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Parent outcome expectancies for purchasing fruit and vegetables: a validation

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Abstract

Objective: To validate four scales – outcome expectancies for purchasing fruit and for purchasing vegetables, and comparative outcome expectancies for purchasing fresh fruit and for purchasing fresh vegetables versus other forms of fruit and vegetables (F&V).
Design: Survey instruments were administered twice, separated by 6 weeks.
Setting: Recruited in front of supermarkets and grocery stores; interviews conducted by telephone.
Subjects: One hundred and sixty-one food shoppers with children (18 years or younger).
Results: Single dimension scales were specified for fruit and for vegetable purchasing outcome expectancies, and for comparative (fresh vs. other) fruit and vegetable purchasing outcome expectancies. Item Response Theory parameter estimates revealed easily interpreted patterns in the sequence of items by difficulty of response. Fruit and vegetable purchasing and fresh fruit comparative purchasing outcome expectancy scales were significantly correlated with home F&V availability, after controlling for social desirability of response. Comparative fresh vegetable outcome expectancy scale was significantly bivariately correlated with home vegetable availability, but not after controlling for social desirability.
Conclusion: These scales are available to help better understand family F&V purchasing decisions.

Keywords
Outcome expectancy
Fruit
Vegetables
Purchase
Validation
Reliability

Eating fruit and vegetables (F&V) has many positive health outcomes[1]. Children tend to eat more F&V when they are available in the home[2,3]. Enabling adult food shoppers (with children at home) to purchase more F&V should increase home F&V availability, and thereby children's F&V consumption.

Outcome expectancies, a term commonly used in Social Cognitive Theory[4], identify the good or not so good things (outcomes) that one believes will happen (expectancies) as a result of doing a behaviour. A concept roughly equivalent to outcome expectancies has appeared in many other psychosocial theories of behaviour: pros and cons in the Transtheoretical Model[5], attitude to the act in the Theories of Reasoned Action and Planned Behaviour[5], and benefits and costs in the Health Belief Model[5]. These constructs are often considered the motivational component of the model in that they provide the attracting or repelling forces for doing the behavior[5]. Outcome expectancies have been used extensively in research on physical activity[6] and have been demonstrated to influence F&V consumption in children[7] and adults[8].

Behaviours, such as purchasing F&V, are usually considered motivated (i.e. are done for a reason or purpose). Knowing what the food shopper with children at home sees as the benefits and costs of purchasing F&V, and of purchasing fresh versus other forms of F&V, could identify the motivating factors for doing the behaviour, and thereby provide mechanisms to target to increase the purchase of F&V. Behaviour change interventions have been tailored to outcome expectancy type beliefs[9].

No scale has been developed to measure the outcome expectancies of purchasing F&V. Since the influences appear to differ for fruit versus vegetable intake[10,11], purchases of one are likely to be partially independent of purchases of the other, and require separate scales. Furthermore, purchase of F&V can occur in different forms (fresh, canned, bottled, frozen), and reasons for buying F&V in one form may vary from those for buying another.

The present study reports psychometric properties, including construct validation, of four new scales: outcome expectancies for purchasing fruit and for purchasing vegetables; outcome expectancies for purchasing fresh fruit and for purchasing fresh vegetables versus other forms

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of F&V. These were developed as part of a programme of research on influences on home availability of F&V, which was the primary validation variable.

Methods

Design

These data were collected as part of a validation study. Food shoppers were recruited in front of supermarkets and grocery stores to participate in two telephone interviews, separated by 6 weeks. Most agreeing to participate completed a telephone interview within a week of the initial contact at the store and were re-interviewed to assess test–retest reliability on the same questions 6 weeks later. Six weeks was deemed to be long enough that participants would not remember their responses from the first call, yet short enough that responses at the second interview would not be susceptible to meaningful change (e.g. seasonality). The interviews started on 25 March 2004 and were completed on 25 June 2004. The Institutional Review Board of the Baylor College of Medicine approved the research protocol. All participants provided signed informed consent during initial contact in the store.

Sample recruitment

An attempt was made to sample a broad distribution of supermarkets, and thereby of shoppers, across all regions of the city. A supermarket was defined as being part of a national chain and having 25 employees or more. One chain supermarket and one small independent grocery store were initially selected from all those in the City of Houston using a random number generator. (Houston has food deserts[12] and so two local grocery stores were added to get shoppers in this area.) For all stores, a 2-mile radius was formed using global information systems mapping procedures. Any other newly selected store within a 2-mile radius of the original store was eliminated from the sample frame, and stores were sequentially randomly sampled so that no ensuing store was within 2 miles. When stores refused to participate, the refusing store (or group of stores) was eliminated from the sampling frame. Six major supermarket chains (out of 15) in Houston provided permission to recruit research participants in front of their stores. As a result, only these supermarkets were kept in the selection procedure. This procedure resulted in the selection of 22 stores (20 large, two small) approximately evenly distributed throughout all neighbourhoods of the city. The survey was more heavily weighted toward supermarkets since proportionally more food shopping occurs there.

Once permission from the store manager was obtained, project staff recruited 11 to 12 people per store (five or six on weekdays, six on weekend days). Given our primary interest in home F&V availability for children, the inclusion criteria were being 19 years of age or older, having a child 18 years or younger in the home, and being the family's primary food purchaser. The recruiter was stationed at the entrance next to a card table with a sign announcing the purpose of the study. The recruiter approached every other person entering the store and asked if they were interested in participating in a study on food shopping practices. Recruiters recorded the perceived gender and ethnicity of those who refused participation and those who agreed to participate but were not eligible. Recruitment and interviews were conducted in Spanish, as necessary, by bilingual interviewers from a form translated into Spanish. Of the 248 people recruited in front of the stores, 161 (67.0%) completed the first interview by telephone. Six weeks after the initial interview, 122 (76.1%) completed the second telephone interview. Participants received $US 20 for completing the first interview and $US 20 for completing the second interview.

