

Predicting habits of vegetable parenting practices to facilitate the design of change programmes

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Abstract

Objective: Habit has been defined as the automatic performance of a usual behaviour. The present paper reports the relationships of variables from a Model of Goal Directed Behavior to four scales in regard to parents' habits when feeding their children: habit of (i) actively involving child in selection of vegetables; (ii) maintaining a positive vegetable environment; (iii) positive communications about vegetables; and (iv) controlling vegetable practices. We tested the hypothesis that the primary predictor of each habit variable would be the measure of the corresponding parenting practice.

Design: Internet survey data from a mostly female sample. Primary analyses employed regression modelling with backward deletion, controlling for demographics and parenting practices behaviour.

Setting: Houston, Texas, USA.

Subjects: Parents of 307 pre-school (3–5-year-old) children.

Results: Three of the four models accounted for about 50% of the variance in the parenting practices habit scales. Each habit scale was primarily predicted by the corresponding parenting practices scale (suggesting validity). The habit of active child involvement in vegetable selection was also most strongly predicted by two barriers and rudimentary self-efficacy; the habit of maintaining a positive vegetable environment by one barrier; the habit of maintaining positive communications about vegetables by an emotional scale; and the habit of controlling vegetable practices by a perceived behavioural control scale.

Conclusions: The predictiveness of the psychosocial variables beyond parenting practices behaviour was modest. Discontinuing the habit of ineffective controlling parenting practices may require increasing the parent's perceived control of parenting practices, perhaps through simulated parent–child interactions.

Keywords
 Parenting practices
 Habit
 Vegetables
 Model of Goal Directed Behavior
 Emotion

Vegetable intake is strongly related to the prevention of several chronic diseases⁽¹⁾. Vegetable preferences are a primary determinant of intake among children⁽²⁾ and are learned early in life^(3,4). Parents are important influences on young children's dietary intake⁽⁵⁾, but many parents report difficulty in getting their young child to eat vegetables⁽⁶⁾.

Parenting practices are the behaviours parents employ to influence their children⁽⁵⁾. The parenting practices in regard to trying to get a child to eat vegetables have been identified as effective (e.g. leading to the child's long-term enjoyment and intake) or ineffective (not leading to long-term enjoyment or intake)⁽⁷⁾. The effective and ineffective vegetable parenting practices have been shown to not be interrelated⁽⁸⁾, with three theory-predicted sub-factors in each: responsiveness, control and structure⁽⁸⁾.

To understand why parents of young children (3–5-year-olds) employ the vegetable parenting practices they do, an expanded Model of Goal Directed Behavior was developed^(9,10). The Model of Goal Directed Behavior enhances the Theory of Planned Behavior by adding a desires construct (similar to intrinsic motivation) between the psychosocial variables and intention, and adding an anticipated emotion variable to the list of psychosocial variables⁽⁹⁾. To provide a more comprehensive set of correlates, habit variables were added to the model, as were predictors of intrinsic motivation: competence (self-efficacy), autonomy and relatedness⁽¹⁰⁾. Items for each scale and subscale were generated from qualitative interviews with target group parents⁽¹¹⁾. Since many of these constructs are not necessarily unidimensional, exploratory and confirmatory factor analyses were conducted on the items in each of the

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general scales⁽¹⁰⁾. Subscales were identified for many of the constructs in the expanded Model of Goal Directed Behavior⁽¹⁰⁾. Exploratory analyses using the Model of Goal Directed Behavior variables were conducted to predict the parenting practices scales^(12,13) and subscales (reference 14; CS Diep, A Beltran, TA Chen *et al.*, unpublished results).

The primary predictors of both the composite parenting practices scales^(12,13) and the sub-factors (reference 14; CS Diep, A Beltran, TA Chen *et al.*, unpublished results) were corresponding habits. Habit has been defined to be a cognitive-motivational 'process by which a stimulus automatically generates an impulse towards action, based on learned stimulus response associations'⁽¹⁵⁾. Thus, parenting habits appear to be automatic non-reflective performance of these parenting practices⁽¹⁶⁾. In research on dietary intake, participants ate out of habit, irrespective of other motivations to eat, suggesting that the more common cognitive approach to behaviour change involving changing attitudes and goals would not be effective in changing habits⁽¹⁷⁾. Thus, to the extent parenting practices are habitual, interventions may need to modify parenting practice habits. Some investigators have called for a more intensive analysis of influences on habit to design more effective behaviour change interventions⁽¹⁸⁾.

