

Short Communication

Examining the feasibility of implementing behavioural economics strategies that encourage home dinner vegetable intake among low-income children

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Abstract

Objective: To examine the feasibility of implementing nine behavioural economics-informed strategies, or ‘nudges’, that aimed to encourage home dinner vegetable intake among low-income children.

Design: Caregivers were assigned six of nine strategies and implemented one new strategy per week (i.e. 6 weeks) during three dinner meals. Caregivers recorded child dinner vegetable intake on the nights of strategy implementation and rated the level of difficulty for assigned strategies. Baseline data on home vegetable availability and child vegetable liking were collected to assess overall strategy feasibility.

Setting: Participants’ homes in a large Midwestern metropolitan area, USA.

Subjects: Low-income caregiver/child (aged 9–12 years) dyads (n 39).

Results: Pairwise comparisons showed that child dinner vegetable intake for the strategy ‘Serve at least two vegetables with dinner meals’ was greater than intake for each of two other strategies: ‘Pair vegetables with other foods the child likes’ and ‘Eat dinner together with an adult(s) modelling vegetable consumption’. Overall, caregivers’ mean rating of difficulty for implementing strategies was 2.6 (1 = ‘not difficult’, 10 = ‘very difficult’). Households had a mean of ten different types of vegetables available. Children reported a rating ≥ 5 for seventeen types of vegetable on a labelled hedonic scale (1 = ‘hate it’, 5–6 = ‘it’s okay’, 10 = ‘like it a lot’).

Conclusions: Behavioural economics-informed strategies are feasible to implement during dinner meals, with some strategies differing by how much they influence vegetable intake among low-income children in the home.

Keywords
Behavioural economics
Vegetables
Low-income
Children
Home setting

Children in the USA are not meeting recommendations for vegetable intake^(1,2). One factor that may influence child vegetable intake is whether they like vegetables^(3–5). Low-income children may experience additional barriers, such as limited home vegetable availability^(6,7). Thus interventions that aim to improve child vegetable intake should consider vegetable liking and availability⁽⁸⁾.

One approach used in the school setting to improve child vegetable intake is the implementation of strategies informed by behavioural economics, or ‘nudges’^(9,10). Behavioural economics, a sub-field grounded in principles of psychology and economics⁽⁹⁾, is based on the premise that the social and

physical environment can be framed in a way to ‘nudge’ individuals to make healthy choices, in a manner that does not limit the choice set itself^(10,11). For example, school cafeterias have been manipulated to increase child vegetable intake by improving aspects of convenience, attractiveness and normativeness⁽¹²⁾. A systematic review of studies implementing nudges in school settings has shown the utility of these approaches in improving eating behaviour among children⁽¹³⁾.

The home environment is a promising setting for studies implementing nudges because children consume about 66% of their daily energy intake at home⁽¹⁴⁾. In a home-based,

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4-week, randomized-controlled, proof-of-concept trial, Cravener *et al.* showed that offering pre-school children vegetables as a default snack, paired with positive incentives, improved vegetable intake⁽¹⁵⁾. The home is a relatively new setting for the application of these principles and limited studies are available particularly among older children. In addition to offering vegetables as a default option, other less studied strategies may be effective and feasible ways to improve child vegetable intake in the home setting. Therefore, the aim of the present study was to determine the feasibility of implementing nine behavioural economics-informed strategies that aimed to encourage dinner vegetable intake among children aged 9–12 years residing in households receiving food assistance (a proxy for low-income status).

Methods

The methodology for the present study was published previously⁽¹⁶⁾. It included information about study recruitment, a description about how the nine strategies were identified, details about measures/instruments and training procedures for caregivers to record child dinner vegetable consumption⁽¹⁶⁾.

Study participants

Inclusion criteria for caregivers included caring for a child between the ages of 9 and 12 years, being the primary food preparer in the home, preparing dinner at least three nights per week, participating in public food assistance programmes (e.g. the Supplemental Nutrition Assistance Program) and reading, writing and speaking English. Caregivers received \$US 100 and their 9–12-year-old received \$US 20 for their participation. Approval was obtained from the University of Minnesota Twin Cities Institutional Review Board. Caregivers and their child signed informed consent and assent forms, respectively.