Item generation

Intensive (qualitative) telephone interviews were conducted with a consenting sub-sample ($n = 84$) of participants in a previous study of the frequency of food shopping[13,14]. The sub-sample was broadly representative of socio-economic and ethnic groups in Houston. One purpose of the intensive interview was to generate outcome expectancy statements (items) for purchasing F&V. The items in the current survey (see Table 2) were derived from statements in those interviews. The co-investigators and staff reviewed the original statements, selected candidate items, and worked through several iterations of item statements for clarity and inclusion in this scale. A five-point response scale (strongly disagree, disagree, not sure, agree, strongly agree) was applied to each purchasing outcome expectancy item and assigned values 1 to 5. A six-point response scale (canned always, canned most of the time, not sure, fresh & canned about equal, fresh most of the time, and fresh always) was applied to each comparative purchasing outcome expectancy item and assigned values 1 to 6.

Social desirability of response

Social desirability of response was measured using the 'Lie Scale' from the Revised Children's Manifest Anxiety Scale developed by Reynolds and Paget[15]. This subscale consists of nine items each coded yes/no. Principal components analysis using tetrachoric correlations for dichotomous data showed that 53.5% of the variance was accounted for by the first component. Loadings for the first component were moderate (0.48) to high (0.83). The internal consistency of the scale, based on Cronbach's α, was 0.77 in this sample[16].

Home availability of F&V

Thirty-five most commonly consumed fruit (13), 100% fruit juice (three) and vegetable (19) items were reported as being in the home (yes/no) in the past week[3]. A single dimension was fit to each of the fruit and vegetable home

availability items. Item Response Theory (IRT) item difficulty estimates for fruit varied from −2.36 (most likely to be at home) for bananas to 1.49 (least likely to be at home) for kiwi. IRT item difficulty estimates for vegetables varied from −2.41 for lettuce to 2.35 for coleslaw. Test–retest reliability coefficients varied from 0.68 to 0.74[17].

Data analysis

IRT is an increasingly accepted set of psychometric theory that advances beyond Classical Test Theory (CTT)[18] approaches to measurement, which were formulated a while ago[19–21]. IRT sequences items and respondents across a latent variable which permits a variety of additional forms of analysis, including assessment of whether all response categories contribute to the location of each item on the scale; the sequencing of items by 'difficulty of response' along the underlying variable; whether each item was 'fit' by the underlying variable; and whether the respondents and the items covered the same portions of the underlying variable[7]. IRT thereby enriches our understanding of the latent variable underlying the items, wherein the sequence of items along the 'difficulty of response' dimension confers meaning.

Item analyses, based on CTT methods, were performed to investigate item properties such as item difficulty (item mean and standard deviation, SD), discrimination (corrected item-total correlation) and scale reliability (Cronbach's α). To test for the unidimensionality of the items on a scale, one-, two- and three-factor principal component analyses with Varimax rotation were conducted, and percentage variance accounted for by each factor was estimated. For the CTT method, a single score was computed by summing the values. In IRT modelling, the Rasch model – a one-parameter model – was employed. Item response functions were assessed graphically to assess whether respondents used the full range of response options in completing the questionnaire and thereby meaningfully contributed to the functioning of an item. Rasch models were employed to estimate item difficulty (i.e. the sequence of items based on difficulty across the underlying variable). The range of difficulty estimates was compared against a desired range of −3.0 to +3.0 (the IRT calibration of the latent variable in SD units). Item fit was evaluated by the in-fit mean-square (MNSQ) statistic. The criterion for acceptable fit is an in-fit MNSQ statistic between 0.75 and 1.33[18]. The person separation (PS) reliability index, a measure analogous to Cronbach's α[22], was computed and a Wright map of items and individuals was generated across the same underlying or latent variable to assess the items' coverage of the latent variable. Each participant's position on the latent variable was estimated using IRT procedures. Bivariate Pearson correlations were then conducted between each of the outcome expectancy scales and the corresponding scale of home availability and social desirability of response. Partial correlations were used to remove the influence of social desirability on the relationship of outcome expectancy with home availability.

Results

Response bias data

Of the 3426 people who were asked to participate in front of the stores, 261 agreed. Those agreeing tended to less likely be male or white and more likely to be black according to interviewer perception (see Table 1). Among those agreeing 13 did not qualify, but there were no statistically significant differences between those qualifying and those not (Table 1).

Among the 248 people who agreed to participate when contacted in front of the store and who qualified, 87 were not included in the analysis: 70 could not be contacted by telephone, four had duplicate identifiers and 13 had technical difficulties in data transmission. There were no statistically significant differences in gender or ethnicity between these two groups (Table 2).

Characteristics of baseline and later samples

The average age of the respondents to both surveys was 38.3 years and they had a mean of 2.5 children (Table 2).

Table 1 Frequency (*n*) and percentage (%) for interviewer-assessed demographic characteristics stratified by participation and qualification status

Characteristic	Agreed	Refused	Total
Gender, *n* (%)*			
Male	52 (19.9)	1211 (35.3)	1263 (34.3)
Female	185 (70.9)	2201 (64.2)	2386 (64.7)
Missing	24 (9.2)	14 (0.4)	38 (1.0)
Total	261 (100.0)	3426 (100.0)	3687 (100.0)
Race/ethnicity, *n* (%)†			
White	30 (11.5)	1106 (32.3)	1136 (30.8)
Hispanic	90 (34.5)	1232 (36.0)	1322 (35.9)
Black	113 (43.3)	900 (26.3)	1013 (27.5)
Other	4 (1.5)	174 (5.1)	178 (4.8)
Missing	24 (9.2)	14 (0.4)	38 (1.0)
Total	261 (100.0)	3426 (100.0)	3687 (100.0)
	Qualified	**Did not qualify**	**Total**
Gender, *n* (%)			
Male	48 (19.4)	4 (30.8)	52 (19.9)
Female	176 (71.0)	9 (69.2)	185 (70.9)
Missing	24 (9.7)	0 (0.0)	24 (9.2)
Total	248 (100.0)	13 (100.0)	261 (100.0)
Race/ethnicity, *n* (%)			
White	29 (11.7)	1 (7.7)	30 (11.5)
Hispanic	85 (34.3)	5 (38.4)	90 (34.5)
Black	107 (43.1)	6 (46.2)	113 (43.3)
Other	3 (1.2)	1 (7.7)	4 (1.5)
Missing	24 (9.7)	0 (0.0)	24 (9.2)
Total	248 (100.0)	13 (100.0)	261 (100.0)

*Gender was significantly ($\chi^2_1 = 17.98$, $P < 0.001$) associated with agreement to participate in the study.
†Race/ethnicity was significantly ($\chi^2_3 = 69.51$, $P < 0.001$) associated with agreement to participate in the study.

