



An After-School Raisin Snack Reduces Subjective Appetite and Energy Intake and Increases Satiety in Normal Weight Children
Nick Bellissimo<sup>1,2</sup>, Bohdan Luhovyy<sup>1</sup>, Evelyn Hurton<sup>1</sup>, Lorianne J. Bennett<sup>1</sup>, Rebecca Mollard<sup>4</sup>, James Painter<sup>3</sup>, G. Harvey Anderson<sup>4</sup>

<sup>1</sup>Applied Human Nutrition, Mount Saint Vincent University. <sup>2</sup> Nutrition, Ryerson University.

<sup>3</sup>Family and Consumer Sciences, Eastern Illinois University. <sup>4</sup>Nutritional Sciences, University of Toronto.



#### Abstract

An increase in the frequency of eating occasions among school-age children is hypothesized to contribute to obesity, but this association may be confounded by the composition of the meal or snack. Therefore, it is important to identify low energy and high nutrient dense snacks that may contribute to healthier body weights by increasing satiety, controlling hunger, and reducing subsequent food intake (FI). The objective of this study was to determine the effect of an ad libitum after-school snack of raisins, grapes, potato chips or chocolate chip cookies on subjective appetite and FI in children. In a repeated-measures crossover design, normal weight (between the 10<sup>th</sup>-80<sup>th</sup> BMI percentile) children (n=26; 11 boys and 15 girls; age: 8-11 y) were randomly assigned to consume one of four snacks: raisins, grapes, potato chips or chocolate chip cookies until they were comfortably full within 15 min. In order to model a typical school day, children consumed a standardized breakfast (fat-free skim milk, cereal, and orange juice), morning snack (apple) and lunch (turkey sandwich and 2% milk) on test days prior to their arrival to the laboratory within 20 min of the end of the school day. FI of the ad libitum snacks was recorded. Subjective appetite was measured before and immediately after snack consumption, and at 15 min intervals to 45 min. Intake of raisins was significantly lower (p<0.05) compared to the other treatments. Grapes, potato chips and cookies resulted in ~ 56%, 70% and 108% higher energy intake compared to raisins, respectively. Cumulative energy intake (breakfast [kcal] + morning snack [kcal] + after-school snack [kcal]) was ~10%, 13% and 19% lower (p<0.05) after raisins compared to grapes, potato chips and cookies, respectively. Although all snacks reduced subjective appetite (P < 0.0001), desire-to-eat was lowest after raisins when expressed on a per kcal basis (P< 0.008). In conclusion, ad-libitum consumption of raisins as an after-school snack contributes to lower daily energy intake and subjective appetite and may promote the maintenance of healthier body weights in children.

## Introduction

- Children's eating patterns are important factors determining energy intake and body weight.
- Frequent snacking is often stated to contribute to overweight in children and adolescents (1).
- Low energy dense snacks (eg. fresh fruit) have more influence on satiety than energy dense snacks (eg. dried fruit, nuts), and therefore have greater potential to reduce energy intake (2).

# Objective

■ To determine the effect of an *ad libitum* after-school snack of raisins, grapes, potato chips or chocolate chip cookies on subjective appetite and FI in children.

# Study Design Morning Breakfast Snack Lunch 0 15 30 45 Fat-free skim milk (250 ml), cereal (28 g) and orange juice (236 ml) Apple Turkey sandwich, 2% milk (250 ml)

At time 0, 15, 30, 45 min subjective appetite measured using visual analogue scales (VAS).

#### Results

Table 1. Subject characteristics

	All Subjects
Age (y)	$10.1 \pm 0.2$
Body Weight (kg)	$33.1 \pm 1.0$
Height (m)	$1.39 \pm 0.01$
$BMI (kg/m^2)$	$17.0 \pm 0.3$
BMI percentile	$51.9 \pm 5.3$
Fat mass (kg)*	$7.4 \pm 0.5$
Fat mass (%)*	$22.0 \pm 1.2$
Fat-free mass (kg)	$25.7 \pm 0.7$
Fat-free mass (%)	$78.0 \pm 1.2$

Data are presented as mean SEM; n = 26.

<sup>\*</sup>Fat-mass determined from the sum of skinfold measurements at four points.