Procedures

Participants were recruited and participated in the study during one of the following three time frames (i.e. time of year): (i) from September to November 2013; (ii) from January to March 2014; or (iii) from March to May 2014. There were relatively equal numbers of parent/child dyads in each of the three time frames. A baseline home visit was conducted to obtain sociodemographic and household information, home vegetable availability and child vegetable liking data. After the baseline home visit, caregivers were randomly assigned six of nine strategies (Table 1). Over a 6-week period, a different strategy was implemented on a weekly basis during at least three dinner meals that week. The order of strategy implementation was randomly assigned.

During a telephone call at the beginning of the first week, researchers assigned caregivers a strategy. Caregivers were

Table 1 Nine behavioural economics strategies evaluated for feasibility

1. Pair vegetables with other foods the child already likes. For example, add beans (less liked) to tacos (liked)
2. Make vegetables more easily available and visible than other foods at the dinner meal. For example, place the vegetable serving dish on the dinner table and keep other foods in another room and/or out of sight
3. Serve vegetables before the rest of the meal. For example, serve vegetables while dinner is being prepared
4. Use a dinner plate that shows the amount of vegetables to eat for a meal. Use paper plates provided for all family members for three meals with sections printed according to MyPlate
5. Offer the child two vegetable options for dinner (prior to preparing the vegetable), one liked and one less liked. Then let the child choose what is served with the dinner meal
6. If the caregiver puts vegetables on the child's plate, give more than usual. If children typically serve themselves vegetables, use a larger serving spoon than normal so they get more than usual. Referred to as the 'Serve more' strategy
7. Eat dinner together with an adult(s) modelling vegetable consumption
8. Serve at least two vegetables with dinner meals. Include two different vegetables as side dishes OR one side dish of vegetables plus another food item with vegetables
9. Let the child help prepare vegetable dishes. For example, ask the child to get vegetables out and wash them

referred to a Strategy Guidebook for instructions and examples for how the strategy could be implemented⁽¹⁶⁾. Caregivers recorded child vegetable intake on the three dinner meals per week when the strategy was implemented using a Dinner Vegetable Record Form. At the end of each week during an audio-recorded telephone call with a trained researcher, caregivers reported child vegetable consumption from the Dinner Vegetable Record Form. Caregivers were also asked to rate the difficulty of using the strategy. At the end of the call, researchers assigned a new strategy. This procedure was followed until caregivers completed six strategies.

Measures

Sociodemographic and household characteristics

Caregivers completed a questionnaire during the baseline home visit to report age, gender, race/ethnicity, highest educational attainment and employment status, as well as child age, gender and race/ethnicity, and household composition. An amended version of the US Department of Agriculture's six-item Food Security Survey was used to assess household food security⁽¹⁷⁾.

Feasibility of strategies

On the three nights that caregivers implemented a strategy, caregivers recorded child vegetable consumption on the Dinner Vegetable Record Form, along with the vegetable type(s) and amount consumed. Caregivers also rated the level of difficulty for each of the strategies they were assigned (1 = 'not difficult', 10 = 'very difficult'). A shortened version of a previously validated home food inventory was

used to document the presence of thirty-six vegetables, including four types of legumes⁽¹⁸⁾. During the baseline home visit, a researcher documented the presence of these vegetables (1 = 'yes', 0 = 'no'). Children also provided liking ratings for these thirty-six vegetable types using a labelled hedonic scale (1 = 'hate it', 5–6 = 'it's okay', 10 = 'like it a lot').

Statistical analyses

Descriptive statistics were calculated to examine the distribution of sociodemographic and household characteristics.

Mean dinner vegetable intake was calculated over the three days each strategy was implemented in its assigned week. Vegetable intakes for the strategies were then compared using a mixed-model ANOVA with a random effect for child. Fixed independent variables included strategies, the week of strategy implementation (as a continuous measure) and the time of year when the strategy was implemented. The week \times time of year interaction was also included in the model. Multiple pairwise comparisons of the strategies were evaluated using the Tukey Honestly Significant Difference test. Least-square means for dinner vegetable intake per each of the nine strategies and 95% confidence intervals were reported.

