# Teaching parents to implement feeding practices using behavioral economics improves nutrient intake in children

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## Abstract

**Introduction:** Children in the United States consume inadequate amounts of vegetables, and there are few effective strategies to increase vegetable consumption among preschoolers. We tested a home-based intervention based on behavioral economics, targeted at parent feeding practices, to determine impact on children's dietary quality.

**Methods:** Low-vegetable consuming 3-5 year-olds were randomized to control (n=12) or treatment (n=12) for the 4-week study. During week 1, all children received daily supplies of plainly packaged raw vegetables presented by parents as a free choice against a chocolate chip granola bar. During weeks 2 and 3, children in the control group continued to receive baseline conditions while the treatment group received vegetables packaged with cartoons and sticker incentives, presented as the optimal default at meals/snacks. Children in the treatment group could "opt out" and receive the granola bar by requests made to parents after a 5 minute wait time. During week 4, all families returned to baseline conditions. Daily food records were recorded by parents for their children and analyzed with Food Processor (Version 10.12).

**Results:** Repeated measures ANOVA showed that children in the treatment group increased vegetable intake ($p<0.05$) and decreased granola bar intake ($p<0.05$) during intervention delivery. The treatment group also increased reported intake of fiber, but decreased overall energy intake from carbohydrates compared to control ($p\leq0.05$ for both). There were also trends in the treatment group for increased Vitamin K, magnesium, and selenium intake ($p\leq0.10$).

**Discussion/Conclusion:** Parents successfully administered feeding practices based on behavioral economics in the home to improve children's dietary quality.

## Background

- US children consume diets that are too low in fiber and too high in added sugars and empty calories (1)
- Feeding practices based on theories from behavioral economics hold promise to improve children's diets, but previous studies did not assess intake or include young children (2)
- Pairing foods with positive stimuli can increase their acceptance and intake (3)
- Offering incentives (4) and presenting vegetables as the default (5) are possible strategies to increase children's vegetable intake

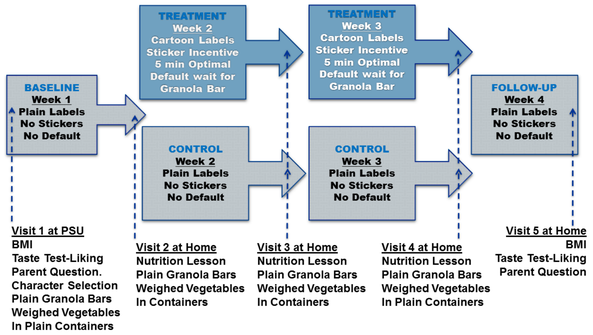
## Objectives

- The primary objective of the study was to test the effectiveness of a combined treatment using incentives, cartoon packaging, and default presentation on children's vegetable intake
- This secondary analysis tested the impact of the intervention on children's reported nutrient intake

## Study Design

- A 4 wk, parallel arm, randomized controlled trial (Fig 1) was conducted
- **Control** – plain packages of raw vegetables presented as a free choice with an alternative (granola bar) (Fig 2)
- **Treatment** – cartoon-packaged raw vegetables with sticker incentives presented as the default during wks 2 & 3 (Fig 2)

**Figure 1.** Study Design




## Methods

**Figure 2**. Containers & Granola Bars


- Vegetables included **sugar snap peas**, **red peppers**, **broccoli**, **cauliflower**, **baby carrots**, and **celery**. All packages included light ranch dressing for dip
- Parents filled out food diaries for their child for 5 days per week across the 4-wk study

## Data Analysis

- Nutrient data were analyzed by Food Processor (V.10.12) to assess total energy, macro- and micronutrients
- GLM Repeated Measures ANOVA conducted to compare outcomes across the 4-wk study (SPSS v. 22)

