

RESEARCH ARTICLE

Preschool Children's Self-Reports of Fruit and Vegetable Knowledge, Preference, and Messages Encouraging Consumption

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ABSTRACT

BACKGROUND: Fruit and vegetable consumption (FVC) is associated with a reduced risk of diabetes, obesity, cancer, and cardiovascular disease. Only one third of children aged 4-8 years consume the recommended 5 servings a day. Studies involving school-aged children (6-11 years) demonstrate that positive outcome expectancies can mediate FVC. There is a lack of similar studies involving preschool-aged (<5 years) children. The purpose of this study was to assess preschool children's knowledge and preference of fruits and vegetables, messages they recall hearing related to FVC, and how they perceive these messages.

METHODS: Children (N = 192) were individually interviewed with a play-based picture card game followed by a mealtime environment reenactment open-ended interview. Fruit and vegetable messages were operationalized using Social Cognitive Theory (SCT). Descriptive statistics and associations are reported.

RESULTS: Each child recalled an average of 2.27 messages associated with FVC. Positive outcome expectancies, negative outcome expectancies, and prompts were most frequently recalled. Statistically significant differences in knowledge, preference, and messages were observed based on income.

CONCLUSIONS: Children as young as age 4 years understand positive outcome expectancies. Experimental trials are warranted to determine if tailored expectancy messages mediate FVC among preschool children.

Keywords: Social Cognitive Theory; positive outcome expectancies; fruit and vegetable consumption; preschool children; assessment.

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Children who are overweight or obese are more likely to be so in adulthood, potentially adding to costs associated with adult obesity.¹ The precursors of obesity, including hypertension, atherosclerosis, and blood lipid and insulin disorders can begin in childhood and are evident in obese children aged 5-17 years.^{2,3} With approximately 10% of all preschool children and 15% of low-income preschool children already being obese by age 5 years⁴ working with preschool-aged children is essential in the prevention of obesity and comorbidities.⁵⁻⁸

Diets high in fruits and vegetables are associated with a lower risk of obesity, diabetes, cancer, and cardiovascular disease for children and adults.^{2,9} Parents are the main role model and provider for a child's fruit and vegetable consumption (FVC).^{10,11} When encouraging FVC, care must be taken with the type of communication used. Persistent prompting such as "finish your vegetables please," can have a negative effect on consumption.¹² In contrast, specific prompts that involve a choice, "would you like an apple or juice?"¹³ can increase FVC among fourth

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graders as can positive outcome expectancies like “fruits and vegetables make you strong,” which are considered a mediator for FVC among fourth-grade children.^{14,15} Additionally, positive outcome messages paired with video demonstrating positive gains show promise with children aged 5-6 years.¹⁶

Positive outcome messages such as “FVC makes you strong and healthy” and perceptions of liking or disliking an outcome have not been extensively studied through child self-reports with children as young as 4 years of age. Studies involving children under age 5 years focus on children’s perceptions of the whole food environment using an effective, but time consuming, fully play-based approach¹⁷ or focus on taste preference and use dyadic interviews.¹⁸ A gap in the literature related to using Social Cognitive Theory (SCT) and assessing children’s understanding of the benefits of FVC with children age 4 years is apparent. In contrast, a variety of obesity and fruit and vegetable interventions exist for upper elementary (grades 4 and 5) with SCT utilized as the framework or evaluation tool.^{14,15,19-21} SCT, a theory for explaining behavior,²² has undergone multiple revisions since its inception. Eleven constructs or concepts exist to explain behavior, but not all constructs need to be used at one time.²³ Construct definitions and their use in many fruit and vegetable interventions, including this study, are listed in Table 4. Interventions identified specifically for preschool children^{24,25} did not specify a theory used for evaluation criteria.

