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Home Fruit, Juice and Vegetable Pantry Management and Availability Scales:

A Validation

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Abstract

Home fruit, 100% juice and vegetable (FJV) availability is related to increased FJV consumption by children. While FJV must be purchased for use in the home, no scales have been reported on home FJV pantry management practices. A scale for home FJV pantry management practices was generated from focus group discussions with diverse food shoppers. A commonly used scale of home FJV availability was also assessed. A grocery store intercept survey recruited 171 food shoppers with children in front of supermarkets and grocery stores. Survey instruments were administered twice, separated by 6 weeks. Single dimensionality was observed for each scale. Item Response Theory parameter estimates revealed easily interpreted patterns in the sequence of items by difficulty of response. These scales are available to help better understand influences on family FJV purchase decisions.

Keywords

pantry; home availability; fruit; vegetables; purchase; validation; reliability; item response modeling

Introduction

Eating fruit, 100% juice and vegetables (FJV) has many positive health outcomes. Children tend to eat more FJV when they are available in the home⁷. Enabling adult food shoppers (with children at home) to purchase more FJV, should increase home FJV availability, and thereby child FJV consumption.

Many people keep a supply of canned, bottled or frozen (not fresh) fruit, 100% juice and vegetables in the home which they periodically restock. This supply (where ever it is stored) is their "home pantry." People likely vary in when they decide to restock the pantry. No scale has been developed to measure how people manage and restock the pantry. Since the influences appear to differ for fruit versus vegetable intake¹, the restocking of one is likely to be partially

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independent of restocking of the other, and therefore require separate scales. FJV for the home pantry can occur in different forms (canned, bottled, frozen).

Item Response Modeling (IRM) is an increasingly accepted set of psychometric techniques for advancing beyond classical test theory (CTT) approaches to measurement. IRM 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 latent variable; the sequencing of items along the latent variable; whether each item was “fit” by the underlying latent variable; and whether the respondents and the items covered the same portions of the latent variable. IRM thereby enriches our understanding of the items, since the sequence of the items by difficulty of agreement along the dimension confers meaning. This sequencing of items along the latent variable makes possible other IRM analyses (e.g., differential item functioning, test equating), but these are not reported here. This study reports both the CTT and IRM psychometric properties, including construct validation of four scales: home fruit, juice and vegetable pantry management practices and home FJV availability. These were developed as part of a research program to examine the influences on home FJV availability.

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 interviews, separated by six weeks. Participants who completed a telephone interview within one week of the initial contact at the store were re-interviewed on the same questions 6 weeks later to assess test-retest reliability. 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 influences (e.g., seasonality). The interviews started March 25, 2004, and were completed June 25, 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 a diverse sample 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 and so two local grocery stores were added to obtain food shoppers in this area). For each of these stores, a two mile radius was formed using GIS procedures. Any other store whose 2 mile radius overlapped the original stores' was eliminated from the sample frame, and stores were sequentially randomly sampled so that no ensuing store's radius overlapped any store already in the sample. 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, 2 small) approximately evenly distributed throughout all neighborhoods of the city. The survey was 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 (5 or 6 on weekdays, 6 on weekend days). Given our primary interest in home FJV availability for children, the inclusionary 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 gender and ethnicity of those who refused participation and those who agreed to participate, but were not eligible, and those who agreed and were eligible to participate. 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, 162 (67.3%) completed the first interview by telephone. At six weeks after the initial interview, 122 (77.8%) completed the second telephone interview. Participants received \$20 for completing the first interview and \$20 for completing the second interview.

Item Generation

Intensive (qualitative) telephone interviews were conducted with a consenting subsample ($n = 84$) of participants in a previous study of food shopping frequency 3. The subsample was broadly representative of socioeconomic and ethnic groups in Houston. One purpose of the intensive interview was to generate home fruit, juice and vegetable pantry management items. The items in the current survey (see Table 2) were derived from statements in those interviews. The co-investigators and staff reviewed all the original statements, selected candidate items, and worked through several iterations of item statements for simplicity, clarity and inclusion in this scale. A five item response scale (strongly disagree, disagree, not sure, agree, strongly agree) was applied to each item and assigned values 1 to 5.