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Table 2 Mean (M), standard deviation (SD), frequency (*n*) and percentage (%) for demographic characteristics of subjects completing outcome expectancies for purchasing of (types of) fruits and vegetables scales stratified by inclusion and interview status

Characteristic	Excluded ($n = 87$)*	Included ($n = 161$)	Total ($n = 248$)
Self-reported age (years), M ± SD (*n*)	37.2 ± 8.1 (14)	38.3 ± 9.2 (155)	38.2 ± 9.1 (169)
Interviewer-assessed gender, *n* (%)			
Male	20 (23.0)	28 (17.4)	48 (19.3)
Female	63 (72.4)	113 (70.2)	176 (71.0)
Missing	4 (4.6)	20 (12.4)	24 (9.7)
Interviewer-assessed race/ethnicity, *n* (%)			
White	12 (13.8)	17 (10.6)	29 (11.7)
Hispanic	27 (31.0)	57 (35.4)	84 (33.9)
Black	44 (50.6)	63 (39.1)	107 (43.1)
Other	0 (0.0)	3 (1.9)	3 (1.2)
Missing	4 (4.6)	21 (13)	25 (10.1)
			Total ($n = 161$)
	Completed both interviews ($n = 122$)	Completed first only ($n = 39$)	Total ($n = 161$)
Self-reported age (years), M ± SD (*n*)	38.9 ± 8.8 (118)	36.5 ± 10.5 (37)	38.3 ± 9.2 (155)
Number of children (<18 years) living in home, M ± SD (*n*)	2.5 ± 1.1 (118)	2.8 ± 1.4 (37)	2.5 ± 1.2 (155)
Gender, *n* (%)			
Male	23 (18.9)	7 (17.9)	30 (18.6)
Female	94 (77.0)	30 (76.9)	124 (77.0)
Missing	5 (4.1)	2 (5.1)	7 (4.3)
Race/ethnicity, *n* (%)			
Hispanic	51 (41.8)	15 (38.5)	66 (41.0)
White non-Hispanic	14 (11.5)	1 (2.6)	15 (9.3)
Black	48 (39.3)	17 (43.6)	65 (40.4)
Other	4 (3.3)	3 (7.7)	7 (4.3)
Missing	5 (4.1)	3 (7.7)	8 (5.0)
Highest education in household, *n* (%)			
General Equivalency Degree, high school graduate or less	64 (52.5)	17 (43.6)	81 (50.3)
Some college/vocational/technical school	33 (27.0)	10 (25.6)	43 (26.7)
College graduate (baccalaureate)	15 (12.3)	6 (15.4)	21 (13.1)
Advanced degree	6 (4.9)	4 (10.3)	10 (6.2)
Missing	4 (3.3)	2 (5.1)	6 (3.7)
Language spoken in home, *n* (%)			
All of another language	22 (18.0)	6 (15.4)	28 (17.4)
Mostly another language	7 (5.7)	1 (2.6)	8 (5.0)
Two languages equally	13 (10.7)	5 (12.8)	18 (11.2)
Mostly English	15 (12.3)	4 (10.3)	19 (11.8)
All English	61 (50.0)	21 (53.8)	82 (50.9)
Missing	4 (3.3)	2 (5.1)	6 (3.7)

* Exclusion due to non-participation for reasons unknown ($n = 70$), technical problems with data ($n = 11$), and missing food management scales item responses ($n = 6$).
No significant differences among inclusion and interview status were observed.
(Note: Missing was not recognised as a category in computing test statistics.)

Seventy-seven per cent were female. Sixty-two per cent spoke all or mostly English at home. Most (86%) were ethnic minority and half (50%) had a high school degree or less. There were no statistically significant differences in these characteristics between those completing both surveys and those completing the first survey only.

Fruit purchasing outcome expectancies (FPOE)

Respondents tended to most frequently use the 'strongly agree' category for most items as indicated by the mean item response (Table 3), except for items on expense of fruit and needing fruit for recipe preparation. All FPOE items were at least moderately discriminating (corrected item-total correlations greater than 0.20) (Table 3). One-, two- and three-dimension principal components analyses suggested that one factor adequately captured the information across items in the scale; one factor accounted for 27.8% of the variance. Cronbach's α across the nine items in this scale was 0.61, low for a traditional scale. The test–retest intraclass correlation (ICC) was 0.62.

IRT modelling revealed that a binary response (strongly agree vs. all others) best captured the responses. Results from the Rasch-type models for the five-point ordinal scale (not shown) yielded misfitting items and item response options that never had the highest probability of being selected. As a result, all items were reduced to binary responses; the binary response mean, SD and corrected item-total correlation for the FPOE scale appear in Table 4. The IRT-estimated item difficulty parameters varied from −1.73 to 2.28, indicating the items did not cover the ends of the distribution. None of the in-fit MNSQ statistics exceeded the acceptable interval (0.75–1.33), indicating the latent variable adequately fit all the items. Cronbach's α for the binary response scale version increased substantially to 0.73 (which is at the lower end of the range of acceptable). The PS reliability was 0.67; the test–retest ICC was 0.66 and 0.62 for CTT- and IRT-derived scale scores, respectively.