The preschool early developmental age is a critical time to help children adopt healthy behaviors.^{24,26} However, approximately 80% of childhood obesity research targets school-aged children of which 90% are knowledge based.^{5,27-29} Interventions should be implemented before children’s taste preferences become dominated by caloric dense foods high in fat, salt, and sugar.²⁷ However, for an intervention to be most effective, it is deemed necessary to perform a comprehensive assessment of the population. Preschool children provide specific challenges which this study sought to overcome with the intent of exploring the viability of using tailored messages derived from SCT constructs, like positive outcome expectancies, with this younger population. Hence, the purpose of this study was to assess preschool children’s knowledge and preference of fruits and vegetables, what messages they recall hearing associated with FVC, such as “eating vegetables makes you healthy,” and how they perceive these messages.

METHODS

Children (N = 220) aged 4 years attending a lottery-funded preschool center were eligible for study participation. Informed consent was obtained from parents for 91.4% (N = 201) of eligible children. Two

children for whom consent was obtained withdrew from the school prior to being interviewed. Seven children did not talk at all during the interview and were not included in the analysis. A final sample of 87.3% (N = 192) or a 95.5% sample response rate was obtained. The mean age of children at the time interviews began was 4.44 years (SD = 0.28) and ranged from age 4.0 to 4.9 years. Most subjects were boys (50.5%). Most children in the sample were White (non-Hispanic) (45.7%) and Black (non-Hispanic) (41.7%) with a small representation of Hispanic/Latino (9.5%), biracial/multiracial (2.5%), and Asian (.5%). About two thirds (64.5%) of children lived in a household earning a total income below \$20,000.

Instrumentation

SCT²² and Piaget’s preoperational child developmental stage provided the framework for developing the play-based assessment involving picture cards and a brief qualitative interview. Tasks were tailored specifically for children aged 4 years in the preoperational stage of cognitive development.³⁰

A reporting form with standardized instructions was developed to record responses to the following measures. *Knowledge*: Picture cards of 11 fruits and 12 vegetables were created to assess knowledge which was defined as the child’s ability to name the fruit or vegetable. Items were regionally appropriate, in season, and readily available at local grocery stores. Multiple forms of the fruit or vegetable, whole fresh peach and sliced canned peach, for example, were used in pictures to help increase recognition. *Preference*: Picture cards were used to categorize fruit and vegetable items into like, dislike, and never tried piles. Emoticon faces aided children in sorting pictures. A smiling emoticon represented a “like,” a frowning with tongue out emoticon represented “dislike,” and a question mark represented “never tried.” *Self-reported fruit and vegetable messages and child perceptions of messages*: A structured set of open-ended questions with probes that re-created the home mealtime environment was designed to elicit responses associated with what messages about FVC the child recalls and how the child perceived these messages. An example of a recalled message included, “vegetables make you stronger”; and a perception was, “I like . . . so I can lift things like Dad.”

Procedure

The protocol was adapted using previously validated methods from other studies involving children aged 4 years.^{17,18,31} Pilot testing was done with a sample similar to the study population. The protocol was reviewed and approved by the university institutional review board and participating school-board superintendent. The preschool director and teachers assisted in

the development of methods and in obtaining parent consent. Child interviews lasted 10-15 minutes, were digitally audio-recorded, and responses were recorded on a standard reporting form. Multiple forms of documentation, including audio recordings, notes, and codebooks, were used to strengthen the credibility and integrity of the data.³²

The following step-by-step protocol was followed. During class time, children were asked individually (child assent) if they would like to play the fruit and vegetable picture card game. Before the interview began, the child was offered a sticker and chose one while the researcher started the audio recorder. The objective and rules were explained as follows. The object was to name the fruit or vegetable (knowledge) they saw and describe what they thought about it (preference). A practice round was done to ensure children understood the procedures and pictures. Particular attention was given to encouraging children to say "I don't know" for preference if they had not tried the fruit or vegetable. It was explained that the question mark was used for items not tried. The first fruit picture was turned over and the child was asked "What is this?" Questions during the knowledge portion of the picture card game were simple and direct as children this age have the cognitive ability to connect names to objects.³⁰ If the child could not identify the fruit or vegetable, they were asked if they needed help. Once the picture was correctly identified by the child or named for them, the child was asked "have you tried this?" If they said no, the picture was put by the question mark in the "never tried" pile. If they stated a preference, the card was placed accordingly into the "like" or "dislike" pile. Great care was taken to keep questioning neutral. Never was the phrase "do you like this" used. In some cases, children were eager and took the cards, turned them over, and placed them into appropriate piles themselves. This was always encouraged to help increase motivation. These children were still guided by the researcher dialogue. Ordinarily, the researcher turned over the cards and placed them into piles. In rare cases (N=7) if a child said nothing during the knowledge and preference phase, the interview was terminated, otherwise the interview continued with the open-ended question phase.