Potential covariates were tested separately in the mixed model to determine effects on differences in mean child dinner vegetable intake between each strategy. Covariates included caregiver's age, race/ethnicity, caregiver education and employment status, number of individuals residing in the household, household food security, home vegetable availability and average vegetable liking rating score across thirty-six vegetable types. Differences were not observed and thus the final mixed-model ANOVA was not adjusted for any covariates. Level of significance was set at $\alpha = 0.05$.

Mean difficulty rating for each strategy, mean total number of different vegetables available in homes, mean vegetable liking across all vegetables and mean number of vegetable types liked by children were calculated.

Results

Based on previously published sample size calculations⁽¹⁶⁾, forty-seven caregiver/child dyads were recruited and completed the baseline home visit. Eight families withdrew from the study and thus thirty-nine caregiver/child dyads were included in the final analyses. Sociodemographic and household characteristics for the thirty-nine caregiver/child dyads are described in Table 2. Most caregivers were female (97.4%) and Black/African American (47.4%) or White (36.8%). The majority had some college education (63.2%) and had low or very low food security status (65.7%). About half of the children were boys (51.3%). Mean child age was 10.4 years.

Table 2 Sociodemographic and household characteristics of low-income caregiver/child dyads ($n = 39$) from a large Midwestern metropolitan area, USA, 2013–2014

	Caregiver		Child	
	Mean or n	SD or %	Mean or n	SD or %
Sociodemographic characteristics				
Age (years; mean and sd)	37.1	7.1	10.4	1.0
Male (n and %)	1	2.6	20	51.3
Race (n and %)				
Black or African American	18	47.4	18	47.4
White or Caucasian	14	36.8	9	23.7
Alaska Native or American Indian	2	5.3	2	5.3
Mixed race	2	5.3	7	18.4
Other	2	5.3	2	5.3
Hispanic or Latino	3	7.9	3	7.9
Education (n and %)				
Have not completed high school	3	7.9		
Received high-school diploma or GED	5	13.2		
Some college or technical school	24	63.2		
4-year college, university degree or advanced degree	6	15.8		
Employment status (n and %)				
Homemaker	16	42.1		
Employed part time	11	28.9		
Employed full time	11	28.9		
Household characteristics				
Food security status (n and %)				
High or marginal	13	34.2		
Low	14	36.8		
Very low	11	28.9		
Number of adults in the home (mean and sd)	1.6	0.9		
Number of children in the home (mean and sd)				
Age <9 years	1.2	0.54		
Age 9–12 years	1.1	1.00		
Age 13–18 years	0.5	0.64		

GED, General Educational Development.

Feasibility of strategies

Mean child dinner vegetable intake ranged from 0.77 to 1.20 cups by week of implementation of the nine different strategies (Table 3). Significant effects were observed for strategy ($P = 0.02$), but not for week of strategy implementation ($P = 0.99$), time of year when the strategy was implemented ($P = 0.54$) or week \times time of year interaction ($P = 0.47$). Children consumed significantly more vegetables when the 'Serve at least two vegetables with dinner meals' strategy was implemented compared with when 'Pair vegetables with other foods child likes' (0.43 more cups; $P = 0.01$) and 'Eat dinner together with an adult(s) modelling vegetable consumption' (0.39 more cups; $P = 0.04$) were implemented. Mean dinner vegetable intake for the remaining six strategies was not different when compared with 'Serve at least two vegetables with dinner meals', 'Pair vegetables with other foods child likes' and 'Eat dinner together with an adult(s) modelling vegetable consumption' strategies (Table 3).

Table 3 Impact of behavioural economics strategies on child mean dinner vegetable intake among low-income caregiver/child dyads (*n* 39) from a large Midwestern metropolitan area, USA, 2013–2014