Four vegetable parenting practices habit subscales were identified: the habit of (i) actively involving a child in the selection of vegetables; (ii) maintaining a positive vegetable environment; (iii) positive communications about vegetables; and (iv) controlling vegetable practices (the only ineffective parenting practices subscale)⁽¹⁰⁾. While programmes have been implemented to make selected food parenting practices (i.e. serving fruit and vegetables, serving healthy snacks, serving non-sweetened drinks) habitual⁽¹⁹⁾, little attention has been accorded discontinuing established habits, especially ineffective parenting practice habits. Theoretically, habits could be changed by changing the situations that trigger habitual behaviour, inhibiting the habitual response and/or changing relevant contingencies⁽¹⁶⁾. Understanding the strong and causal influences on habit⁽²⁰⁾ may also shed light on approaches to habit change.

The current research was conducted both to add to the literature on correlates of habits^(21,22) and to understand the influences on habit in regard to vegetable parenting practices with an eye towards designing a parenting habit change programme. As a partial validation of our measurement procedures, we hypothesized that the primary correlate of each habit variable would be the measure of the corresponding parenting practice. In addition, an exploratory analysis was conducted of a data set reporting a Model of Goal Directed Behavior correlating with vegetable parenting practices^(8,10). This is the first study to identify correlates of parenting practice habits.

Methods

Methods have been presented in detail elsewhere^(8,10).

Sample recruitment

An Internet survey was announced in a Children's Nutrition Research Center newsletter distributed to 25 000 recipients; fliers were posted on participant volunteer billboards around the Texas Medical Center, public libraries and YMCAs. We also sent personal emails to the Children's Nutrition Research Center list of volunteers, and listed the study on the Baylor College of Medicine volunteer website. Inclusionary criteria were being a parent of a pre-school child (3–5 years old), able to read and write English, and having the child spend most of the time with that caregiver. About 409 registrants entered the data collection website and provided informed consent. Three hundred and seven met inclusionary and exclusionary criteria and provided complete data. Access to the Internet survey implied access to both a computer and an Internet connection. Given the low-risk nature of the study, selecting the 'participate' button in the survey was taken as evidence of consent. The Institutional Review Board of the Baylor College of Medicine reviewed and approved the research protocol.

Measures

Items ($n = 220$) were generated to assess Model of Goal Directed Behavior constructs using qualitative interviews⁽¹¹⁾. Factor analysis was used to identify subscales^(8,10), which were bivariate correlated with parenting practices scales to assess validity.

Twenty habit items were generated starting with the stem 'Without thinking about it...', using a three-category frequency response (1 = 'always'; 2 = 'sometimes'; 3 = 'never'). Four parenting habit subscales resulted: habit of (i) active child involvement in vegetable selection ($\alpha = 0.83$); (ii) positive vegetable environment ($\alpha = 0.67$); (iii) positive communications about vegetables ($\alpha = 0.60$); and (iv) controlling vegetable practices ($\alpha = 0.68$; e.g. 'Without thinking about it I yell at my child for not eating their vegetables').

Eighteen attitude items were generated, each starting with the stem 'If my child started eating more vegetables on most days...' A three-category response was employed (1 = 'disagree'; 2 = 'neither agree nor disagree'; 3 = 'agree'). Three attitude subscales resulted: (i) health benefits of vegetables ($\alpha = 0.72$); (ii) negative effects of vegetables ($\alpha = 0.66$; e.g. '...being exposed to germs on vegetables'); and (iii) benefits of vegetables other than health ($\alpha = 0.66$; e.g. '...being exposed to a variety of foods').