With the picture cards still in view, the structured open-ended questions with probes were started. The interview sequence began with broad questions and narrowed to more specific questions while still maintaining the necessary non-leading format.³¹ When children stated an outcome expectancy like "get strong" or "get sick," follow-up questions asking what they thought about being strong were asked to determine how the child perceived this outcome. If they reported they "liked" or "didn't like" the outcome, the message was coded as the SCT

construct outcome expectancy. If they reported they did not know, the message was coded as an outcome expectation. Finally, to connect the outcome further with specific activities the child liked, the child was asked why they liked or did not like the outcome.

Most child responses were short, consisting of 1 to 5 words. In cases where a child spoke for a long time, could not be clearly heard, or words were simply missed, the form was marked for later audio review. All open-ended questions and probes on the structured guide were asked before the interview ended. Upon completion, regardless of the quantity of responses, the child was thanked and offered a sticker. The interview recording form was secured into an envelope, the child was escorted back to class, and the next child on the list was called and asked to participate.

Data Preparation (Coding)

SCT construct definitions were used to develop an a priori code book and guide the operationalization of recalled messages into appropriate SCT constructs. Updates to the codebook became an iterative process as some messages required a consensus from evaluators to determine which definition the message best fit. In addition to SCT definitions, criteria and examples reported in the literature^{12,15,33,34} were used to assist in the interpretation of child statements and coding (Table 4). Some negative reinforcement messages consisted of a threat of a future negative outcome like not being allowed to watch TV. It was necessary to make the assumption that the intention of parents was to increase FVC. Hence, the "threat" was the negative stimulus and removing the "threat" was the reinforcement. No reported negative outcome was considered punishment as the intent would then be to decrease the behavior.³⁵

Prior to coding, all forms were reviewed to gain an understanding of what the children self-reported and to assess the trustworthiness of the data.³² Audio recordings were reviewed and additional information was added to the forms as necessary. Interview recording forms were reviewed first by the lead researcher. Each individual participant's form was reviewed and coded within a class before proceeding to the next class. As each subject's form was coded, the actual statement was recorded on a tabulation form to consolidate messages onto one document. Codes were treated as continuous variables representing a total number of messages reported for each construct. Next, a cross-check of codes³² was conducted by the lead researcher and a research assistant who reassessed each participant's form to ensure integrity of the coding process and mitigate possible drifting³⁶ in the first round of coding. Disagreements were discussed until consensus was reached and a code was finalized. A final cross-check was conducted with a third researcher using a consensus method.

Messages that did not fit any SCT definition were excluded.

Data Analysis

Data were collected for 7 income tiers of \$10,000 increments. The study sample median income of \$20,000 was used as the marker to categorize subjects in $\leq \$20,000$ or $> \$20,000$ categories. At the time of the study, the poverty threshold for a family of 3 was \$18,530 and \$22,350 for a family of 4.³⁷ We also conducted analysis using a $\leq \$30,000$ and $> \$30,000$ threshold. These analyses produced the same pattern of results reported using the \$20,000 threshold. Descriptive statistics were performed to generate frequencies, means, and standard deviations for each type of message.

The independent samples t-test with $\alpha \leq 0.05$ was used to assess differences related to sex and income levels. The Bonferroni post hoc test was used to control for type-1 error. Cohen's d was calculated for each test. Correlations between knowledge, preference, and messages were assessed using Pearson's product-moment correlation test, 2-tailed, with $\alpha \leq 0.05$ used for significance level. Effect sizes were reported using r^2 . Only SCT coded messages were used in the analysis. Coded messages were counted only once per child when calculating how many children stated each type of SCT message. All coded messages were included in correlation analyses.

