PROTEIN SNACKS IMPROVE SATIETY AND DIET QUALITY IN TEENS
The Study

RATIONALE
Snacks play an important role in the diet, especially for kids. In fact, snacks have been incorporated in their daily routine, with kids consuming a snack within the school day as well as prior to specific after school activities. It is not surprising that the observed increase in snacking in recent years has led to a corresponding increase in calories consumed from snacks. As we have also seen a corresponding increase in obesity, calories consumed from snacks have become a controversial topic and area of research. One cannot overlook the importance of the type of snack consumed and its nutrition profile.

Findings showed that adult populations experienced greater satiety and reductions in total daily caloric intake when consuming high-protein snacks compared to high-fat/sugar snacks. However, it was unknown whether young people would have the same type of response.

APPROACH
This novel study assessed whether an afternoon snack containing protein improved appetite control, satiety, and reward-driven eating behaviors compared to high-fat/sugar snacks or no snacking in normal to overweight adolescents. Select aspects of mood and cognition were also assessed after the consumption of each snack.

METHODS
PARTICIPANTS
31 healthy, normal to overweight adolescents (age 13-19) completed the randomized, crossover-design clinical trial.

SNACK INTERVENTIONS
Chocolate peanut caramel-flavored puddings
- Protein-rich snack (26g protein from DuPont™ Danisco SUPRO® soy protein isolate/6g fat/27g carbohydrates)
- ‘Typical’ snack low in protein, high fat, higher carbohydrate (4g protein/12g fat/32g carbohydrates)
- Acclimation: Participants were provided with one of the above snacks at home for three days. On the fourth day, the participants consumed a controlled breakfast and lunch and then reported to the testing facility to complete an 8-hour testing day. The survey protocol for this study is depicted in figure 1 below:

OUTCOME MEASURES
- Appetite questionnaires completed before and after snack
- Food cue-stimulated functional magnetic resonance imaging brain scans (fMRI)
- Computer tests to assess cognitive function and mood
- Time prior to request for next meal
- Quantity and quality of evening snacks consumed
- Total daily energy and nutrient intake measurements to assess the quality and quantity of daily intake

Afternoon snacking, particularly on foods rich in soy protein, improves appetite control, satiety, and diet quality in young people, while beneficially influencing certain aspects of mood and cognition.
Study Results

Afternoon snacking, particularly on higher protein soy foods, improves appetite control, satiety, and diet quality in young people, while beneficially influencing select aspects of mood and cognition.

1 The consumption of the higher protein snack led to greater reductions in appetite and a greater delay in subsequent eating compared to the high-fat snack and no snack.

- On the day the protein snack was consumed, the request for next meal was delayed by 20 minutes, a statistically significant delay when compared to no snack.
- No differences in next meal or daily energy intake were detected between treatments.

PERCEIVED APPETITE RESPONSES

![Composite Appetite Score (mm)](chart)

2 Study findings suggest improvements in energy intake regulation and diet quality occur with the consumption of protein-rich afternoon snacks.

- Consuming a 260 kcal protein snack led to:
  - Greater protein intake for the day and lower fat consumption compared to the high-fat snack.
  - Fewer high-fat/high-sugar snacks consumed throughout the evening compared to skipping snack (p<0.01); the snack with a ‘typical’ nutrition profile did not elicit this reduction.
- Dietary compensation and improvements in dietary quality were observed when subjects received the protein-rich snack.
  - The protein snack was nearly compensated for (82 ± 59%) through the reduction in daily energy content, whereas the snack higher in fat was not (13 ± 47%).

3 The findings from this study suggest a daily afternoon snack, particularly one rich in soy protein, may be a dietary strategy to improve mood, and cognition in young people.

- Consuming an afternoon snack prevented the decline in feelings of vigor-activity (energy), which was observed when snack was skipped.
- Additionally, the protein-rich snack reduced feelings of confusion and tended to increase cognitive flexibility.
- Consumption of the high-protein snack did not influence neural activation in brain regions controlling food motivation/reward in young people.
  - Since the satiating properties of protein are generally experienced hours after eating a protein-rich food, conducting fMRI scans later than 30 minutes post-snack may show food reward/motivation effects similar to the high-fat snack.

NOVEL FINDINGS:

- The consumption of a high-protein afternoon snack led to improvements in appetite control and satiety compared to consumption of a calorie-equivalent snack low in protein and higher in fat and carbohydrates.
- High-protein snacks have the ability to reduce feelings of confusion-bewilderment and increase cognitive function.
  - Dietary protein may have led to increase in dopamine secretion which is known to to evoke feelings of pleasure and wellbeing, and modulate attention and cognitive function.
Several previous studies conducted with adults have examined the effects of consuming high-protein snacks on appetite, satiety, and/or daily food intake.

The few studies that examined subjects’ responses to a single snack produced mixed results regarding the beneficial effects of high-protein snacking.

This study utilizes a more tightly-controlled design by providing a similar snack food type (i.e., chocolate-peanut-caramel-flavored puddings) and similar protein sources (i.e., soy protein) for both the high-protein and high-fat patterns. The consumption of the high-protein snack led to greater reductions in appetite and a greater delay in subsequent eating compared to the high-fat snack and no snack in overweight adolescents. Further, daily energy intake did not increase following the consumption of the 260 kcal high-protein snack, illustrating dietary compensation. Collectively, this data lends support for the improvements in satiety and the regulation of energy intake.

Snacks commonly consumed by young people are typically low in protein and higher in fat and carbohydrates. Thus, typical snacks contribute to the consumption of nutrients already consumed in excess while lowering the consumption of nutrients, such as high-quality lean protein sources, that fuel healthy growth and development.

REFERENCE