Items were created for two different types of norms. Descriptive norms identified the respondents' perceptions of the extent to which most parents try and get their child to eat more vegetables ($\alpha = 0.13$). Parents were asked to select from a three-category response option, which included 1 = 'disagree', 2 = 'neither agree nor disagree' and 3 = 'agree', for each statement. Closer to the original formulation for the Theory of Planned Behavior, normative expectations identified what the respondent believed other

people expected them to do and the extent to which the respondent wanted to please those people. Given the complexities of modern family structures and living arrangements, different respondents are likely responsive to the expectations of people in different social roles. To reduce this complexity we asked the respondent to identify 'the three most important people who influence your decisions about your child in a good or a bad way' from a menu. For each of these three role players, the respondent was asked to respond to two questions: 'It is important to my [role person] that my child eats more vegetables' and 'It is important to me to please my [role person] when it comes to getting my child to eat more vegetables'. The two most important were included in the scale ($\alpha=0.71$). Parents were asked to select from a three-category response (1 = 'disagree'; 2 = 'neither agree nor disagree'; 3 = 'agree') for each statement.

Thirty perceived behavioural control items were generated starting with the stem 'How easy would it be to get my child to eat more vegetables if I...', using a three-category difficulty response (1 = 'difficult'; 2 = 'neither easy nor difficult'; 3 = 'easy'). Three perceived behavioural control scales resulted: (i) perceived behavioural control of positive influences on vegetable consumption ($\alpha=0.85$); (ii) perceived behavioural control of negative influences on vegetable consumption ($\alpha=0.82$; e.g. 'How easy would it be to get my child to eat more vegetables if I give them something sweet to eat or drink if they are upset'); and (iii) perceived behavioural control of negative parenting practices ($\alpha=0.54$; e.g. 'How easy would it be to get my child to eat vegetables if I insist they sit at the table to eat their vegetables').

Twenty-one competence/self-efficacy items were generated with a three-category response (1 = 'not sure'; 2 = 'somewhat sure'; 3 = 'sure'). Two vegetable parenting self-efficacy scales resulted: (i) advanced vegetable parenting self-efficacy ($\alpha=0.85$; e.g. 'I can get my child to eat vegetables at most dinners'); and (ii) rudimentary vegetable parenting self-efficacy ($\alpha=0.76$; e.g. 'I can always have vegetables available at home so my child can eat them').

'Perceived behavioural control' (from the Theory of Planned Behavior) and 'self-efficacy' (from Social Cognitive Theory) are highly interrelated constructs. Reflecting our best understanding of how the original formulators framed each construct, we operationalized perceived behavioural control items as the respondent's perceived ease in performing specific parenting practices (i.e. 'How easy would it be to get my child to eat more vegetables if I...') *v.* self-efficacy items as the respondent's perceived ability or confidence (i.e. 'I can...') to perform specific parenting practices. Acceptable model fit statistics were obtained with each construct.

Anticipated emotion items systematically varied types of vegetables served (i.e. usual, new, liked, disliked) with eating behaviour (ate it, refused it) because we

believed consistent and inconsistent service and behaviour would lead to diverse meaningful emotional responses. Thirty-two anticipated emotion items were generated starting with four different stems: (i) 'If I served my child a new vegetable and they ate it, I would feel...'; (ii) 'If I served my child a new vegetable and they refused to eat it, I would feel...'; (iii) 'If I served my child a vegetable that they liked, and they refused to eat it, I would feel...'; and (iv) 'If I served my child a vegetable that I knew they disliked, and they ate it, I would feel...'. Three agreement response categories were offered (1 = 'disagree'; 2 = 'neither agree nor disagree'; 3 = 'agree'). Four anticipated emotion scales resulted: (i) positive parent emotional response to child vegetable refusal ($\alpha=0.92$); (ii) negative parent emotional response to child vegetable acceptance ($\alpha=0.83$); (iii) negative parent emotional response to child vegetable refusal ($\alpha=0.79$); and (iv) positive parent emotional response to child vegetable acceptance ($\alpha=0.66$).

Twelve relatedness items were generated starting with the stem 'If my child ate at least three portions of vegetables most days I would feel...', using a three-category agreement response (1 = 'disagree'; 2 = 'neither agree nor disagree'; 3 = 'agree'). Two relatedness scales resulted: (i) relatedness through parent values ($\alpha=0.81$; e.g. 'If my child ate at least three portions of vegetable most days I would feel I am respected by others'); and (ii) relatedness through child wellness ($\alpha=0.61$; e.g. 'If my child ate at least three portions of vegetables most days I would feel I am a responsible parent').

