

Food processing and structure impact the metabolizable energy of almonds.

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Abstract:

The measured metabolizable energy (ME) of whole almonds has been shown to be less than predicted by Atwater factors. However, data are lacking on the effects of processing (roasting, chopping or grinding) on the ME of almonds. A 5-period randomized, crossover study in healthy individuals (n = 18) was conducted to measure the ME of different forms of almonds (42 g per day), as part of a controlled diet: whole, natural almonds; whole, roasted almonds; chopped almonds; almond butter; and control (0 g per day). After 9 days of adaptation to each diet, participants collected all urine and fecal samples for 9 days. Diets, urine, and feces were analyzed to determine ME. Fracture force and fracture properties of whole and chopped almonds were measured. Measured ME (kcal g⁻¹) of whole natural almonds (4.42), whole roasted almonds (4.86), and chopped almonds (5.04) was significantly lower than predicted with Atwater factors (P < 0.001); ME of almond butter (6.53 kcal g⁻¹) was similar to predicted (P = 0.08). The ME of whole roasted and chopped almonds was lower than almond butter (P < 0.0001). ME of whole natural almonds was lower than whole roasted almonds (P < 0.05). This may be due to lower hardness of whole roasted (298 ± 1.3 N) compared to whole natural almonds (345 ± 1.6 N) (P < 0.05), and to whole natural almonds fracturing into fewer, larger particles, thus inhibiting the release of lipids. Atwater factors overestimate the ME of whole (natural and roasted) and chopped almonds. The amount of calories absorbed from almonds is dependent on the form in which they are consumed.

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