Home FJV Availability

Home FJV availability was assessed in conjunction with home FJV pantry management practices. Thirty five fruit (13), 100% juice (3), and vegetable (19) items were identified as being available (yes or no) in the home in the past week .

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. This subscale consists of eight items each coded yes/no. This scale had a Cronbach's alpha of 0.76 in the GEMS study .

Data Analysis

Item analyses, based on Classical Test Theory methods, were performed to investigate item properties such as item difficulty (item mean and standard deviation), discrimination (corrected item-total correlation) and scale reliability (Cronbach's alpha). 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 percent variance accounted for by each factor was estimated. For the CTT method, a single score on each variable was completed by summing the values. Using Item Response Modeling (IRM), the 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 of response across the underlying variable). The range of difficulty estimates was compared against a desired range of -3.0 to +3.0 (the IRM calibration of the latent variable in standard deviation units). Item fit was evaluated by the infit mean-square (MNSQ) statistic. The criterion for acceptable fit is an infit MNSQ statistic between 0.75 and 1.33. The person separation (PS) reliability index, a measure analogous to Cronbach's alpha, was computed and a Wright map of items and individuals was generated. The Wright map links the range of the latent variable to the distribution of the difficulty of the items and the distribution of

respondents. In an ideal situation participants would be normally distributed across the latent variable between -3 logits and +3 logits, and item difficulties would be distributed throughout the same range. Each participant's position on the latent variable was estimated using IRM procedures. Bivariate Pearson correlations were then conducted between each of the outcome home pantry management scales and the corresponding scales of home availability, as a test of construct validity.

Results

Characteristics of baseline & later samples

Of the 248 people agreeing to participate in this study, there were no age, gender or ethnic group differences between those included in the analyses and those excluded (top of Table 1). Of those who were not included, 70 could not be reached by telephone, 5 had missing data, and 11 had technical difficulties in data retrieval. The average age of the respondent to both surveys was 38.5 years (See Table 1.). About 76.5% were female; 62.9% spoke all or mostly English at home; 80.9% were ethnic minority; and 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.

Home Fruit Pantry Management Practice (HFPMP)

Respondents tended to most frequently use the “strongly agree” category for most items as indicated in the mean item response (Table 2), except for items on use of coupons and purchasing as a habit. All HFPMP items were discriminating (i.e., positively correlated with the total score) (Table 2). One, two and three dimension principal components analyses suggested that one factor accurately captured all the information across items in the scale. The first factor captured 59.1% of the variance. The Cronbach's alpha across the nine items in this scale was 0.88 for both administrations. The 6 week test-retest ICC was 0.64.

Inspection of the item response functions and infit statistics derived from the IRM modeling of the HFPMP scale indicated the original 5-point response scale was functioning as a 3-point scale. Strongly disagree, disagree, and not sure were collapsed into one category so that the modified scale consisted of strongly agree, agree, and all others; the trinary response mean, standard deviation and item total correlation for the HFPMP scale appear in Table 3. The IRM estimated item difficulty parameters varied from -0.39 to 0.57. The threshold values for the item response functions varied from -1.22 to 1.06, indicating the items did not cover the ends of the distribution (-3 to +3). Only one of the infit statistics exceeded the acceptable interval (0.75 to 1.33) indicating the latent variable adequately fit the items. Since this item was “purchased using a coupon,” a potentially important behavior, and the step infit statistics were within the acceptable range, we decided to keep the item. The Cronbach's alpha for the trinary response scale version was 0.87. The PS reliability was 0.79; the test retest ICC was 0.65 and 0.62 for the CTT and IRM scores, respectively.

Figure 1 presents the Wright map for the HFPMP scale. The latent variable extends from -4 (at the bottom of the page) to +4 (at the top of the page). The distribution of participants across this latent variable is presented by Xs; each X represents 1.2 respondents. The respondents with the lowest values (highest negatives) were lowest on the food pantry management scale. Those at the top of the page were the highest on this scale. The difficulty of the items represented by their thresholds is linked to the same scale and presented on the right side. The first threshold is between the strongly agree and agree categories (as denoted for the store sales item by “sale (1)”). The second threshold for this item is between the agree and the combined categories (as denoted by “sale (2)”). While there was substantial variability in the distribution of respondents across the latent variable, the distribution of item thresholds was more limited. According to

IRM, items (or item thresholds) should cover the same distribution of the variable as the respondents. Portions of the latent variable not covered by item (or item thresholds) are considered sections not thoroughly validly assessed. Figure 1, thereby, indicates that items should be generated at both the easier and more difficult ends of this latent variable to enhance the validity of the scale.