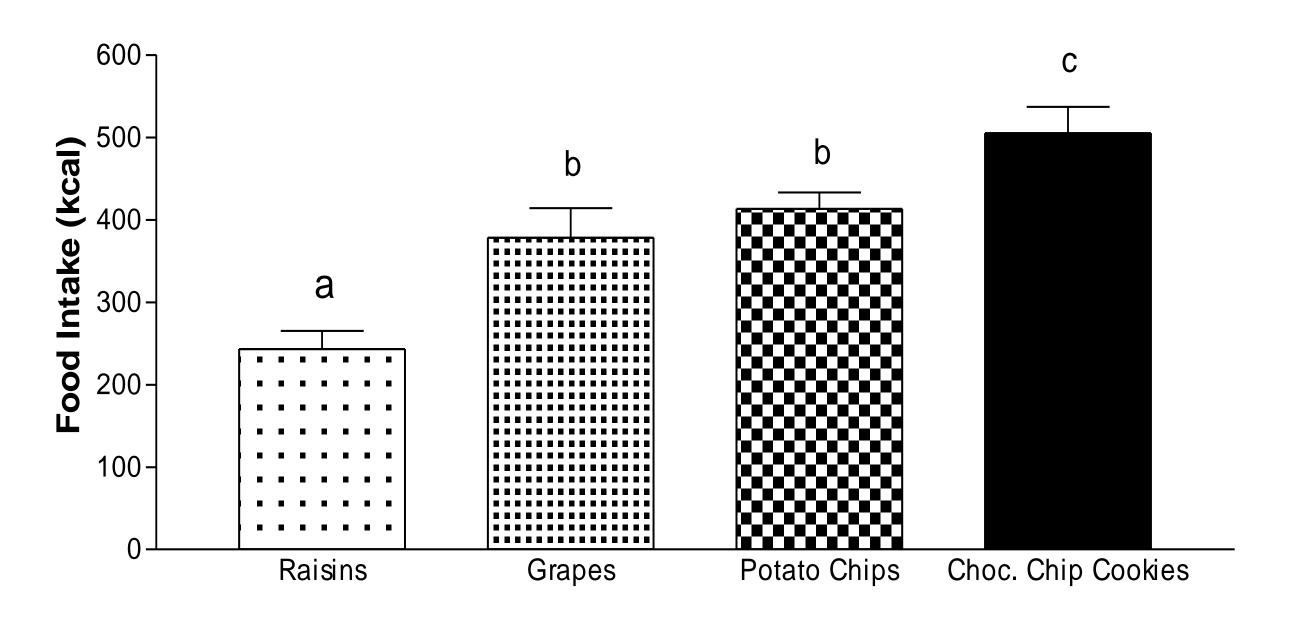


Figure 1. Ad-libitum food intake [kcal] of test snacks within 15-min in 8-11 y old children. Means with different letters differ, p < 0.05 (Tukey). n=26