RESULTS

Knowledge

The fruits correctly identified by the most children included apples (95.8%, $N=184$), bananas (95.8%, $N=184$), and strawberries (82.8%, $N=159$). Vegetables correctly identified by the most children included corn (79.7%, $N=153$), carrots (72.4%, $N=139$), and broccoli (50.5%, $N=96$). Children correctly identified an average of 6.27 ($SD=1.93$, $N=192$) of the 11 fruits and 4.07 ($SD=2.34$, $N=192$) of the 12 vegetables. Statistically significant differences were observed for income. Children in $> \$20,000$ households ($M=12.16$, $SD=3.83$) identified more fruits and vegetables than children in $\leq \$20,000$ households ($M=9.75$, $SD=3.65$), $t(154)=-3.79$, $p \leq .01$, $d=0.62$. All knowledge results are reported in Table 1.

Preference

The most preferred fruits self-reported by children were apples (93.2%, $N=179$) followed by grapes (90.6%, $N=174$), bananas (89.6%, $N=173$), and oranges (86.5%, $N=166$). Vegetables of highest preference included corn (85.9%, $N=165$), green beans (83.3%, $N=160$), peas (79.2%, $N=152$), and potatoes (75.0%, $N=144$). Children liked an average

Table 1. Child Knowledge

	Percent Correctly Identified		
	All Children N = 192	$\leq \$20,000$ N = 102	$> \$20,000$ N = 59
Fruits			
Apple	95.8	98.0	96.6
Banana	95.8	94.0	98.3
Strawberry	82.8	79.4	89.8
Grapes	79.7	75.5	88.1
Watermelon	77.6	79.4	84.7
Orange	74.0	72.5	84.7
Blueberry	50.0	40.2	66.1
Peach	29.2	24.5	37.3
Pineapple	28.6	24.5	30.5
Cantaloupe	6.8	4.9	10.2
Plum	6.8	8.8	5.1
Mean number correct/SD	6.27/1.93	6.02**/1.81	7.02**/1.18
Vegetables			
Corn	79.7	76.5	91.5
Carrots	72.4	69.6	83.1
Broccoli	50.5	43.1	71.2
Beans (green, string, snap)	50.0	48.0	57.6
Peas	35.9	28.4	40.7
Potatoes	33.3	28.4	45.8
Tomatoes	33.3	32.4	44.1
Lettuce	15.6	12.7	20.3
Greens (collards, mustards)	13.5	15.7	13.6
Bell peppers	8.9	6.9	15.3
Celery	8.3	5.9	13.6
Squash	5.8	4.9	10.2
Mean number correct/SD	4.07/2.34	3.73**/2.23	5.14**/2.36

** $p < .01$.

Knowledge was a score based on number of fruits and vegetables correctly identified. Percent correctly identified values are the proportion of the total sample and total sample per income strata. Values are in descending order only for all children.

SD, standard deviation.

of 8.49 ($SD=2.24$, $N=192$) of the 11 fruits and 7.27 ($SD=3.24$, $N=192$) of the 12 vegetables. Statistically significant differences were observed between income groups (Table 2). No statistically significant differences in preference were observed between boys and girls.

Messages

Approximately 81% of children ($N=155$) reported 1 or more messages that fit a SCT construct. An average of 2.27 ($SD=1.78$) messages ranging from 0 to 12 were reported per child (Table 3). Positive outcome expectancy messages were mentioned most frequently and at least once by 54.3% of children, followed by command prompts (33.9%), negative outcome expectancies (26.7%), positive reinforcements (19.6%), and negative reinforcements (19.0%). Each original message, "I will have good eyes" or "I won't get dessert," for example, was stated by multiple children. After coding, a child may have stated multiple types of SCT coded messages and each type of SCT coded message multiple times. A complete list of the