The HFPMP scale with trichotomized responses was not correlated with social desirability or Home Fruit Availability (Table 4).

Home 100% Juice Pantry Management Practice (HJPMP)

Respondents tended to most frequently use the “strongly agree” category for the HJPMP responses, as revealed by the mean item responses (See Table 2). All items were discriminating. The one factor principal components solution provided a reasonable fit to the items accounting for 59.1% of the variance. The Cronbach’s alpha was 0.89 for the baseline assessment and 0.92 for the second assessment. The test-retest reliability was 0.71.

Inspection of the item response functions and unfit statistics derived from the IRM modeling of the HJPMP scale indicated the original 5-point response scale was functioning as a 3-point scale. Strongly disagree, disagree, and not sure were collapsed into one category so that the modified scale consisted of strongly agree, agree, and all others. The mean item scores using trinary responses are in Table 3. All items were discriminating and Cronbach’s alpha was 0.89. The PS reliability was 0.80, and test-retest ICC being 0.71 and 0.71 for the CTT and IRM scores, respectively.

The HJPMP item thresholds did not cover both a small portion of the easier end of the distribution of respondents and a major portion of the more difficult end (Figure 2). The HJPMP scale was not significantly correlated ($r = -0.05$) with social desirability, but was significantly correlated ($r = 0.37$) with Home 100% Juice Availability (Table 4). HJPMP was still significantly correlated ($r = 0.36$) with Home 100% Juice Availability after controlling for social desirability.

Home Vegetable Pantry Management Practices (HVPMP)

The means, standard deviations and item total correlations for each of the nine HVPMP items appear in Table 2. All items were discriminating. A single factor appeared to capture the meaningful variance in these items (66.2%). The single factor Cronbach alpha was 0.92 for the first administration and 0.93 for the second. The test-retest ICC was 0.67.

Inspection of the item response functions and infit statistics derived from the IRM modeling of the fruit HVPMP scale indicated the original 5-point response scale was functioning as a 3-point scale. Strongly disagree, disagree, and not sure were collapsed into one category so that the modified scale consisted of strongly agree, agree, and all others. The mean, standard deviation and item total correlations for the trinary response scales for these items appear in Table 3. All items were positively correlated with the total score and were therefore appropriately discriminating. The item difficulty estimates ranged from -0.77 to 0.66 (Table 3). The item threshold values ranged from -1.74 to 1.60. All infit values were within the acceptable range except for use of coupons, which was retained in the scale. The Cronbach’s alpha for the scale with trinary responses was increased to 0.91. The PS reliability was 0.86. The test retest ICC were 0.67 and 0.64 for the CTT and IRM scores, respectively.

The item threshold values did not cover the extreme easier or extreme more difficult ends of the underlying distributions (see Figure 3). The HVPMP was not significantly correlated with social desirability, but was significantly correlated 0.23 with Home Vegetable Availability.

HVPMP was significantly correlated 0.36 with Home Vegetable Availability after correcting for social desirability (see Table 4).

Home Fruit, 100% Juice and Vegetable Availability

The means, standard deviations, and item total correlations for each of the three scales appear in Table 5. All items in the scales were at least moderately discriminating ($CITC > 0.20$) (except beans, french fries, and cole slaw). A one factor solution appeared to capture meaningful variance in each set of items (fruit: 34.4%, 100% juices: 55.5%, vegetables: 25.4%). The Cronbach's alpha for the fruit items was 0.68 and 0.67 for the first and second administration; 0.40 and 0.41 for the first and second administration of the 100% Juice items; and 0.69 and 0.67 for the first and second administration of the vegetable items. The test retest ICC was 0.74 for home fruit availability; 0.58 for home 100% fruit juice availability and 0.68 for home vegetable availability. The difficulty estimates ranged from -2.36 to 1.49 for the home fruit availability scale; -1.46 to 1.50 for the home 100% juice availability; and -2.41 to 2.35 for home vegetable availability. All the item misfit values were within the acceptable range for each scale. The PS reliability was 0.67 for home fruit availability; 0.41 for home 100% juice availability; and 0.67 for home vegetable availability. The fruit and vegetable items covered most of the distribution of underlying the home fruit and vegetable availability scales (Figures 4 & 5).