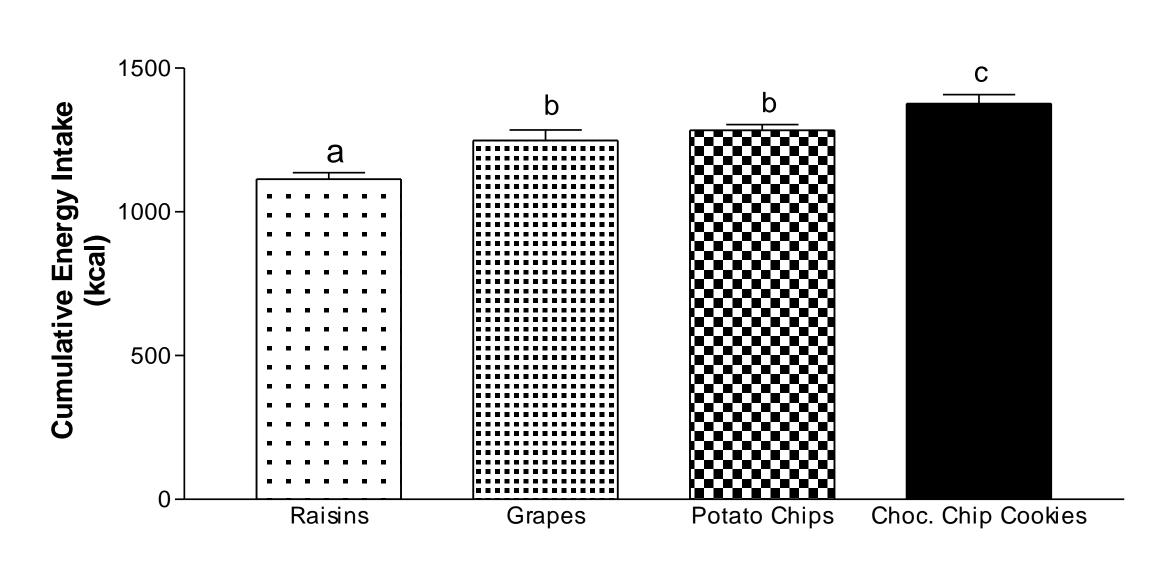


Figure 2. Cumulative energy intake (breakfast [kcal] + morning snack [kcal] + lunch [kcal] + after-school snack [kcal] in 8-11 y old children. Means with different letters differ, P < 0.05 (Tukey). n=26

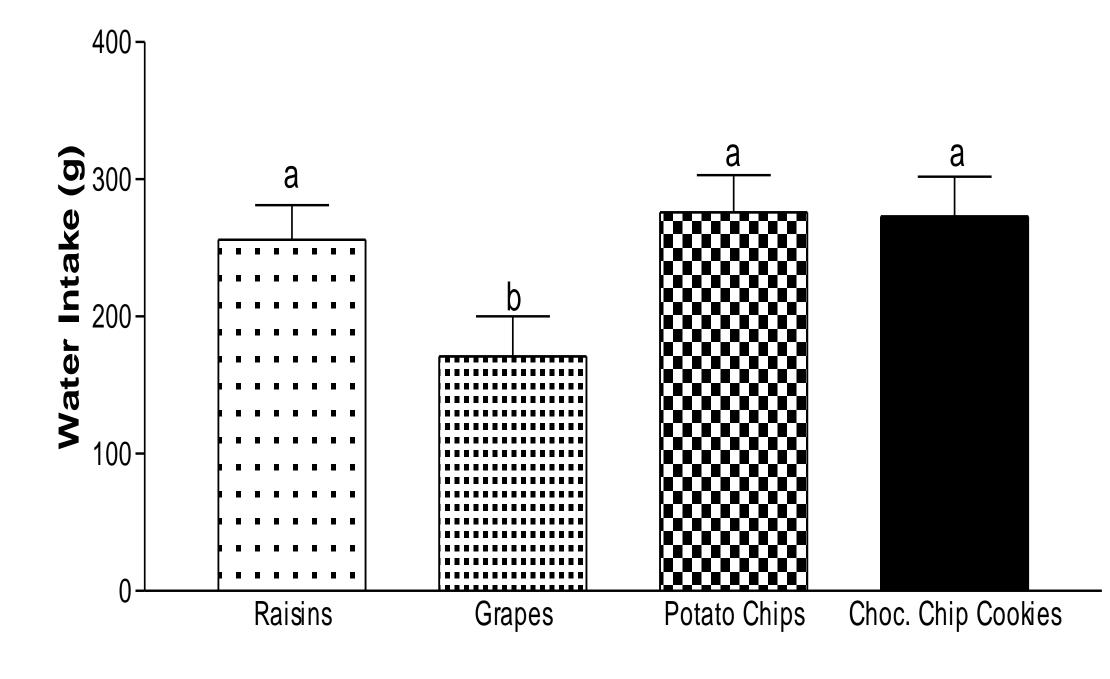


Figure 3. Water intake (g) during consumption of snacks within 15-min in 8-11 y old children. Means with different letters differ, p < 0.05 (Tukey). n=26