Using the same three-category agreement response (1 = 'disagree'; 2 = 'neither agree nor disagree'; 3 = 'agree'), three autonomy items, twenty-six barrier items and four desire (similar to the intrinsic motivation construct) items were generated. One autonomy scale resulted ($\alpha=0.31$; e.g. 'It is my desire to encourage my child to eat at least three portions of vegetables most days'). Three perceived barrier scales resulted: (i) child doesn't like vegetables ($\alpha=0.88$; e.g. 'Getting my child to eat vegetables at meals is difficult'); (ii) respondent doesn't like vegetables ($\alpha=0.85$; e.g. 'I don't like vegetables myself'); and (iii) cost of vegetables ($\alpha=0.67$; e.g. 'Fresh vegetables spoil too fast'). One desire scale resulted ($\alpha=0.78$; e.g. 'Encouraging my child to eat vegetables is hard').

Twenty-one intention items were generated starting with the stem 'In the next month I plan to...', using a three-category intention response (1 = 'will not do'; 2 = 'may or may not do'; 3 = 'will do'). Four parenting intentions scales resulted: (i) authoritative parenting intentions ($\alpha=0.83$; e.g. 'In the next month I plan to encourage my child to try a couple of bites of a vegetable'); (ii) active child involvement intentions ($\alpha=0.84$; e.g. 'In the next month I plan to ask my child to help with vegetable preparation'); (iii) controlling parenting intentions ($\alpha=0.71$; e.g. 'In the next month I plan to keep my child from going to play if they don't eat their

vegetables'); and (iv) permissive parenting intentions ($\alpha=0.61$; e.g. 'In the next month I plan to let my child eat when they want to eat').

In a separate manuscript⁽⁸⁾ with data from this Internet survey we reported confirmatory factor analyses on the effective vegetable parenting practices (EVPP) and ineffective vegetable parenting practices (IVPP; separate items developed in the same way) with the same sample, indicating that the most interpretable structure had separate (completely independent) two-level factor structures⁽⁸⁾. Responsive ($\alpha=0.055$), non-directive controlling ($\alpha=0.63$) and structural ($\alpha=0.46$) effective parenting practices factors were identified as specified by theory⁽⁵⁾, with the same type of scales among the ineffective parenting practices: responsive ($\alpha=0.55$), controlling ($\alpha=0.63$) and structural ($\alpha=0.50$). For the analyses reported herein, in addition to the individual factor scales, the values for the fourteen effective items were also summed (EVPP sum (possible range: 14–42), Cronbach's $\alpha=0.69$) and the fourteen ineffective items were summed (IVPP sum (possible range: 14–42), Cronbach's $\alpha=0.60$) to obtain unweighted composite scales.

Participants reported gender of participating parent, gender of selected child, ethnicity of parent, highest household educational attainment and annual household income using standard questions.

Analyses

Given the exploratory nature of the analyses, and large number of tests, multiple regression was conducted using the demographics and Model of Goal Directed Behavior scales and subscales as predictors with backward deletion ($P<0.01$). The demographic variables were retained whether significantly related or not to control for their influences. Demographics and all Model of Goal Directed Behavior scales and subscales were initially entered into the model. Predictors were deleted from the model one at a time, based on which scale/subscale would result in the smallest amount of change in variance of each habit subscale when deleted. The procedure was repeated until the remaining predictive scales/subscales were statistically

significant ($P<0.01$). For each habit variable, the first model included the demographics and all Model of Goal Directed Behavior variables other than the parenting practices. In the second analysis, for each habit variable the parenting practices were also included to ensure we were predicting something other than simply parenting practices. Interaction terms were not included in the models because including all the possible interaction terms would dramatically increase the number of predictors, which was inappropriate with our sample size⁽²³⁾. All the analyses were conducted using the statistical software package SAS version 9.4.