Discussion

In this generally low socioeconomic sample, the three home fruit, 100% juice and vegetable availability scales had generally acceptable characteristics, with each adequately functioning as a single dimension. The fruit most likely to be available in the home were bananas, oranges, and apples, while the least likely were plums, dried fruit and kiwi. This corresponds with preferences for fruit in other studies 6. The most likely vegetables to be available in the home were lettuce, tomatoes and beans, while the three least likely to be available were cole slaw, potato salad and greens. The low availability of cole slaw and potato salad may reflect the need to prepare them and possible spoilage after preparation (i.e., can't keep them in the refrigerator for long) or their being infrequent special occasion foods (e.g., Independence Day, Cinco de Mayo).

A set of three scales was created to identify home pantry management practices separately for purchasing canned, bottled or frozen fruit, 100% juice, and vegetables as part of a program of research on predictors of home FJV availability. Adequate psychometric characteristics were obtained for each of these scales once the response scales were reduced to three categories. The 100% juice and vegetable home pantry management scales correlated with the corresponding home 100% juice and vegetable availability scale (an indicator of validity). These scales appear ready for use by other investigators of home FJV availability, but should be validated in other samples.

IRM scales are similar to Guttman scales in that agreement with items later in the scale assume agreement with items earlier in the scale. Thus, a person's position or score on an IRM scale can be understood as the point on the latent variable where the respondent agreed with items to that point, but not with items beyond that point. The items at the more numerically positive end of the scale are generally harder to agree with (thereby meriting the "difficulty to respond" label). For example, among home fruit availability the more commonly consumed fruit (bananas, oranges, apples) were at the easier to agree with end of the scale, and the less commonly consumed fruit (plums, dried fruit, and kiwi) were at the "more difficult to agree with" end of the distribution. Similarly, for home vegetable availability, lettuce and tomatoes were at the easier to agree with (i.e., more likely to be available at home) end of the scale and

the less commonly available foods, potato salad and cole slaw, were at the more difficult to agree with end.

One possible implication of this progressive agreement sequencing of items along the underlying scale is that interventions targeting these 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 others have next most often agreed with. This suggests that this would be the easiest point along the variable to achieve change. For example, if a respondent had bananas, oranges and apples available at home, grapes should be the next easiest fruit to convince the respondent to make available at home. This intervention implication, however, remains to be tested.

For the fruit and 100% juice scales, the easiest to agree with items were "purchasing them when on sale", but for vegetables it was "when I run out". This suggests that fruit and 100% juice were more luxury items, but vegetables were always kept in stock at home. Purchasing as a function of habit or purchasing with coupons were the most difficult to agree with items. This suggests that purchasing as a function of habit is not a key factor in purchasing decisions for canned, bottled or frozen FJV and making coupons more available for these items will not enhance their purchase. It is not clear if this is because these respondents did not have access to coupons (e.g., did not get a newspaper), did not usually use coupons, or the financial incentive of using coupons was not enough to overcome their perceived high cost 3.

It is usually prescribed that the difficulty estimates of items or their thresholds in IRM scales should vary from -3.0 to +3.0, and that items cover all the portions of the distribution of people so that items are really tapping the underlying beliefs. The items in these home pantry management scales tended to vary in difficulty from approximately -1.7 to +1.6. This suggests that items need to be generated and tested at the extremely easy and difficult ends of the distribution.

IRM enhanced the CTT analysis of these scales by identifying trinary response categories as better fitting the responses provided. This suggests that future versions of this scale should use only a three category response. The sequencing of items within scales by difficulty of item response revealed patterns that were easily interpreted and meaningful, resulting in suggested guidance for programs to increase FJV 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 converting to simpler trinary response categories. These were valuable contributions for the development of new scales.

