutritional value and choice share of nutrient-dense products**, obstructing longstanding governmental efforts to increase their intake in the population.
- Poor nutrition literacy is a catalyst of this effect.

Introduction

Health officials have long warned individuals to both 1) limit calorie intake and 2) improve diet quality with more nutrient-dense foods. But public policies have heavily focused on 1) limiting calorie intake, making calorie posting more and more prevalent, without much success.

We argue that this has led to an unjustified belief that "all calories are bad" that biases judgments of nutrient-dense products, as well as food choices. Nutritional value and calories are not necessarily negatively correlated, contrary to what consumers tend to believe.

This is important because nutrient-dense diets may help to improve long-term weight homeostasis better than calorie restriction.

Pilot data (Amazon)

- **Data**: we recorded the caloric and the nutritional contents of the top 20 best-selling items in six snack categories on Amazon.com: three less nutritious ones (cookies, potato chips, candy & chocolate), and three nutrient-dense ones (granola bars, nuts & seeds, snack trail & mixes).
- Nutrient-dense snacks incorporate significantly **more proteins**, $F_{(1, 111)} = 161.03$, $p < .001$, and **more unsaturated fats**, $F_{(1, 111)} = 23.84$, $p < .001$, while containing **less saturated fats,** $F_{(1, 111)} = 21.62$, $p < .001$, than less nutritious snacks.
- Nutrient-dense products also contained marginally **more fibers,** $F_{(1, 111)} = 2.97$, $p = .088$, and marginally **less sugar**, $F_{(1, 111)} = 3.14$, $p = .079$.
- Nutrient-dense snacks and less nutritious snacks do not differ in **caloric density** (F(1, 111) = 1.20, p = .28).

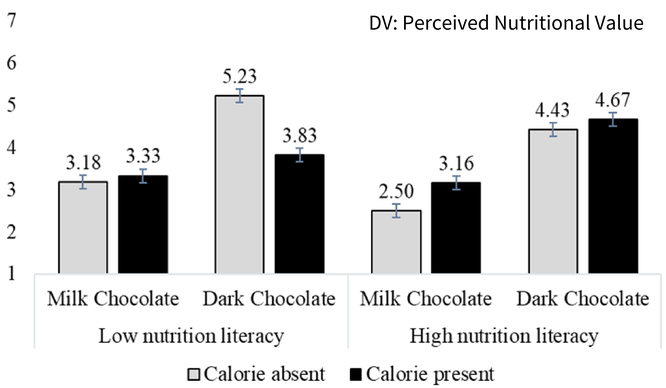
Mozaffarian, D. (2016). Dietary and policy priorities for cardiovascular disease, diabetes, and obesity: a comprehensive review. *Circulation, 133*(2), 187-225.
Cadario, R., & Chandon, P. (2020). Which healthy eating nudges work best? A meta-analysis of field experiments. *Marketing Science, 39*(3), 465-486.

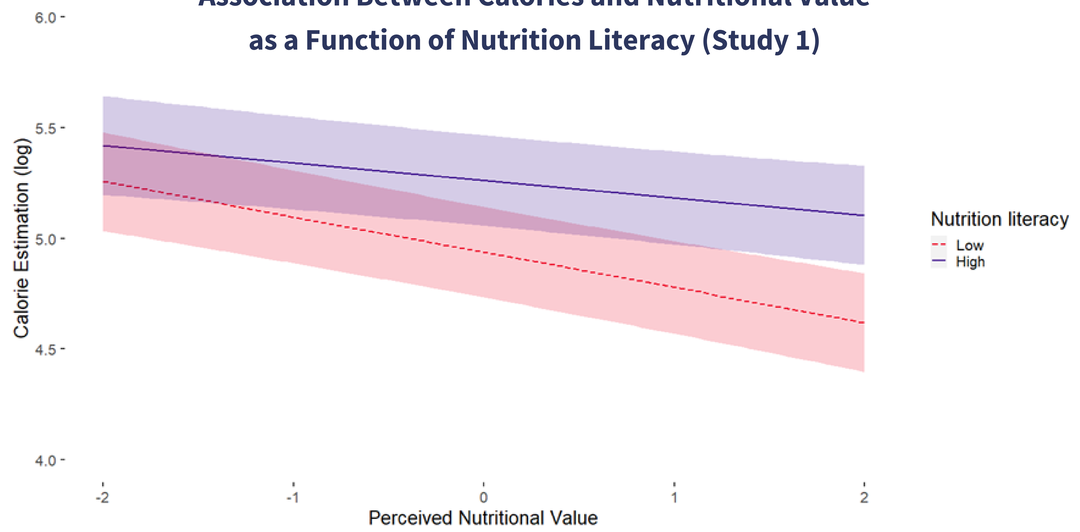
Study 1 (n = 203 US students)

Calorie information reduces the perceived nutritional value of more nutritous products

- Design: 2 between-Ps conditions (Calorie info Absent vs. Present)

- Procedure: Participants evaluated the nutritional value of both dark chocolate (more nutritious) and milk chocolate (less nutritious), and answered the nutrition literacy scale.





- *Figure above:* Participants without calorie information estimated the caloric content of both dark chocolate and milk chocolate (after they estimated nutritional value)
- Significant interaction, $b = .03$, $t_{(99)} = 2.53$, $p = .013$, such that increases in nutrition literacy reduced the negative association between nutritional value and calorie estimates.
- *Figure on the left (bottom):* Calorie information decreased the difference in perceived nutritional value between the two products for 80% of our sample; only the top 20% people in nutrition literacy were unaffected

Study 2 (n = 104) - Calorie estimation task

Procedure: Participants were given the caloric content of more (less) nutritious products and asked to guess the caloric content of less (more) nutritious products in a 2 x 2 within-subject design.

Results: A hierarchical linear model revealed a significant interaction, $F_{(1, 309)} = 15.7$, $p < .001$. When given the caloric content of less nutritious foods, participants underestimated the caloric content of more nutritious foods ($M = -169.3$). Conversely, when given the calories of more nutritious foods, participants overestimated the caloric content of less nutritious foods ($M = 82.3$). This suggests that people hold a calories-must-be-bad bias (i.e., they do not believe more nutritious products can contain as many calories as less nutritious ones).

Study 3 (n = 496) - Choice

- **Procedure**: Participants chose between a regular granola bar and a more nutritious (i.e., nutrient-added) granola bar. In a 2 x 2 between-subject design we manipulated whether we provided calorie information and whether the added nutrient contained calories (e.g., proteins or omega 3) or not (e.g., calcium or vitamin C).
- **Results:** We found an interaction, $p < .01$. When added nutrients contained calories, the likelihood of choosing the more nutritious granola bar was lower in the presence (vs. absence) of calorie information (62% vs. 88%), $p < .001$. This pattern did not arise when added nutrients did not contain calories.

Study 4 (n = 244) - Intervention

- **Procedure:** Participants were assigned to one of three conditions (no info vs. calorie info vs. calorie info & visual display), and evaluated the nutritional value of six foods regrouped in three pairs of more vs. less nutritious foods with similar caloric content (e.g., almonds vs. potato chips).
- **Results**: We found an interaction such that compared to the control, calorie posting alone reduced the perceived nutritional value of the more nutritious foods ($M = 4.22$ vs 4.57, $p < .01$), but the association of calorie information and visual display of nutrients did not ($M = 4.43$ vs 4.57, $p = .30$). The perceived nutritional value of the less nutritious items was not affected.

Example of stimuli for the Calorie info & Visual display condition (Study 4)