Results

The sample was composed of mostly female (90%), White and more well-educated participants. Previous manuscripts have reported sample characteristics in detail and the lack of differences between completers and non-completers^(8,10,14,24).

Table 1 reports the bivariate correlations of parenting practices subscales and composite scales with the parenting practices habit subscales. Only one of the habit subscales incorporated mostly ineffective parenting practices, i.e. controlling vegetable practices. The habit subscales were substantially related to the parenting practices subscales in the expected directions. The obtained correlations were stronger with the effective, than the ineffective, parenting practices scores. As hypothesized, the habit of active child involvement was most strongly related to effective control parenting practices ($r=0.636$, $P<0.01$); the habit of maintaining a positive vegetable environment was most strongly related to effective structure parenting practices ($r=0.481$, $P<0.01$); the habit of positive communications about vegetables was most strongly related to effective responsiveness parenting practices ($r=0.658$, $P<0.01$); and the habit of controlling vegetable practices was most strongly related to ineffective controlling parenting practices ($r=0.636$, $P<0.01$).

Table 1 Bivariate relationships among parenting practices and parenting habits among a mostly female sample of parents of pre-school (3–5-year-old) children (n 307), Houston, TX, USA

Parenting practice factor	Parenting practice habit			
	Active child involvement in vegetable selection	Controlling vegetable practices	Positive vegetable environment	Positive vegetable communications
Effective responsiveness	0.251**	0.267**	0.268**	0.658**
Effective structure	0.362**	–	0.481**	0.235**
Effective control	0.636**	–	0.264**	–
Effective parenting composite	0.604**	–	0.438**	0.436**
Ineffective responsiveness	–	0.201**	–	–
Ineffective structure	–	–	–0.201**	–
Ineffective control	–	0.636**	–	0.214**
Ineffective parenting composite	–	0.505**	–	–

** $P<0.01$.

Table 2 Regression models predicting vegetable parenting practices habit scales among a mostly female sample of parents of pre-school (3–5-year-old) children (n 307), Houston, TX, USA

	DV: Habit of active child involvement in vegetable selection		DV: Habit of positive vegetable environment		DV: Habit of positive vegetable communication		DV: Habit of controlling vegetable practices	
	Standardized estimate	SE	Standardized estimate	SE	Standardized estimate	SE	Standardized estimate	SE
Child age	0.063	0.161	-0.065	0.057	-0.040	0.092	-0.095	0.108
Child gender	-0.002	0.257	0.034	0.093	0.049	0.148	0.021	0.176
Parent gender	-0.019	0.411	0.010	0.149	-0.039	0.237	0.016	0.282
Some college or less	-0.017	0.360	0.060	0.128	0.019	0.203	0.139	0.241
College graduate	0.040	0.334	-0.043	0.121	0.076	0.190	0.056	0.226
< \$US 20 000	-0.071	0.478	-0.105	0.174	0.010	0.273	-0.119**	0.323
\$US 20 000–39 999	-0.143**	0.387	-0.080	0.140	-0.092	0.222	-0.068	0.263
\$US 40 000–59 999	-0.038	0.345	-0.105	0.125	0.038	0.199	-0.044	0.235
Black/African American	0.078	0.397	-0.014	0.140	-0.089	0.222	0.028	0.265
Hispanic/Latino	-0.088	0.466	-0.002	0.168	-0.074	0.268	-0.006	0.318
Other	-0.028	0.321	-0.037	0.116	-0.058	0.182	-0.086	0.220
Effective responsiveness	-	-	-	-	0.604***	0.048	-	-
Effective structure	-	-	0.274***	0.044	-	-	-	-
Effective control	0.537***	0.071	-	-	-	-	-	-
Ineffective control	-	-	-	-	-	-	0.469***	0.047
Child doesn't like vegetables	0.200***	0.031	-	-	-	-	-	-
Respondent doesn't like vegetables	-0.153**	0.046	0.201***	0.016	-	-	-	-
Negative parent emotional response to child vegetable refusal	-	-	-	-	-0.144***	0.019	-	-
Rudimentary self-efficacy	-0.144**	0.058	-	-	-	-	-	-
Negative parenting practices	-	-	-	-	-	-	-0.245***	0.056
Adjusted R^2	0.496		0.320		0.478		0.517	

DV, dependent variable.