## Participants

**Table 1.** Characteristics of mothers and children

| Variable | Controls (n=12) | Treatment (n=12) | All Children (n=24) |
|---|---|---|---|
| *Categorical Variables* | | n (%) | |
| *Sex* | | | |
| % Male | 6 (50.0) | 6 (50.0) | 12 (50.0) |
| % Female | 6 (50.0) | 6 (50.0) | 12 (50.0) |
| *Ethnicity* | | | |
| % White | 12 (100.0) | 10 (83.3) | 22 (91.7) |
| % "Other" | 0 (0.0) | 2 (16.7) | 2 (8.3) |
| *Infant Feeding* | | | |
| % Breast-fed | 11 (92.0) | 10 (83.0) | 21 (87.5) |
| % Formula-fed | 1 (8.0) | 2 (17.0) | 3 (12.5) |
| Continuous Variables | | Mean ± S.D. | |
| Age (years) | 4.0 ± 0.75 | 3.8 ± 0.87 | 3.9 ± 0.81 |
| BMI z-score | 0.3 + 1.16 | 0.4 ± 0.88 | 0.4 + 1.01 |
| BMI - mother | 26.0 ± 4.4 | 25.6 ± 4.0 | 25.8 ± 4.1 |
| BMI - father | 28.2 ± 3.9 | 30.4 ± 3.2 | 29.3 ± 3.7 |

## Summary of Main Outcomes

- The treatment group increased vegetable intake and decreased granola bar intake due to the intervention ($p<0.05$)
- The control group showed no change

## Nutrient Intake

- Children in the treatment group reported greater calorie-adjusted intake of fiber during week 2 compared to baseline ($p<0.05$)

**Figure 3.** Dietary fiber intake adjusted for total calories

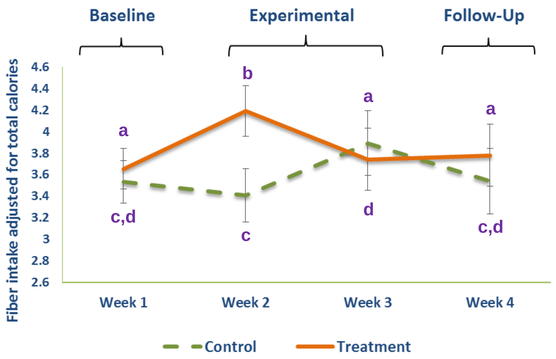



**Figure 3 legend.** Post-hoc within-group comparisons:

a,b % Fiber intake increased in wk 2 compared to all others ($p<0.05$)
c,d % Fiber intake increased in wk 3 relative to wk 2 ($p<0.05$)

- The treatment group decreased % of energy intake from carbohydrates during the intervention (wk 3) ($p \leq 0.02$)

**Figure 4.** Percent of calories from carbohydrates

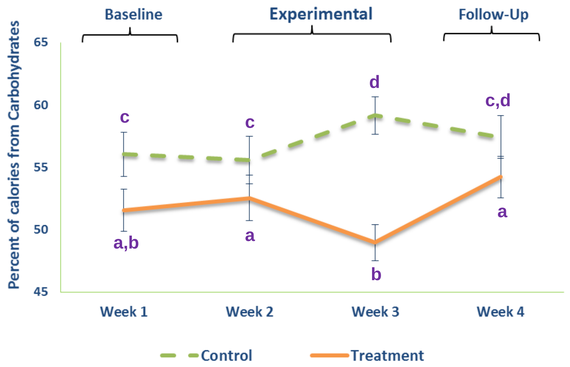



**Figure 4 legend.** Post-hoc within-group comparisons:

a,b % of calories from carbohydrate decreased in wk 3 relative to wk 2 and 4 ($p<0.05$)
c,d % of calories from carbohydrate increased in wk 3 compared to wks 1 and 2 in the control group ($p<0.05$)

- There were also trends for the treatment group to increase reported intake of magnesium and selenium ($p<0.10$)
- **Note:** The initial abstract reported a trend for the treatment group to increase Vit K intake, but after further analyses, this trend was no longer present

## Conclusions

- Parents were able to administer feeding practices derived from behavioral economics in the home to successfully improve children's dietary quality

## Acknowledgements

- Please find out more about PSU's Children's Metabolic Kitchen and Eating Behavior Lab and the students who are essential to the lab's progress at our website:

http://nutrition.psu.edu/childrens-eating-lab

- Funding: College of Health & Human Development @ PSU

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