The strengths of this research include the reasonably large sample for a validation study and the assessment of test-retest reliability of scales, the assessment and statistical control for social desirability of response, and the diverse ethnic and socioeconomic 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), not covering the full underlying dimensions of the corresponding variables, the demographics of the sample for which the results may not generalize to other groups, and the small sample of small local grocery stores. Given the mismatch between the pantry management scale concerning only canned, bottled or frozen FJV, and the home availability scale including any form of FJV, correlations would have been even higher if the home availability measure were restricted to canned, bottled or frozen FJV.

Conclusion

Home FJV Management Practices for canned, bottled or frozen FJV and home availability of FJV can be quantified. The sequence of items can be meaningfully interpreted. The scales relate to other variables in expected and meaningful ways, providing evidence of construct validity.

Investigators should use these variables to better understand influences on home FJV availability. Tests of the possible intervention tailoring implication should be tested.

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Figure 1.

Wright Map of Item Thresholds for Home Fruit Management Practices (Each 'X' represents 1.2 cases and the labels for thresholds show the levels of item, and step, respectively)

Figure 2.

Wright Map of Item Thresholds for Home Juice Management Practices (Each 'X' represents 1.2 cases and the labels for thresholds show the levels of item, and step, respectively)

Figure 3.

Wright Map of Item Thresholds for Home Canned Vegetable Management Practices (Each 'X' represents 1.3 cases and the labels for thresholds show the levels of item, and step, respectively)

Figure 5.
Wright Map of Item Thresholds for Availability of Vegetables in the Home (Each 'X'
represents 0.3 cases)

Table 1

Means (M), Standard Deviations (SD), Frequencies (n), and Percentages (%) for Demographic Characteristics Of Subjects Completing Home Canned Fruit, Juice, and Vegetable Management Practices Scales Stratified by Inclusion and Interview Status

Characteristic	Excluded (n=86) ^a	Included (n=162)	Total (n=248)
Self-reported Age $M \pm SD$ (n)	34.6 $\pm$ 6.9 (13)	38.5 $\pm$ 9.3 (156)	38.2 $\pm$ 9.1 (169)
Interviewer-assessed Gender n(%)			
Male	19 (22.1)	29 (17.9)	48 (19.3)
Female	65 (75.6)	111 (68.5)	176 (71.0)
Missing	2 (2.3)	22 (13.6)	24 (9.7)
Interviewer-assessed Race/Ethnicity n(%)			
White	9 (10.5)	20 (12.3)	29 (11.7)
Hispanic	29 (33.7)	55 (34.0)	84 (33.9)
Black	46 (53.5)	61 (37.7)	107 (43.1)
Other	0 (0.0)	3 (1.9)	3 (1.2)
Missing	2 (2.3)	23 (14.1)	25 (10.1)
	Completed Both Interviews (n=122)	Completed 1 st Only (n=40)	Total (n=162)
Self-reported Age $M \pm SD$ (n)	39.2 $\pm$ 8.8 (118)	36.6 $\pm$ 10.3 (38)	38.5 $\pm$ 9.3 (156)
Gender n(%)			
Male	25 (20.5)	6 (15.0)	31 (19.2)
Female	92 (75.4)	32 (80.0)	124 (76.5)
Missing	5 (4.1)	2 (5.0)	7 (4.3)
Race/Ethnicity n(%)			
Hispanic	50 (41.0)	15 (37.5)	65 (40.2)
White-non-Hispanic	15 (12.3)	2 (5.0)	17 (10.5)
Black	48 (39.3)	18 (45.0)	66 (40.7)
Other	4 (3.3)	3 (7.5)	7 (4.3)
Missing	5 (4.1)	2 (5.0)	7 (4.3)
Highest Education in Household n(%)			
GED, HS graduate or less	64 (52.5)	17 (42.5)	81 (50.0)
Some college/voc/tech school	32 (26.2)	11 (27.5)	43 (26.5)
College Graduate (baccalaureate)	16 (13.1)	7 (17.5)	23 (14.2)
Advanced degree	6 (4.9)	3 (7.5)	9 (5.6)
Missing	4 (3.3)	2 (5.0)	6 (3.7)
Language Spoken in Home n(%)			
All of another language	21 (17.2)	6 (15.0)	27 (16.7)
Mostly another language	7 (5.7)	1 (2.5)	8 (4.9)
2 languages equally	14 (11.5)	5 (12.5)	19 (11.7)
Mostly English	16 (13.1)	4 (10.0)	20 (12.3)
All English	60 (49.2)	22 (55.0)	82 (50.6)
Missing	4 (3.3)	2 (5.0)	6 (3.7)