Table 2. Differences in Child Preference by Income

Knowledge/Preference Variable	≤\$20,000 N = 102		>\$20,000 N = 59		p-Value
	Mean	SD	Mean	SD	
Fruits liked	8.93	1.84	7.91	2.52	.00
Fruits disliked	0.85	1.33	1.23	1.48	.10
Fruits never tried	1.22	1.27	1.86	1.81	.01
Vegetables liked	7.48	3.16	6.61	3.78	.11
Vegetables disliked	2.00	2.39	2.32	2.22	.42
Vegetables never tried	2.52	2.10	3.07	2.29	.13
Total fruits and vegetables liked	16.43	4.43	14.44	5.35	.02
Total fruits and vegetables disliked	2.86	3.02	3.46	3.20	.18
Total fruits and vegetables never tried	3.74	2.99	4.93	3.62	.03

Statistically significant p values are in bold type.
SD, standard deviation.

Table 3. Frequency of Recalled Messages

SCT Construct	N	Mean	SD	Range	
				Minimum	Maximum
Environment/situation					
Positive prompt	15	0.08	0.29	0	2
Command prompt	74	0.38	0.58	0	3
Behavioral capability	8	0.04	0.20	0	1
Negative outcome expectations	4	0.02	0.14	0	1
Positive outcome expectancy	172	0.90	1.01	0	5
Negative outcome expectancy	66	0.34	0.62	0	3
Positive reinforcement	49	0.26	0.55	0	3
Negative reinforcement	45	0.23	0.52	0	3
Reciprocal determinism	3	0.02	0.12	0	1
Total number of messages	436	2.27	1.90	0	12

N = total number of times messages was stated. Individual children may have stated message more than once.
SCT, Social Cognitive Theory.

specific types of messages under each SCT construct stated by children is in Table 4.

Statistically significant differences in mean number of messages recalled were observed between income groups (Table 5). Behavioral capability messages were stated more by children in households with an annual income >\$20,000 ($M = 0.09$, $SD = 0.28$) than by children in households earning ≤\$20,000 ($M = 0.02$, $SD = 0.14$), $t(162) = -1.21$, $p = .05$, $d = 0.31$. Positive outcome expectancy messages were stated more by children in households earning >\$20,000 ($M = 1.19$, $SD = 1.10$) than by children in households earning ≤\$20,000 ($M = 0.72$, $SD = 0.93$), $t(162) = -2.81$, $p = .01$, $d = .46$. Negative outcome expectancies were stated more by children in >\$20,000 households ($M = 0.50$, $SD = 0.71$) than by children in ≤\$20,000 households ($M = 0.25$, $SD = 0.52$), $t(162) = -2.44$, $p = .016$, $d = 0.39$. Overall, children in >\$20,000 households ($M = 2.85$, $SD = 1.82$) stated more total messages than children in ≤\$20,000 household ($M = 1.92$, $SD = 1.93$), $t(162) = -2.95$, $p = .004$, $d = 0.49$. These results were potentially due to a small number of participants

in the >\$20,000 households reporting a large number of messages. To mitigate this possibility we also conducted analyses comparing children in ≤\$20,000 and >\$20,000 households and whether a message type was never stated or was stated at least once. This analysis produced an almost identical pattern of results. The majority (70%) of children in >\$20,000 households stated at least 1 positive outcome expectancy compared with 47% of children from ≤\$20,000 households, $\chi^2(1, N = 164) = 8.07$, $p = .005$. At least 1 negative outcome expectancy was stated by 38% of children from >\$20,000 households compared with 21% of children from ≤\$20,000, $\chi^2(1, N = 164) = 5.64$, $p = .02$. The exception was the number of children who stated a behavioral capability message. Only 5 children (8%) from >\$20,000 households stated a behavioral capability message compared with only 2 children (2%) from ≤\$20,000 households.

Correlations

Associations were observed between knowledge ($M = 10.34$, $SD = 3.93$) and positive outcome expectancies ($M = 0.89$, $SD = 1.01$), $r(190) = .44$, $p < .01$, $r^2 = .19$; negative outcome expectancies ($M = 0.34$, $SD = 0.62$), $r(190) = .34$, $p < .01$, $r^2 = .12$; and the total number of messages stated ($M = 2.27$, $SD = 1.89$), $r(190) = .46$, $p < .01$, $r^2 = .21$. These associations were maintained when stratified by income (Table 5).