The reference category for child gender is girl, for parent gender is female, for highest educational attainment is postgraduate, for household income level is at least \$US 60 000, and for race/ethnicity is White.

** $P < 0.01$, *** $P < 0.001$.

In the regression modelling (Table 2), effective control parenting practices (standardized $\beta = 0.537$, $P < 0.001$) were positively related to the habit of active child involvement in vegetable selection. The barrier of child doesn't like vegetables (standardized $\beta = 0.200$, $P < 0.001$) was positively related, and the barrier of respondent doesn't like vegetables (standardized $\beta = -0.153$, $P < 0.01$) and rudimentary self-efficacy (standardized $\beta = -0.144$, $P < 0.01$) were significantly inversely related. This model accounted for 49.6% of the variance in the habit of active child involvement in vegetable selection (Table 2).

Effective structure parenting practices (standardized $\beta = 0.274$, $P < 0.001$) contributed to the habit of maintaining a positive vegetable environment, and this habit was more common among parents who didn't like vegetables (standardized $\beta = 0.201$, $P < 0.001$). This model accounted for 32.0% of the variance in the habit of maintaining a positive vegetable environment (Table 2).

Effective responsiveness parenting practices were strongly related (standardized $\beta = 0.604$, $P < 0.001$) to the habit of maintaining positive communications about vegetables. Among the psychosocial variables, the habit of maintaining positive communications about vegetables was lower among those with higher negative parental emotional response to child vegetable refusal (standardized $\beta = -0.144$, $P < 0.001$). This model accounted for 47.8% of

the variance in the habit of maintaining positive vegetable communications (Table 2).

Ineffective control parenting practices (standardized $\beta = 0.469$, $P < 0.001$) were significantly related to the habit of controlling vegetable practices (the only ineffective parent practices habit subscale). Negative relationships were obtained with perceived behavioural control of negative parenting practices (standardized $\beta = -0.245$, $P < 0.001$). This model accounted for 51.7% of the variance in the habit of controlling vegetable practices.

Discussion

Models controlling for parenting practices were tested since the variance remaining after controlling for parenting practices is logically that due to the habit, i.e. the automatic performance of the behaviours. It was reassuring that the parenting practices that most strongly predicted the habits were the ones that would be expected by theory, both in the bivariate correlations and in the regression models. Thus, effective control was most strongly related with the habit of active child involvement in vegetable selection; effective structure with the habit of maintaining a positive vegetable environment; effective responsiveness with the habit of maintaining positive communications

about vegetables; and ineffective control with the habit of using controlling vegetable practices.

After parenting practices, the habit of active child involvement in vegetable selection was most strongly predicted by two barrier scales and one self-efficacy scale, essentially Social Cognitive Theory variables. A reasonable interpretation of these findings would be that a parent was more likely to have a habit of actively involving the child in vegetable selection if the child didn't like vegetables, but less likely to have this habit if she didn't like vegetables herself or had rudimentary (but not advanced) self-efficacy for effective parenting. To increase the habit of active child involvement in vegetable selection, an intervention may have to both (i) increase the parent's preference for vegetables (e.g. by multiple exposures) and (ii) increase the rudimentary self-efficacy. Repeated simulated interactions with a child character who initially refuses vegetables, for which the parent is provided effective and ineffective parenting practices, may enhance a parent's self-efficacy for dealing with a vegetable-refusing child^(24,25).

After parenting practices, the habit of maintaining a positive vegetable environment was most strongly correlated with a barrier: respondent doesn't like vegetables. The relationship was positive, suggesting that parents who didn't like vegetables were more likely to keep child-preferred vegetables at home. This likely reflects parental self-control and should be capitalized upon in an intervention.

After parenting practices, the primary predictor of the habit of maintaining positive communications about vegetables was an emotion variable (a Model of Goal Directed Behavior variable): higher parent negative emotional response to child vegetable refusal, which was inversely related. This suggests that an intervention to increase the habit of maintaining positive communications about vegetables may have to decrease a parent's negative emotional response to child vegetable refusal. Changing emotional responses has been addressed in psychotherapy and may require cognitive behavioural⁽²⁶⁾ or desensitization⁽²⁷⁾ therapies. The desensitization could occur through multiple exposures to a simulated child's refusal.