No significant differences among inclusion and interview status was observed (Note: Missing was not recognized as a category in computing test statistic)

^aExclusion due to no participation for reasons unknown (n=70), technical problems with data (n=11), and missing food management scale item responses (n=5)

Results from Item Analyses and Principal Components Analyses (with Varimax Rotation) of Home Canned Fruit, Juice, and Vegetable Management Practices Scales

Table 2

Scale	M (SD)	CITC	One Factor		Two Factor		% Variance Explained Cronbach's alpha ICC
			1		1	2	
I decided to buy more canned, bottled, or frozen FRUIT ...							
...when they are on sale	4.0 (1.3)	0.57	0.68		0.42	0.61	59.1% / 10.7%
...when I have a coupon for them	3.4 (1.6)	0.44	0.57		0.13	0.92	0.88 / 0.88
...when I am running low	3.8 (1.4)	0.73	0.80		0.70	0.40	0.64
...when I run out	3.9 (1.5)	0.67	0.79		0.81	0.13	
...to replace what we have eaten	3.8 (1.4)	0.77	0.86		0.80	0.28	
...to stock up on them	3.8 (1.5)	0.70	0.78		0.76	0.25	
...as a habit every time I go shopping	3.4 (1.6)	0.69	0.80		0.78	0.19	
...to keep a variety at home	3.9 (1.4)	0.74	0.83		0.79	0.24	
I decided to buy more canned, bottled, or frozen 100% JUICE ...							
...when they are on sale	4.2 (1.3)	0.60	0.67		0.33	0.79	59.1% / 13.1%
...when I have a coupon for them	3.7 (1.5)	0.45	0.54		0.12	0.89	0.89 / 0.92
...when I am running low	4.0 (1.3)	0.77	0.84		0.75	0.38	0.71
...when I run out	4.2 (1.2)	0.69	0.78		0.69	0.37	
...to replace what we have drunk	4.2 (1.2)	0.75	0.83		0.77	0.33	
...to stock up on them	4.0 (1.3)	0.76	0.84		0.83	0.23	
...as a habit every time I go shopping	3.8 (1.5)	0.72	0.81		0.72	0.14	
...to keep a variety at home	3.9 (1.4)	0.70	0.79		0.85	0.09	
I decided to buy more canned, bottled, or frozen VEGETABLES ...							
...when they are on sale	3.9 (1.4)	0.70	0.76		0.46	0.73	66.2% / 10.0%
...when I have a coupon for them	3.5 (1.6)	0.55	0.63		0.19	0.91	0.92 / 0.93
...when I am running low	3.9 (1.4)	0.84	0.90		0.81	0.38	0.67
...when I run out	4.1 (1.3)	0.78	0.84		0.74	0.40	
...to replace what we have eaten	3.8 (1.5)	0.80	0.86		0.84	0.27	
...to stock up on them	3.9 (1.4)	0.80	0.86		0.83	0.29	
...as a habit every time I go shopping	3.6 (1.5)	0.73	0.80		0.82	0.18	
...to keep a variety at home	3.9 (1.4)	0.77	0.83		0.80	0.28	

Abbreviations: M=mean, SD=standard deviation, CITC=corrected item-total correlation

Table 3

Estimates Derived from Classical Test Theory (CTT) Analysis and Item Response Modeling (IRM) Analysis of Home Canned Fruit, Juice, and Vegetable Management Practices Scales (Trichotomized)