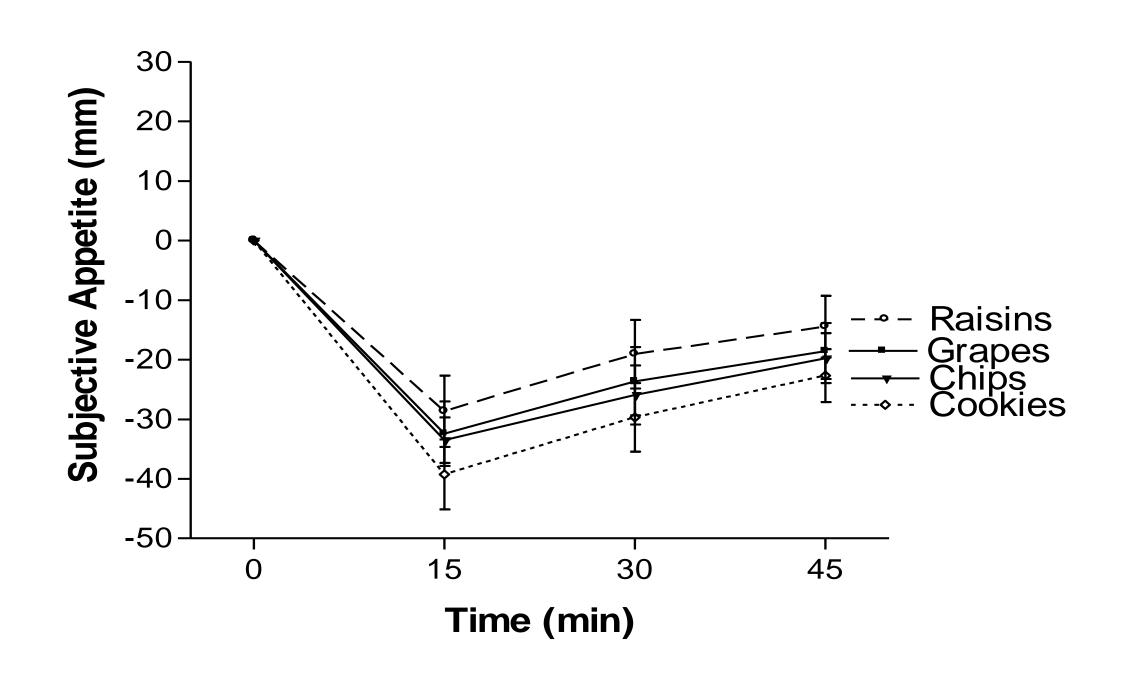


Figure 4. Change from baseline average appetite was not affected by treatment (p = 0.17) but time (p < 0.001) was a factor in 8-11 y old children. n=26

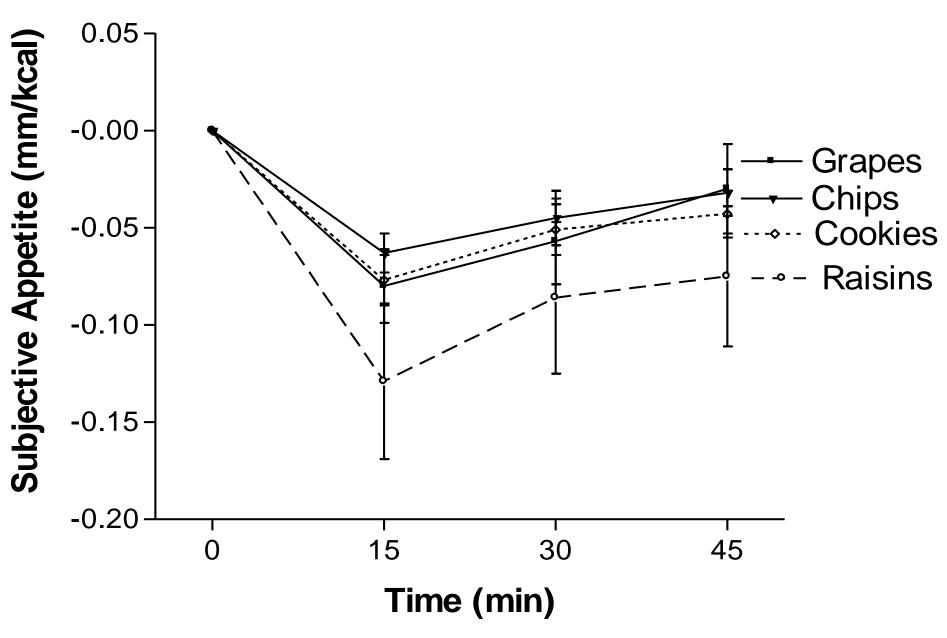


Figure 5. Desire-to-eat (mm/kcal) was affected by treatment (p < 0.008) and time (p < 0.001) in 8-11 y old children. n = 26.

### Discussion / Conclusion

- Ad-libitum snack consumption was lower, and satiety greater, after raisins.
- Cumulative energy intake was lowest after raisins compared to grapes, potato chips or chocolate chips cookies.
- Water intake was reduced after grapes due to its greater moisture content.
- Motivation-to-eat was decreased after all treatments, but raisins decreased desire-to-eat on a per kcal basis to a greater extent than other snacks.
- In conclusion, ad-libitum consumption of raisins as an afterschool snack contributes to lower daily energy intake and subjective appetite and may promote the maintenance of healthier body weights in children.

#### References

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