The participants and the items are displayed across the latent FPOE scale in Fig. 1. Items did not cover a major portion of the more difficult end of the distribution (the larger positive numbers) (see Fig. 1).

The dichotomised FPOE scale correlated −0.32 ($P < 0.01$) with social desirability and 0.33 ($P < 0.01$) with home fruit availability (Table 5). FPOE correlated 0.29 ($P < 0.01$) with home fruit availability after controlling for social desirability, suggesting some social desirability response bias.

Vegetable purchasing outcome expectancies (VPOE)

Respondents tended to most frequently use the 'strongly agree' category for the VPOE responses, as revealed by the mean item responses (see Table 3). All items were discriminating, except for the first item which had a low corrected item-total correlation. The one-factor principal components solution provided a reasonable fit to the items accounting for 31.6% of the variance. Cronbach's α was 0.72 and the test–retest reliability was 0.71.

Examination of the IRT in-fit statistics and item response functions revealed that item responses were best characterised as a binary response between 'strongly agree' and all other responses. The mean item scores using binary responses are displayed in Table 4. All items were discriminating; and Cronbach's α increased (by using the binary scoring) to 0.77. Item difficulty estimates ranged from −1.99 to 1.73. The PS reliability was 0.72, and the test–retest ICC was 0.66 and 0.67 for CTT- and IRT-derived summary scores, respectively.

The items did not cover the more difficult end of the distribution of VPOE (Fig. 2). The VPOE scale correlated −0.34 ($P < 0.01$) with social desirability and 0.27 ($P < 0.01$) with home vegetable availability. VPOE correlated 0.23 ($P < 0.01$) with home vegetable availability after controlling for social desirability, suggesting some social desirability of response in the raw scores.

Comparative fruit purchasing outcome expectancies (CFPOE)

The mean, SD and corrected item-total correlations for each of the nine CFPOE scale items appear in Table 3. All items were at least moderately discriminating. A single factor captured meaningful variance in these items (36.6%). The single-factor Cronbach's α was 0.78. The test–retest ICC was 0.55.

IRT modelling analysis to assess the effective response categories suggested a binary response fit the items best (fresh always vs. all other responses). The mean, SD and corrected item-total correlations for the binary response scales for these items appear in Table 4. All items were discriminating. The item difficulty estimates ranged from −1.62 to 1.45 (Table 4). All in-fit values were within the acceptable range. Cronbach's α for the scale with binary responses increased (from that using the five-category scale) to 0.86. The PS reliability was 0.76. The test–retest ICC was 0.67 and 0.65 for CTT- and IRT-derived summary scores, respectively.

The CFPOE items covered only the central portions of the distribution of outcome expectancies for purchasing type of fruit, missing both the extreme positive and the extreme negative ends of the distribution (Fig. 3). CFPOE was not significantly correlated with social desirability, but was correlated 0.24 ($P < 0.01$) with home fruit availability. CFPOE was correlated 0.19 ($P < 0.05$) with home fruit availability after correcting for social desirability.

Comparative vegetable purchasing outcome expectancies (CVPOE)

The mean, SD and corrected item-total correlations appear in Table 3. All items were discriminating. A one-factor solution appeared to capture meaningful variance in these items (43.9%). Cronbach's α for these items was 0.83, and the test–retest ICC was 0.67.

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Table 3 Mean (M), standard deviation (SD), corrected item-total correlation (CITC), one-factor solution, two-factor solution, percentage variance explained for each factor, Cronbach's α and the test–retest intraclass correlation (ICC) for each of the four scales

Item	M (SD)	CITC	One factor	Two factor		% Variance explained Cronbach's α ICC
I like to eat **FRUIT** because…						27.8%, 16.1%,12.1%
a. …they are good for your health.	4.9 (0.3)	0.25	0.42	0.24	0.38	0.61
b. …they taste good.	4.8 (0.5)	0.49	0.68	0.53	0.42	0.62
c. …they are inexpensive.	3.6 (1.4)	0.29	0.43	0.02	0.70	
d. …they are easy to prepare.	4.3 (1.2)	0.44	0.60	0.18	0.76	
e. …I grew up eating them.	4.4 (1.1)	0.31	0.59	0.68	0.07	
f. …of the vitamins & minerals they have.	4.7 (0.6)	0.32	0.54	0.57	0.13	
g. …I need them for what I am preparing.	4.1 (1.1)	0.20	0.30	−0.09	0.63	
h. …I like to eat them.	4.8 (0.6)	0.28	0.56	0.75	−0.07	
i. …my children like to eat them.	4.7 (0.9)	0.33	0.58	0.66	0.07	
I like to eat **VEGETABLES** because…						31.6%, 16.8%, 13.0%
a. …they are good for your health.	4.9 (0.4)	0.08	0.15	−0.29	0.60	0.72
b. …they taste good.	4.4 (0.9)	0.44	0.62	0.34	0.57	0.71
c. …they are inexpensive.	3.9 (1.2)	0.41	0.54	0.75	−0.06	
d. …they are easy to prepare.	4.3 (1.0)	0.44	0.56	0.78	−0.07	
e. …I grew up eating them.	4.4 (1.1)	0.46	0.64	0.46	0.46	
f. …of the vitamins & minerals they have.	4.7 (0.6)	0.29	0.43	0.02	0.66	
g. …I need them for what I am preparing.	4.6 (0.8)	0.43	0.61	0.58	0.24	
h. …I like to eat them.	4.6 (0.8)	0.50	0.69	0.28	0.76	
i. …my children like to eat them.	4.1 (1.2)	0.45	0.61	0.56	0.28	
Comparing fresh with canned, bottled & frozen **FRUIT**, would you say fresh …						36.6%, 17.3%
a. …are better for your health?	5.5 (0.9)	0.27	0.42	−0.04	0.67	0.78
b. …taste better?	5.4 (.01)	0.42	0.59	0.14	0.73	0.55
c. …are less expensive?	4.2 (1.7)	0.42	0.53	0.61	0.12	
d. …are easier to prepare?	3.8 (1.9)	0.63	0.71	0.89	0.07	
e. …are quicker to prepare?	3.5 (2.0)	0.54	0.64	0.86	0.00	
f. …are the kind you grew up eating?	4.9 (1.3)	0.36	0.48	0.36	0.31	
g. …are the kind you need for what you are preparing?	4.7 (1.4)	0.56	0.70	0.59	0.38	
h. …are the kind you enjoy?	5.3 (1.2)	0.47	0.65	0.14	0.80	
i. …are the kind your children prefer?	4.9 (1.5)	0.49	0.66	0.29	0.66	
Comparing fresh with canned, bottled & frozen **VEGETABLES**, would you say fresh …						43.9%, 17.8%
a. …are better for your health?	5.5 (1.0)	0.31	0.44	0.70	−0.02	0.83
b. …taste better?	5.4 (1.0)	0.48	0.63	0.84	0.10	0.67
c. …are less expensive?	4.1 (1.8)	0.51	0.60	0.12	0.69	
d. …are easier to prepare?	3.4 (1.9)	0.68	0.74	0.09	0.91	
e. …are quicker to prepare?	3.1 (1.9)	0.59	0.67	0.02	0.87	
f. …are the kind you grew up eating?	4.8 (1.5)	0.50	0.62	0.44	0.44	
g. …are the kind you need for what you are preparing?	4.4 (1.5)	0.69	0.78	0.46	0.63	
h. …are the kind you enjoy?	5.3 (1.1)	0.51	0.67	0.81	0.18	
i. …are the kind your children prefer?	4.6 (1.5)	0.62	0.75	0.59	0.48	