Group Item	M (SD)	CTTC	Average Item Difficulty		Thresholds		Infitt MSQ		Cronbach's alpha PS Reliability ICC (1), ICC(2)
			Est (SE)		Step 1	Step 2	Average	Step 1	Step 2
I decided to buy more canned, bottled, or frozen FRUIT ...									
...when they are on sale	1.28 (0.79)	0.53	-0.39 (0.10)	-1.22	0.44	1.17	1.02	1.07	0.87
...to keep a variety at home	1.26 (0.82)	0.69	-0.31 (0.25)	-0.95	0.34	0.91	0.95	0.96	0.79
...when I run out	1.25 (0.86)	0.64	-0.24 (0.09)	-0.67	0.19	0.90	0.92	0.91	0.65, 0.62
...to stock up on them	1.21 (0.83)	0.69	-0.16 (0.10)	-0.84	0.53	0.91	0.94	0.90	
...to replace what we have eaten	1.14 (0.78)	0.71	-0.02 (0.10)	-0.98	0.95	0.84	0.96	0.92	
...when I am running low	1.13 (0.80)	0.70	0.01 (0.10)	-0.89	0.91	0.85	0.94	0.87	
...when I have a coupon for them	0.95 (0.85)	0.40	0.53 (0.09)	-0.14	1.20	1.40	0.99	1.22	
...as a habit every time I go shopping	0.95 (0.88)	0.63	0.57 (0.09)	0.09	1.06	1.03	0.96	1.07	
I decided to buy more canned, bottled, or frozen 100% JUICE ...									
...when they are on sale	1.45 (0.74)	0.54	-0.52 (0.10)	-1.31	0.28	1.25	0.95	1.02	0.89
...to replace what we have drunk	1.39 (0.76)	0.74	-0.31 (0.10)	-1.15	0.53	0.72	0.87	0.72	0.80
...when I run out	1.39 (0.78)	0.68	-0.27 (0.10)	-1.01	0.47	0.94	0.93	0.92	0.71, 0.71
...to stock up on them	1.27 (0.77)	0.73	0.01 (0.10)	-0.97	1.00	0.94	0.95	0.91	
...to keep a variety at home	1.28 (0.80)	0.67	0.06 (0.27)	-0.73	0.84	1.01	0.93	0.96	
...when I am running low	1.28 (0.79)	0.76	0.07 (0.10)	-0.79	0.92	0.80	0.89	0.75	
...as a habit every time I go shopping	1.17 (0.84)	0.71	0.42 (0.10)	-0.27	1.12	1.00	0.93	0.99	
...when I have a coupon for them	1.14 (0.87)	0.43	0.53 (0.10)	-0.02	1.08	1.47	0.98	1.29	
I decided to buy more canned, bottled, or frozen VEGETABLES ...									
...when I run out	1.40 (0.77)	0.76	-0.77 (0.11)	-1.74	0.21	0.89	0.87	0.91	0.91
...to keep a variety at home	1.25 (0.77)	0.72	-0.22 (0.29)	-1.41	0.97	0.91	0.96	0.95	0.86
...when I am running low	1.23 (0.80)	0.80	-0.19 (0.11)	-1.26	0.89	0.85	0.94	0.92	0.67, 0.64
...when they are on sale	1.25 (0.81)	0.61	-0.16 (0.11)	-1.13	0.80	1.27	1.03	1.17	
...to stock up on them	1.22 (0.78)	0.77	-0.09 (0.11)	-1.28	1.09	0.87	0.91	0.95	
...to replace what we have eaten	1.16 (0.84)	0.78	0.17 (0.11)	-0.63	0.98	0.85	0.86	0.83	
...as a habit every time I go shopping	1.04 (0.82)	0.68	0.60 (0.11)	-0.41	1.60	1.07	0.95	1.01	
...when I have a coupon for them	1.02 (0.86)	0.51	0.66 (0.11)	-0.08	1.39	1.52	1.01	1.29	

Abbreviations: M=mean, SD=standard deviation, CTTC=corrected item-total correlation, Est=IRM item parameter estimate, SE=IRM parameter standard error, infitt MSQ=IRM weighted mean square index, PS reliability=IRM person separation reliability, ICC(1)=intra-class correlation between time 1 and time 2 CTT estimates, ICC(2)=intra-class correlation between time 1 and time estimates IRM estimates

Table 4

Correlations between Home Canned Fruit, Juice, and Vegetable Management Practices and Fruit, Juice, and Vegetable Availability With and Without Controlling for Social Desirability

	Social Desirability	Availability
Unadjusted		
Home Fruit Management Practices	0.02	0.09
Home Vegetable Management Practices	-0.01	0.23**
Home Juice Management Practices	-0.05	0.37**
Adjusted for Social Desirability		
Home Fruit Management Practices		0.11
Home Vegetable Management Practices		0.23**
Home Juice Management Practices		0.36**

Note: Each food group management practices is correlated with its corresponding food group availability