After parenting practices, the primary predictor of the habit of using controlling vegetable practices (the only ineffective parenting practices habit scale) was perceived behavioural control of negative parenting practices on vegetable consumption. A reasonable interpretation of these findings would be that a parent who had a habit of using controlling vegetable parenting practices (a generally undesired trait) would have lower perceived control of the use of negative parenting practices. Since we would want to reduce this habit, an intervention would appear to need to increase a parent's perception of control of the use of negative parenting practices (e.g. by simulating interactions with a child, thereby enabling the parent to successfully

select more positive and fewer negative parenting practices^(24,25)).

Only two other published papers have analysed habit^(21,22). With a somewhat larger sample (n 406) of undergraduate students, but fewer variables and extensive interaction terms, significant effects were detected with exercise behaviour: perceived behavioural control, affective attitude, planning, and a perceived behavioural control by planning interaction term⁽²¹⁾. In a smaller study (n 127) in a community-dwelling population, intrinsic reward was related to fruit and vegetable intake habit strength, but self-efficacy and intention were not⁽²²⁾. The current analyses did not detect a relationship for intrinsic motivation nor intention, but did for rudimentary self-efficacy. Both studies found the behaviour, perceived behavioural control and attitude were correlated with habit, and intention was not. Given the diverse habits investigated across studies (multiple vegetable parenting practices habits *v.* an exercise habit *v.* fruit and vegetable intake habit), predictive conceptual models (Model of Goal Directed Behavior *v.* Theory of Planned Behavior *v.* Self Determination Theory) and samples (community-dwelling *v.* undergraduate), the findings are fraught with non-comparabilities, precluding arriving at firm conclusions.

The strengths of the present work included the use of validated scales and a modestly large sample size. The fact that about 50 % of the variance was accounted for in three of the four habits suggests the models captured important aspects of each habit, but much of this variance was captured by the parenting practices. The smaller percentages of variance captured by the psychosocial variables, and the inability to infer causality from a cross-sectional design, leave open whether these variables could be useful for designing an intervention. Other weaknesses include the self-reported nature of all variables, the low internal consistency reliability for some of the scales, and the exploratory nature of the analyses.

The present paper is the first to analyse correlates of habit of parenting practices. Changing habits has not been frequently targeted in the behaviour change literature and will require novel intervention procedures, such as simulated interactions with a child. Several variables have been identified that may be helpful to target the change procedures. Procedures common in video games, e.g. simulated interactions and social feedback, appear to provide important mechanisms to test for promoting habit change.