Table 4 Estimates derived from Classical Test Theory (CTT) analysis and Item Response Theory (IRT) analysis of the outcome expectancies for purchasing (types) of fruits and vegetables scales (dichotomised)

Item	M (SD)	CITC	Est (SE)	In-fit MNSQ	Cronbach's α PS reliability ICC(1), ICC(2)
I like to eat **FRUIT** because...					0.73
a. ...they are good for your health.	0.90 (0.29)	0.34	−1.73 (0.18)	0.88	0.67
h. ...I like to eat them.	0.86 (0.35)	0.43	−1.09 (0.17)	0.91	0.66, 0.62
i. ...my children like to eat them	0.83 (0.38)	0.43	−0.80 (0.44)	0.99	
f. ...of the vitamins and minerals that they have.	0.79 (0.41)	0.40	−0.51 (0.16)	0.92	
b. ...they taste good.	0.79 (0.41)	0.54	−0.46 (0.16)	0.87	
e. ...I grew up eating them	0.69 (0.46)	0.44	0.23 (0.15)	1.03	
d. ...they are easy to prepare.	0.63 (0.48)	0.48	0.57 (0.15)	0.91	
g. ...I need them for what I am preparing.	0.46 (0.50)	0.29	1.52 (0.14)	1.19	
c. ...they are inexpensive.	0.34 (0.47)	0.34	2.28 (0.15)	1.14	
I like to eat **VEGETABLES** because...					0.77
a. ...they are good for your health.	0.89 (0.31)	0.31	−1.99 (0.16)	1.05	0.72
f. ...of the vitamins and minerals that they have.	0.80 (0.40)	0.36	−1.02 (0.15)	1.20	0.66, 0.67
h. ...I like to eat them.	0.73 (0.45)	0.61	−0.44 (0.14)	0.81	
e. ...I grew up eating them.	0.70 (0.46)	0.46	−0.27 (0.14)	1.11	
g. ...I need them for what I am preparing.	0.68 (0.47)	0.42	−0.14 (0.14)	1.11	
d. ...they are easy to prepare.	0.58 (0.50)	0.48	0.49 (0.14)	1.10	
b. ...they taste good.	0.58 (0.50)	0.54	0.53 (0.14)	1.03	
i. ...my children like to eat them.	0.48 (0.50)	0.42	1.11 (0.41)	1.14	
c. ...they are inexpensive.	0.38 (0.49)	0.50	1.73 (0.14)	0.93	
Comparing fresh with canned, bottled & frozen **FRUIT**, would you say fresh...					0.86
a. ...are better for your health?	0.67 (0.47)	0.40	−1.62 (0.15)	1.18	0.76
h. ...are the kind you enjoy?	0.63 (0.49)	0.57	−1.23 (0.15)	0.86	0.67, 0.65
b. ...taste better?	0.61 (0.49)	0.56	−1.14 (0.15)	1.02	
i. ...are the kind your children prefer?	0.51 (0.50)	0.57	−0.43 (0.42)	0.94	
f. ...are the kind you grew up eating?	0.46 (0.50)	0.56	−0.06 (0.15)	1.10	
g. ...are kind you need for what you are preparing?	0.36 (0.48)	0.70	0.63 (0.15)	0.79	
c. ...are less expensive?	0.29 (0.46)	0.54	1.18 (0.15)	1.11	
d. ...are easier to prepare?	0.29 (0.46)	0.63	1.22 (0.15)	0.93	
e. ...are quicker to prepare?	0.27 (0.45)	0.65	1.45 (0.15)	0.90	
Comparing fresh with canned, bottled & frozen **VEGETABLES**, would you say fresh...					0.87
a. ...are better for your health?	0.68 (0.47)	0.55	−2.19 (0.16)	1.41	0.78
b. ...taste better?	0.67 (0.47)	0.65	−1.91 (0.16)	0.93	0.64, 0.73
h. ...are the kind you enjoy?	0.62 (0.49)	0.69	−1.3 (0.16)	0.89	
f. ...are the kind you grew up eating?	0.47 (0.50)	0.53	−0.33 (0.16)	1.22	
i. ...are the kind your children prefer?	0.38 (0.49)	0.64	0.22 (0.46)	0.88	
g. ...are kind you need for what you are preparing?	0.31 (0.46)	0.63	0.96 (0.16)	0.88	
c. ...are less expensive?	0.29 (0.46)	0.53	1.02 (0.16)	1.23	
d. ...are easier to prepare?	0.25 (0.43)	0.64	1.56 (0.17)	0.82	
e. ...are quicker to prepare?	0.22 (0.41)	0.66	1.96 (0.17)	0.81	

M – mean; SD – standard deviation; CITC – corrected item-total correlation; Est – IRT item parameter estimate; SE – IRT parameter standard error; in-fit MNSQ – IRT weighted mean square index; PS reliability – IRT person separation reliability, ICC(1) – intraclass correlation between time 1 and time 2 CTT estimates; ICC(2) – intraclass correlation between time 1 and time estimates IRT estimates.

