

# CRUNCH ON THIS:

## The Science of Satiety

### SATIETY: THE FEELING OF FULLNESS AFTER EATING A MEAL OR SNACK

According to research by Dr. John Blundell, the attributes of foods that determine the level of their overall 'satiating power' are<sup>1</sup>:



- Energy density
- Volume
- Fiber content
- Protein
- Glycemic index
- Rate of eating
- Palatability
- Taste
- Food texture

**For manufacturers charged with developing snacks that will satisfy and fulfill consumers, nutrient rich and energy-dense California almonds deliver against the attributes of a satiating ingredient.** Many studies have been conducted to examine the effects of almonds, consumed as part of a sensible eating plan, on outcomes related to satiety and/or body composition.

In addition to developing a product that satiates, manufacturers are also tasked with meeting **consumer demands** for products that align with their focus on:

- Weight management
- Smart snacking
- General nutrition
- Protein
- Fiber

**GOOD NEWS: almonds can help manufacturers deliver on those demands too.**

### Almonds examined as a weight-wise alternative to a high-carb snack

According to research published in the *Journal of the American Heart Association*, snacking on 1.5 ounces of whole natural almonds every day instead of a banana muffin with the same number of calories **reduced LDL (bad) cholesterol (-5.3 mg/dL) and total cholesterol (-5.1 mg/dL) in participants.**<sup>2</sup> In addition, the nutrients delivered from the almonds improved a traditional cholesterol-lowering diet (HDL) when substituted for a high-carbohydrate snack. **The study results suggest that snacking on nutrient-rich almonds instead of a high-carb snack can be a weight-wise strategy and may help improve body composition.**

The study also found reduced abdominal (belly) fat (-0.15 lbs) and waist circumference (-0.31 inches) in study participants in the almond group. The randomized, controlled clinical study evaluated 52 healthy adults with elevated total cholesterol, LDL-cholesterol and an average body mass index of 26.3 kg/m<sup>2</sup> over a six-week period in a crossover design with a two-week washout period

in-between diets. Participants were provided with balanced, healthy diets based on their calorie needs to maintain weight, and were identical except for the daily snack. Differences in the nutrient profiles of the control (58 percent cholesterol, 15 percent protein, 26 percent total fat) and almond (51 percent cholesterol, 16 percent protein, 32 percent total fat) diets were due to nutrients inherent to each snack. Researchers did not assess pre-study dietary intake and physical activity data, and there was a small total body weight loss from baseline in both groups. The test diets were not matched for macronutrients, limiting conclusions about the independent effect of almonds on the endpoints measured. Nonetheless, the nutrients delivered from almonds improved a traditional cholesterol-lowering diet when substituted for a high-carb snack.

### Almonds examined for satisfaction without weight gain

A separate study by Dr. Richard Mattes of Purdue University's Department of Nutrition Science, published in the *European Journal of Nutrition*, has shown that approximately 1.5 ounces/250 calories of almonds may provide daylong benefits when consumed as a snack or as part of a meal, by helping decrease consumption later on in the day.<sup>3</sup> This four-week randomized, controlled clinical study of 137 adults who were at risk of type 2 diabetes but otherwise healthy were randomly assigned to one of five groups: a control group that did not consume nuts or seeds during the study period, and two meal groups and two snack groups that consumed 1.5 ounces of whole almonds daily at assigned breakfast or lunch meal times, or morning or afternoon snack times.

**The study group who received almonds as a snack experienced less hunger and desire to eat throughout the day, compared to those who did not consume almonds.** In addition, eating almonds did not lead to weight gain or increase daily total calorie intake in the participants studied, despite eating an additional 250 calories from almonds every day. Although the study was of relatively short duration, these findings suggest that almonds may be a satisfying snack option to help maintain a healthy weight. **This suggests that almonds are a smart ingredient for manufacturers looking to acutely enhance the satiety of a new or existing product. And, almonds are nutrient-rich and in appropriate amounts pose little risk for weight gain – a concern that grows with the increase in overall consumer snacking occasions.**