Behavioural economics strategy	No. of caregivers who implemented the strategy*	Dinner vegetable intake (cups)		
		Least-squares mean†	SE†	95% CI
Serve at least two vegetables with dinner meals	27	1.20 ^a	0.11	1.00, 1.42
Serve vegetables before the rest of the meal	21	1.09 ^{a,b}	0.12	0.85, 1.32
Let child help prepare vegetable dishes	23	0.99 ^{a,b}	0.11	0.77, 1.22
Offer the child two vegetable options for dinner, one liked and one less liked. Then let the child choose what is served	21	0.97 ^{a,b}	0.12	0.74, 1.19
Use a dinner plate that shows the right amount of vegetables to eat for a meal	25	0.96 ^{a,b}	0.11	0.74, 1.17
If caregiver puts vegetables on child's plate, give child more than usual. If children typically serve themselves, put a larger spoon than normally used with the vegetable so they get more than usual	27	0.95 ^{a,b}	0.11	0.74, 1.16
Make vegetables more easily available and visible than other foods at the dinner meal	23	0.88 ^{a,b}	0.12	0.64, 1.12
Eat dinner together with an adult(s) modelling vegetable consumption	25	0.81 ^b	0.11	0.60, 1.03
Pair vegetables with other foods child likes	25	0.77 ^b	0.11	0.55, 0.99

^{a,b}Mean values within a column with unlike superscript letters were significantly different according to Tukey Honestly Significant Difference pairwise comparisons ($P < 0.05$).

*Within a week, a caregiver may have provided Dinner Vegetable Food Record data from one to three dinners.

†Least-squares means and SE from mixed-model ANOVA.

Caregivers rated the difficulty of implementing the strategies with an overall mean of 2.6, with mean scores for individual strategies ranging from 2.1 to 2.9 on a 10-point scale. Households had on average 10 (SD 3.9) different types of vegetables present in the home. On average, children had tried 24 (SD 4.9) different vegetable types. The mean vegetable liking rating for children was 6.7 (SD 1.1). They rated 17 (SD 5.0) types of vegetable ≥ 5 on the 10-point scale.

Discussion

Findings suggest that the nine tested strategies had a similar effect on mean child dinner vegetable intake. The 'Serve at least two vegetables with dinner meals' strategy may be particularly effective at encouraging child vegetable intake in the home environment, a finding underscored by previous studies reporting that serving more than one vegetable significantly increased both the selection⁽¹⁹⁾ and consumption of vegetables⁽²⁰⁾ in settings outside the home. Serving more than one type of food (e.g. vegetables) is a visual cue that nudges people into eating more⁽²¹⁾.

In the current study, one strategy was implemented per week; however, in previous school-based interventions, multiple behavioural economics strategies have been implemented simultaneously in cafeterias in what is known as 'smarter lunchroom makeovers'^(12,22). Making these small environmental changes simultaneously has resulted in positive eating behaviour changes for children in school settings. Results from the current study indicate that single strategies implemented in the home had similar effects on dinner vegetable intake among children. Therefore, the use of multiple strategies by caregivers simultaneously may also be an effective means to improve dietary intake at home.

Simultaneous implementation of multiple strategies in school cafeterias may be feasible because of the availability of dedicated staff and resources; however, further research is needed to determine whether caregivers can easily manage implementing multiple strategies at home.

A variety of vegetable types were available in homes and children generally liked vegetables, both of which support the low ratings of difficulty by caregivers. As other studies have reported, availability and child food preferences often influence food preparation and mealtime practices^(23,24). To avoid food waste, low-income caregivers may limit the type of vegetables they purchase to those their children like. Brown and Wenrich reported that food waste is a barrier for low-income caregivers regarding preparation of unfamiliar vegetables⁽²³⁾. Interviews and grocery shopping observations by Daniel also showed that avoidance of food waste by low-income parents limits choice of foods to those their children prefer⁽²⁵⁾.

The present study has several limitations. First, baseline and follow-up child dinner vegetable intake record data were not collected. These data would have helped determine the cumulative effect of implementing the behavioural economics strategies. Also, there may have been measurement error when caregivers reported child dinner vegetable intake on the nights when strategies were implemented. Another limitation is that there was no within-group control. Future studies should consider collecting child dinner vegetable intake on nights when strategies are not implemented. Lastly, the Strategy Guidebook allowed for caregivers to implement the strategies in various ways, which could have influenced the resulting vegetable intake. Despite these limitations, the current study addresses a major gap in the literature regarding the feasibility of implementing behavioural

economics strategies in the home setting. Given the success of nudges in the school environment, incorporating similar strategies in the home could potentially further improve child vegetable intake. Future studies should consider allowing parents to self-select strategies they would like to implement in order to account for vegetable availability, as well as child vegetable preferences.

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