The IRT modelling to assess the effective response categories suggested a binary response fit the items best (fresh always vs. all other responses). The mean, SD and item total correlations for the binary response scales for these items appear in Table 4. The items with binary responses were more discriminating. The difficulty estimates ranged from −2.19 to 1.96. All of the item in-fit values were within the acceptable range, except for the first item. This item was retained in the scale because of the interest in the importance of health to comparative food purchasing decisions and the in-fit value was just outside the acceptable range. Cronbach's α for the scale with binary responses increased to 0.87. The PS reliability was 0.78 and the test–retest ICC was 0.64 and 0.73 for CTT and IRT summary scores, respectively.

The items covered a substantial portion (−2.5 to 2.0) of the distribution of the outcome expectancies for purchasing type of vegetables, but not the extremely easy or the extremely difficult ends (Fig. 4). The CVPOE scale was correlated −0.31 ($P < 0.01$) with social desirability and 0.18 ($P < 0.05$) with home vegetable availability. However, CVPOE was not significantly related to home vegetable availability after controlling for social desirability (Table 5).

Discussion

A set of four scales was created to identify outcome expectancies separately for purchasing fruit, vegetables and for comparative fruit and vegetable purchases as part of a programme of research on predictors of home F&V

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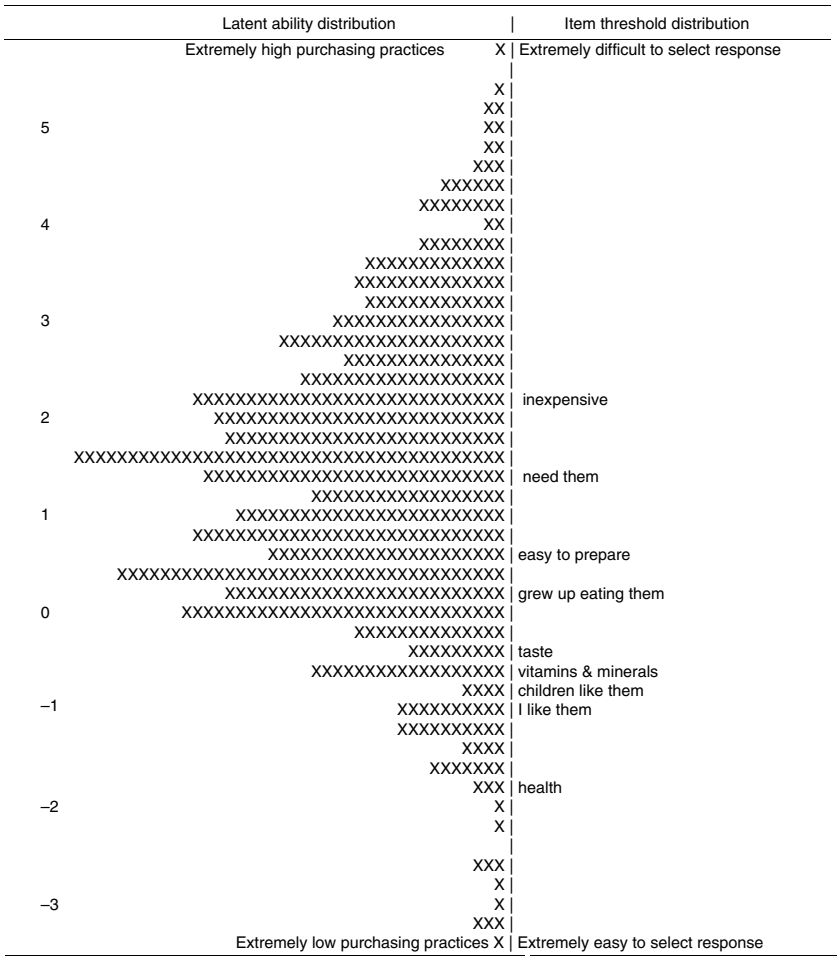

Fig. 1 Wright map of item thresholds for outcome expectancies for purchasing fruit (each 'X' represents 0.3 cases)

availability. Adequate psychometric characteristics were obtained for each of these scales. The fruit comparative scale significantly correlated with the corresponding home fruit availability scale, after controlling for social desirability. The vegetable comparative scales significantly correlated with the vegetable availability scale; however, this relationship was not significant after controlling for social desirability. These scales appear ready for use by other investigators studying F&V purchasing decisions.

Table 5 Correlations between outcome expectancies for purchasing (types) of fruits and vegetables and availability of fruits and vegetables with and without controlling for social desirability

	Social desirability	Availability	Availability controlling for social desirability
Fruit purchasing	−0.32**	0.33**	0.29**
Vegetable purchasing	−0.34**	0.27**	0.23**
Comparative fresh fruit	−0.14**	0.24**	0.19*
Comparative fresh vegetables	−0.31**	0.18*	0.13

*Significant at $P < 0.05$; **significant at $P < 0.01$.
Note: Fruit purchasing is correlated with availability of fruit and vegetable purchasing is correlated with availability of vegetables.

Future users, however, could simplify response by using only the binary response scales.