**
p < 0.01

Table 5

Results from the Item Analyses (Classical Test Theory and Item Response Modeling) and Principal Components Analyses (with Varimax Rotation) of Availability of Fruit, Juice, and Vegetables Scales

Group Item	M (SD)	CITC	One Factor		Two Factor		Item Difficulty		Infit MSQ	% Variance Explained Alpha/PS Reliability ICC(1)/ ICC(2)
			1		1	2		Est.		
Fruit										
Bananas	0.88 (0.32)	0.39	0.74		0.36			-2.36	0.93	34.4% / 13.3%
Oranges	0.85 (0.36)	0.44	0.63		0.22			-1.99	0.98	0.68/0.67
Apples	0.81 (0.39)	0.25	0.73		0.47			-1.71	0.91	0.74/0.70
Grapes	0.64 (0.48)	0.34	0.38		0.64			-0.65	1.05	
Fruit Salad	0.56 (0.50)	0.21	0.49		0.5			-0.26	0.88	
Peaches	0.44 (0.50)	0.34	0.49		0.38			0.39	0.92	
Cantaloupe	0.39 (0.49)	0.27	0.4		-0.15			0.64	1.14	
Pears	0.38 (0.49)	0.27	0.65		0.39			0.57	0.91	
Applesauce	0.38 (0.49)	0.34	0.34		0.69			0.72	1.00	
Watermelon	0.34 (0.47)	0.24	0.53		-0.04			0.84	1.08	
Plums	0.33 (0.47)	0.31	0.52		0.29			0.94	1.02	
Dried Fruit	0.27 (0.44)	0.34	0.43		0.32			1.31	1.02	
Kiwi	0.23 (0.42)	0.30	0.55		0.28			1.49	1.00	
Juice										
Orange Juice	0.82 (0.39)	0.20	0.47		n/a			-1.46	1.04	55.5% / na
Apple Juice	0.59 (0.49)	0.27	0.67		--			-0.04	1.00	0.40 / 0.41
Grape Juice	0.30 (0.46)	0.24	0.6		--			1.50	1.02	0.58/0.56
Vegetables										
Lettuce	0.95 (0.23)	0.23	0.7		0.69			-2.41	1.00	25.4% / 16.7%
Tomatoes	0.94 (0.24)	0.23	0.64		0.96			-2.31	0.98	0.69 / 0.67
Beans	0.90 (0.30)	0.15	0.21		0.09			-1.71	1.00	0.68/0.68
Corn	0.88 (0.32)	0.24	0.16		-0.33			-1.51	1.03	
Carrots	0.77 (0.42)	0.33	0.52		0.45			-0.63	0.99	
Broccoli	0.70 (0.46)	0.32	0.55		0.43			-0.18	1.03	
Green Beans	0.69 (0.46)	0.37	0.4		0.13			-0.14	0.98	
Mashed Potatoes	0.62 (0.49)	0.41	0.55		0.33			0.23	0.96	
Other White Potatoes	0.59 (0.49)	0.23	0.34		0.3			0.34	1.07	
Green Peas	0.59 (0.49)	0.39	0.41		0.06			0.35	1.02	
Celery	0.55 (0.50)	0.33	0.5		0.49			0.48	1.02	
Other Cabbage	0.54 (0.50)	0.28	0.41		0.39			0.59	1.05	
Spinach	0.52 (0.50)	0.36	0.47		0.28			0.6	0.99	
Refried Beans	0.53 (0.50)	0.21	0.39		0.39			0.63	1.06	
French Fries	0.52 (0.50)	0.11	0.17		0.05			0.66	1.19	
Greens	0.43 (0.50)	0.35	0.43		0.26			1.01	0.99	
Potato Salad	0.31 (0.46)	0.30	0.73		0.8			1.67	1.01	
Cole Slaw	0.19 (0.39)	0.16	0.26		0.26			2.35	1.13	

Abbreviations: M=mean, SD=standard deviation, CITC=corrected item-total correlation, Est=IRM item parameter estimate, Infit MSQ=IRM weighted mean square index, PS reliability=IRM person separation reliability, ICC(1)=intra-class correlation between time 1 and time 2 CTT estimates, ICC(2)=intra-class correlation between time 1 and time estimates IRM estimates