## Almonds examined for effects on satiety and daily energy intake

A study in the *European Journal of Clinical Nutrition* investigated the effects on satiety and energy intake after consumption of two different portion sizes of almonds, 1 ounce/160 calories versus 1.5 ounces/250 calories, compared to no snack in a group of 32 healthy, normal weight, Caucasian women.<sup>4</sup> According to the study, there were no significant differences in total daily energy intake between the groups, indicating that the participants naturally compensated for the almond calories consumed as a mid-morning snack as they ate throughout the day. The study was con-



ducted in a randomized, crossover design, meaning that each participant completed each intervention – no almonds, 1 ounce or 1.5 ounces of almonds – during the three-day test period.

On each test day, participants consumed all meals under supervision at the study site, and did not eat or drink between meals other than the assigned mid-morning snack at 11:00 a.m. Participants were fed lunch mid-day and permitted to eat as much as they wanted until they were comfortably full.<sup>4</sup> They were instructed to eat until comfortably full at dinner as well, and assessed their appetite ratings every 30 minutes in-between meal periods. **Ratings of appetite and fullness were dose-dependent, with participants reporting being the least hungry when eating 1.5 ounces of almonds, and the hungriest on the day when they didn't eat almonds.**

Subjective ratings of appetite and fullness were measured at regular intervals using VAS (visual analogue scale) ratings, and energy intake was assessed by weighing the meals before and after consumption. Although the study just looked at the impact of one day's meals and did not control for habitual almond intake, the studies suggest that snacking on nutrient-rich almonds may improve satiety and help control cravings.

### Making Calories Count

Snacking is on the rise, with an estimated 97 percent of Americans reporting that they snack at least once a day, and 40 percent consuming three to four snacks per day, according to a study published in the *Journal of Nutrition*.<sup>5</sup> **The snacks that best nourish the body and satisfy hunger typically include fiber, protein and good fats**, and consumers are asking for these nutrient-rich snacks as they are getting a larger proportion of their calories from snack occasions.<sup>6</sup>

**The unique nutrient package in almonds makes them a satisfying, weight-wise ingredient for manufacturers, who need to deliver craveable, satisfying snacks that also provide nutrients.** Almonds fit the bill because they're satiating and help control hunger but don't lead to extra caloric intake. And, they may have fewer calories than we think.

A study published in the *American Journal of Clinical Nutrition* found that when considering digestibility, **a one-ounce serving of almonds (about 23 nuts) has just 129 calories as opposed to the previous count of 160 – that's 20 percent fewer calories!**<sup>7</sup> The study examined 18 healthy adults who consumed a controlled nut-free diet or an almond-containing diet (providing 1.5 or 3.0 ounces/day) for 18 days in a crossover design.<sup>7</sup> During the final nine days of each treatment period, samples were collected

from the participants and analyzed, along with their diets, for macronutrient and energy contents.<sup>7</sup> The metabolizable energy content of the almonds was determined, and the human diet was found to be 129 kcal/1 ounce serving, compared to current energy predictions of 168-170 kcal/serving based on the Atwater factors.<sup>7</sup> The Atwater factors, when applied to almonds, resulted in a 32 percent overestimation of their measured energy content. Further research is needed to better understand how this technique for calculating calories could potentially affect the calorie count of other foods.<sup>7</sup>

Almonds are also rich in nutrients. One serving of almonds (28 grams, or about 23 almonds) has 13 grams of unsaturated fat and only 1 gram of saturated fat.\* Ounce for ounce, almonds are the tree nut highest in protein (6 mg/oz), fiber (4g), vitamin E, calcium (75 mg/oz), riboflavin and niacin (1 mg/oz).

\*According to the U.S. Food and Drug Administration, "Scientific evidence suggests, but does not prove, that eating 1.5 ounces per day of most nuts, such as almonds, as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease." U.S. Dietary Guidelines recommend that the majority of fat intake be unsaturated.

**The bottom line? Crunch on California almonds for the development of nutrient-rich, wholesome, satiating snack products.**

#### References

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