IRT scales are similar to Guttman scales in that agreement with items later in the scale assumes agreement with items earlier in the scale[18]. Thus, a person's position or score on an IRT scale can be understood as the point where the respondent agreed with items to that point, but not with items beyond that point. The items at the higher end of the scale are generally harder to agree with (thereby meriting the 'difficult to respond' label). For example, people generally like fruit because of their sweet taste, but often do not like vegetables[7]. In the FPOE scale, the items referring to liking to eat them or good taste (items h, i and b) were more easily agreed with (−1.09, −0.80 and −0.46, respectively) than the same items on the VPOE scale (−0.44, 1.11 and 0.53, respectively). Similar patterns were detected for the comparative purchasing scales.

One possible implication of sequencing items along the underlying scale based on difficulty is that interventions targeting these underlying constructs could tailor to the participant's point on the scale. That is, the next item beyond the person's point on the scale is the item to which

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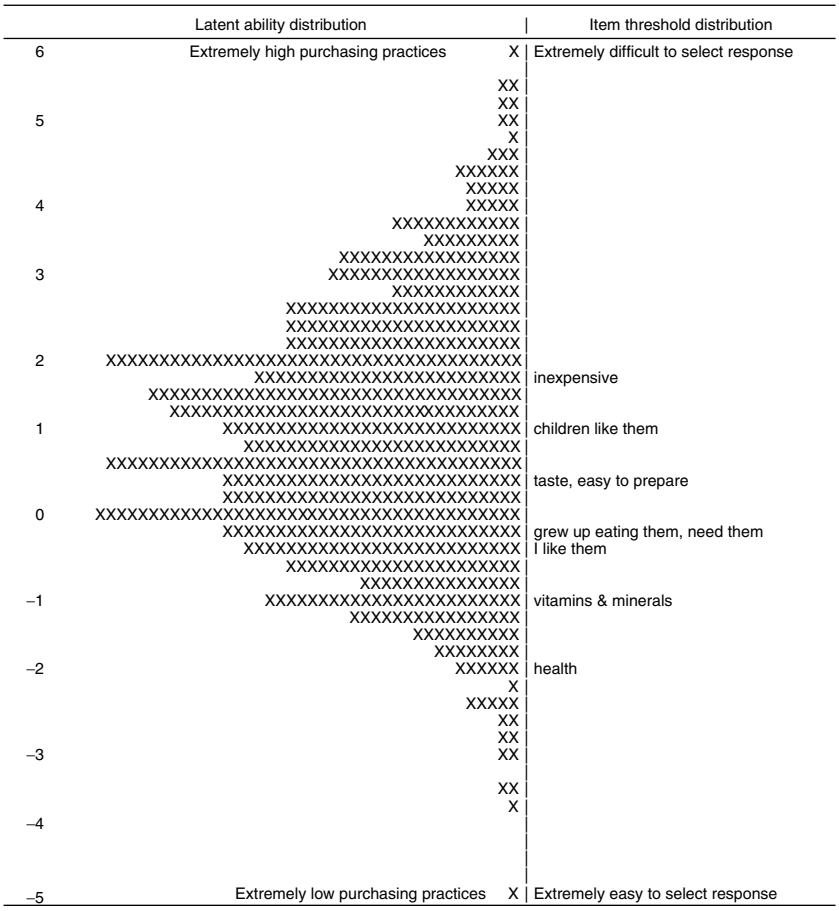

Fig. 2 Wright map of item thresholds for outcome expectancies for purchasing vegetables (each 'X' represents 0.3 cases)

others have next most often agreed with. This suggests that this would be the easiest point along the ability continuum to achieve change. For example, if a participant believes that vegetables are better for your health, taste good and are inexpensive, it should be easiest to help that person come to believe that vegetables are easy to prepare. However, this intervention implication remains to be tested.

For each scale, the items that were easiest to agree with were that fruit or vegetables are good for your health, or the fresher items are better for your health. This suggests that the healthiness of F&V is well-recognised and would not benefit from further persuasive arguments. The inexpensiveness of the fruit, vegetables or fresh items was always at the more difficult end to agree with. This suggests that national policy should attend to the expense of F&V, and local programmes would benefit from comparative analyses of the cost of F&V, relative to nutrient content. The taste ratings were in the middle of the set of items for fruit, low for vegetables, but high for fresh versus other vegetables. This suggests that shoppers appreciate the good taste of fresh F&V versus other forms, and they tend to like the taste of fruit more than the taste of vegetables. This suggests that tasty, simple, quick and easy-to-prepare recipes should be developed for vegetables that people can enjoy.

The difficulty estimates of items in IRT scales should vary from -3.0 to $+3.0$, and items should cover all portions of the distribution of people, so that items are really tapping the underlying beliefs[7]. The items in these scales tended to vary in difficulty from approximately -2.0 to $+2.0$. This suggests that the scales would be further enhanced by generating and testing items at the extremely easy and difficult ends of the distributions in order to more fully represent the F&V outcome expectancy constructs.

IRT enhanced the CTT analysis of these scales by identifying binary response categories as better fitting the responses provided; and, when used, the binary responses resulted in higher item-total correlations and Cronbach's α values. Sequencing items within scales by the difficulty of item response revealed patterns that were easily interpreted and meaningful, resulting in suggested guidance for national policy or local programmes to increase F&V purchases (and resulting consumption). Ways to improve the scales were identified by the need to generate items that cover more of the underlying dimension for each scale and using only binary response scales. These were valuable contributions for the development of new scales.