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References

- Boeing H, Bechthold A, Bub A *et al.* (2012) Critical review: vegetables and fruit in the prevention of chronic diseases. *Eur J Nutr* **51**, 637–663.
- Di Noia J & Byrd-Bredbenner C (2014) Determinants of fruit and vegetable intake in low-income children and adolescents. *Nutr Rev* **72**, 575–590.
- Russell CG, Worsley A & Liem DG (2015) Parents' food choice motives and their associations with children's food preferences. *Public Health Nutr* **18**, 1018–1027.
- Mennella JA (2014) Ontogeny of taste preferences: basic biology and implications for health. *Am J Clin Nutr* **99**, issue 3, 704S–711S.
- Hughes SO, O'Connor TM & Power TG (2008) Parenting and children's eating patterns: examining control in a broader context. *Int J Child Adolesc Health* **1**, 323–330.
- Cullen KW, Baranowski T, Rittenberry L *et al.* (2000) Social-environmental influences on children's diets: results from focus groups with African-, Euro- and Mexican-American children and their parents. *Health Educ Res* **15**, 581–590.
- O'Connor TM, Watson K, Hughes S *et al.* (2010) Health professionals' and dietetics practitioners' perceived effectiveness of fruit and vegetable parenting practices across six countries. *J Am Diet Assoc* **110**, 1065–1071.
- Baranowski T, Chen TA, O'Connor T *et al.* (2013) Dimensions of vegetable parenting practices among preschoolers. *Appetite* **69**, 89–93.
- Perugini M & Bagozzi RP (2001) The role of desires and anticipated emotions in goal-directed behaviours: broadening and deepening the theory of planned behaviour. *Br J Soc Psychol* **40**, 79–98.
- Baranowski T, Beltran A, Chen TA *et al.* (2013) Psychometric assessment of scales for a Model of Goal Directed Vegetable Parenting Practices (MGDVPP). *Int J Behav Nutr Phys Act* **10**, 110.
- Hingle M, Beltran A, O'Connor T *et al.* (2012) A model of goal directed vegetable parenting practices. *Appetite* **58**, 444–449.
- Baranowski T, Beltran A, Chen TA *et al.* (2015) Predicting use of ineffective vegetable parenting practices with the Model of Goal Directed Behavior. *Public Health Nutr* **18**, 1028–1035.
- Diep CS, Beltran A, Chen TA *et al.* (2015) Predicting use of effective vegetable parenting practices with the Model of Goal Directed Behavior. *Public Health Nutr* **18**, 1389–1396.
- Baranowski T, Beltran A, Chen TA *et al.* (2013) Predicting use of ineffective response, structure and control vegetable parenting practices with the Model of Goal Directed Behavior. *J Food Res* **2**, 80–88.
- Gardner B (2014) A review and analysis of the use of 'habit' in understanding, predicting and influencing health-related behaviour. *Health Psychol Rev* (Epublication ahead of print version).
- van't Riet J, Sijtsema SJ, Dagevos H *et al.* (2011) The importance of habits in eating behaviour. An overview and recommendations for future research. *Appetite* **57**, 585–596.
- Neal DT, Wood W, Wu M *et al.* (2011) The pull of the past: when do habits persist despite conflict with motives? *Pers Soc Psychol Bull* **37**, 1428–1437.
- Nilsen P, Bourne M & Verplanken B (2008) Accounting for the role of habit in behavioural strategies for injury prevention. *Int J Inj Contr Saf Promot* **15**, 33–40.
- McGowan L, Cooke IJ, Gardner B *et al.* (2013) Healthy feeding habits: efficacy results from a cluster-randomized, controlled exploratory trial of a novel, habit-based intervention with parents. *Am J Clin Nutr* **98**, 769–777.
- Baranowski T (2011) Understanding the behavioral linkages needed for designing effective interventions to increase fruit and vegetable intake in diverse populations. *J Am Diet Assoc* **111**, 1472–1475.
- de Bruijn GJ, Gardner B, van Osch L *et al.* (2014) Predicting automaticity in exercise behaviour: the role of perceived behavioural control, affect, intention, action planning, and behaviour. *Int J Behav Med* **21**, 767–774.
- Wiedemann AU, Gardner B, Knoll N *et al.* (2014) Intrinsic rewards, fruit and vegetable consumption, and habit strength: a three-wave study testing the associative-cybernetic model. *Appl Psychol Health Well Being* **6**, 119–134.
- VanVoorhis CRW & Morgan BL (2007) Understanding power and rules of thumb for determining sample sizes. *Tutor Quant Methods Psychol* **3**, 43–50.
- Baranowski T, O'Connor T, Hughes S *et al.* (2012) Smart phone video game simulation of parent-child interaction: learning skills for effective vegetable parenting. In *Serious Games for Healthcare: Applications and Implications*, pp. 248–265 [S Arnab, I Dunwell and K Debattista, editors]. Hershey, PA: IGI Global.
- Beltran A, O'Connor T, Hughes S *et al.* (2012) Alpha test of a video game to increase children's vegetable consumption. *Games Health J* **1**, 219–222.
- Smith AM, Flannery-Schroeder EC, Gorman KS *et al.* (2014) Parent cognitive-behavioral intervention for the treatment of childhood anxiety disorders: a pilot study. *Behav Res Ther* **61**, 156–161.
- Abramowitz JS (2013) The practice of exposure therapy: relevance of cognitive-behavioral theory and extinction theory. *Behav Ther* **44**, 548–558.