Also, when stratified by income, new associations were observed. A statistically significant association between command prompts ($M = 0.33$, $SD = 0.55$) and knowledge ($M = 9.75$, $SD = 3.65$) was observed, but only for children in households earning ≤\$20,000, $r(100) = .22$, $p = .026$, $r^2 = .04$. Disliking fruits and vegetables ($M = 2.86$, $SD = 3.02$) was associated with negative outcome expectancies ($M = 0.25$, $SD = 0.52$) only for children in ≤\$20,000 income households, $r(100) = .22$, $p = .03$, $r^2 = .05$. Disliking fruits and vegetables ($M = 2.86$, $SD = 3.02$) was associated with negative outcome expectations ($M = 0.03$, $SD = 0.17$) only for children in households earning ≤\$20,000, $r(100) = .24$, $p = .01$, $r^2 = .06$. Finally, liking fruits and vegetables ($M = 14.44$, $SD = 5.35$) was associated with negative reinforcements ($M = 0.25$, $SD = 0.57$) only for children in >\$20,000 households only $r(57) = .26$, $p = .05$, $r^2 = .07$. All correlations are reported in Table 5.

DISCUSSION

The purpose of this study was to assess preschool children's self-reported knowledge and preference of fruits and vegetables, what messages they recall hearing related to encouraging FVC (eg, "vegetables make you healthy"), and how they perceive these

Table 4. Child Recalled Messages and Criteria for Coding

SCT Construct	Criteria	Messages
Environment/situation	Environment is the physical external features or stimuli with which the person interacts. Situation is how the person perceives the environment. Both have been used synonymously. ²³ Prompts, a product of the environment, are imperative statements made by the parent. ^{12,23} Positives prompts included context related to modeling.	Positive prompts: I love it! / Can you eat them with me? Command prompts: At least try a bite/Taste them. Eat them now/Eat it/You better eat it. You have to eat it/You are supposed to eat. You are wasting them.
Negative outcome expectations	The outcome is exclusively the result of not engaging in the desired behavior (FVC).	
Positive outcome expectancies	Outcome exclusively the result of engaging in desired behavior (FVC). Requires child to value outcome. Value was assessed by asking child if they liked or did not like the outcome. Responses varied from simply stating "like" to adding associations (see specific expectancy associations).	You will like it; it might be good. You get big/We grow. We can poop; go doo-doo. Get healthy. Good for you/my body. They are good. Body can run fast. Get strong; have bigger muscles.
Negative outcome expectancies	The outcome is exclusively the result of not engaging in the desired behavior (FVC). Requires the child to value the outcome.	We do not grow. We get sick. Have to see the doctor. We get hungry. We will not get strong. I won't need vitamins this week. I like to: exercise/play/jump. I can beat up brother. I can: box/ wrestle. I can lift up things. I can: bounce ball/ dunk ball. I get energy to run. Love having bigger muscles. I can jump on a trampoline.
Specific expectancy associations	I want to grow up so I can learn to drive a car I like. I can pull the wheel barrel I can go to sister's school I like to see better (in case you get scared in dark) I like because it makes me happy If you hold poop you could get sick Good to be healthy, makes us feel better	You get a cookie/candy/drink. You can have something to drink. You can watch a movie. Get to play with iPod. Can buy something at the store. Good job. Good, you ate it all. You will get in trouble. Get a spanking. Do not get to go play. Must stay at the table until finished. Do not get snack/drink/ice cream/Scooby snack. I ask for a plum, I ate it, and Mama bought more for me.
Positive reinforcement	The message had to clearly indicate the addition of a desirable stimulus such as a reward or praise. Controlled by external person. ³⁵	
Negative reinforcement	This required the removal of an undesirable stimulus (threat) or outcome. Controlled by external person. ³⁵	
Reciprocal determinism	Message indicated that a parent response or behavior was clearly a result of a child's request or behavior.	
Behavioral capability	A message that demonstrated clear intent to increase a child's knowledge or abilities in relation to FVC or preparation.	You can eat them like this. Eat when you are hungry. Tells me how to cook. Do not have to eat them if your belly is full.