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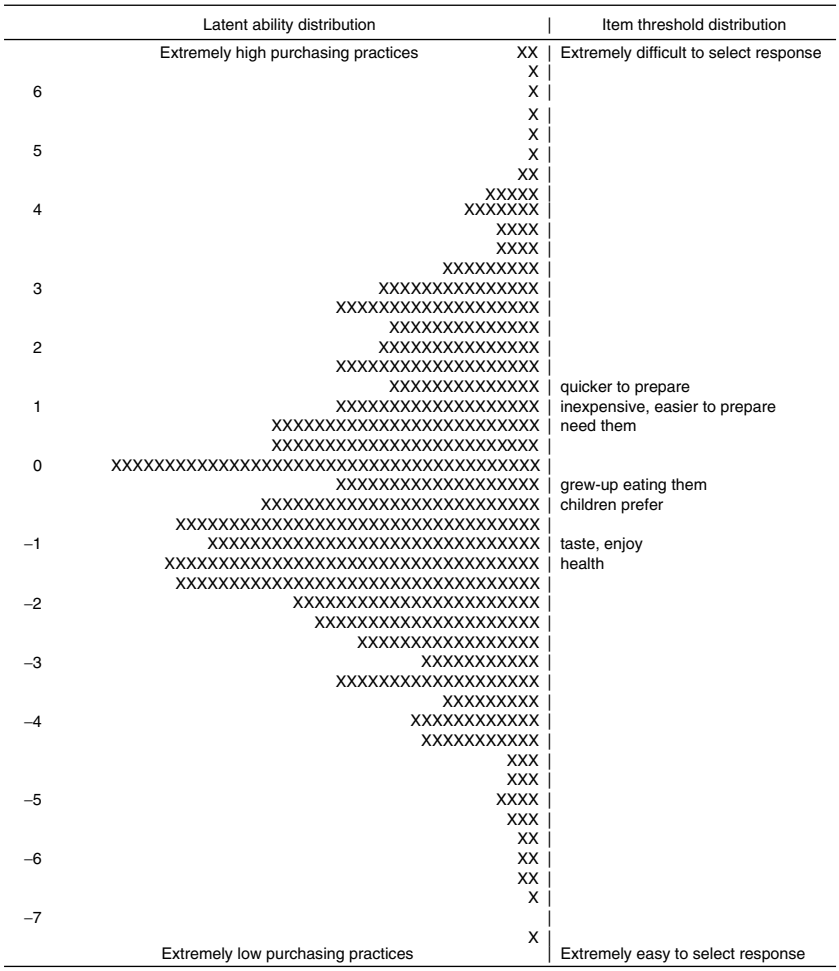

Fig. 3 Wright map of item thresholds for outcome expectancies for purchasing types of fruit (each 'X' represents 0.3 cases)

The strengths of this research include the assessment of test–retest reliability of scales, the assessment and statistical control for social desirability of response, and the diverse ethnic and socio-economic composition of the sample. The limitations include the self-report nature of the data (which may be unavoidable for the variables in this type of research), some participation bias with greater participation among females and blacks, and not covering the full underlying dimensions of the corresponding variables. The possibility of ethnic group or gender modifying the relationships reported here should be addressed in larger samples.

Conclusion

Outcome expectancies for purchasing F&V and fresh versus other forms of F&V can be quantified; the sequencing of items can be meaningfully interpreted; and the scales were related to other measures in expected and meaningful ways. Investigators should use these variables to better understand influences on home F&V availability. Tests of the possible intervention tailoring implication should be conducted.

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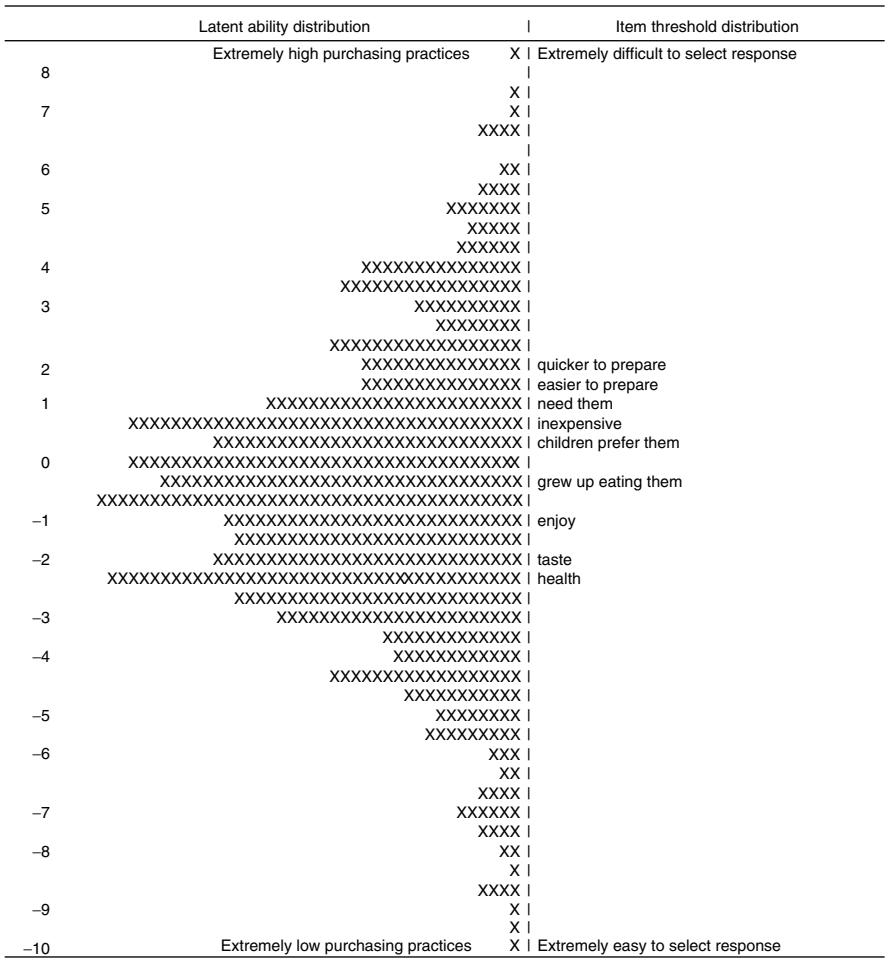

Fig. 4 Wright map of item thresholds for outcome expectancies for purchasing types of vegetables (each 'X' represents 0.3 cases)

this manuscript, and coordinated contributions to the manuscript. K.W. is a statistician and conducted all statistical analyses. M.M. was the project manager for this study. A.B. was a research coordinator for this project. J.B., K.C., T.N., J.F. and S.O'D. participated in the design and oversight of the study. All authors reviewed drafts and made contributions to this manuscript.

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