Definitions for SCT constructs adapted from Ref. 23.
FVC, fruit and vegetable consumption.

messages or outcomes, in other words, if the child liked the outcome stated in the message. Studies using individual interviews to elicit self-reports from children this young were not identified. Based on the experience and data gained in this study, assessments of children aged 4 years are feasible and produce meaningful data. However, interpretation of the data

must be done with careful consideration of children's cognitive abilities.

Assessing knowledge and preference first provided a gateway to the more difficult open-ended assessment. The knowledge assessment helped children build confidence and elicited responses related to preference and at times, without being prompted, what family

Table 5. Income Differences and Intercorrelations

Variable	All Children Combined				≤\$20,000, N = 102				> \$20,000, N = 59				p-Value
	1	2	3	M, SD	1	2	3	M, SD	1	2	3	M, SD	
1. Total number of F&V child correctly identified (knowledge)	—	0.03	0.04	10.34, 3.93	—	0.09	0.00	9.75, 3.65	—	0.21	−0.01	11.98, 3.88	
2. Total number of F&V child likes (preference)	0.03	—	−0.74**	15.76, 4.94	0.09	—	−0.74**	16.43, 4.43	0.21	—	−0.72**	14.44, 5.35	
3. Total number of F&V child Dislikes (preference)	0.04	−0.74**	—	3.09, 3.08	0.00	−0.74**	—	2.86, 3.02	−0.01	−0.72**	—	3.46, 3.20	
Environment/situation													
Positive prompt	0.07	0.02	−0.85	0.08, 0.29	0.03	0.08	−0.02	0.05, 0.22	0.09	0.06	−0.20	0.13, 0.39	.08
Command prompt	0.15*	0.03	−0.03	0.38, 0.57	0.22*	0.10	−0.04	0.33, 0.55	−0.11	0.03	−0.04	0.43, 0.53	.22
Behavioral capability	0.09	0.01	−0.02	0.04, 0.20	0.03	−0.03	−0.06	0.02, 0.14	0.14	0.03	0.03	0.09, 0.28	.05
Negative outcome expectations	0.01	−0.11	0.21**	0.02, 0.14	−0.07	−0.14	0.24*	0.03, 0.17	0.17	−0.14	0.23	0.02, 0.13	.63
Positive outcome expectancy	0.44**	−0.03	0.05	0.89, 1.01	0.35*	0.11	−0.06	0.72, 0.93	0.43**	0.09	0.06	1.19, 1.10	.01
Negative outcome expectancy	0.34**	−0.19**	0.23**	0.34, 0.62	0.25*	−0.15	0.22*	0.25, 0.52	0.38**	−0.07	0.13	0.50, 0.71	.02
Positive reinforcement	0.11	−0.03	−0.01	0.25, 0.55	0.14	−0.04	−0.06	0.25, 0.59	0.10	−0.05	0.01	0.20, 0.44	.65
Negative reinforcement	0.04	0.06	−0.11	0.23, 0.52	0.06	−0.06	−0.06	0.25, 0.54	−0.01	0.26*	−0.21	0.25, 0.57	.86
Reciprocal determinism	0.13	0.04	0.03	0.02, 0.13	0.01	0.01	0.01	0.01, 0.10	0.22	0.11	0.03	0.03, 0.18	.28
Sum total of messages given in all constructs	0.46**	−0.06	0.07	2.27, 1.89	0.36**	0.01	−0.01	1.92, 1.93	0.48**	0.13	−0.01	2.85, 1.82	.01

Statistically significant correlations are represented with * $p < .05$; ** $p < .01$.

Income differences for means of recalled messages are in last column to right with statistically significant p-values in bold type.

F&V, fruits and vegetables; M, mean; SD, standard deviation.

members say. Knowledge was higher among children in households earning >\$20,000. This parallels research demonstrating income is a determinant of FVC because of greater availability and exposure.^{34,38} However, children of ≤\$20,000 households reported liking more items than children in >\$20,000 households. This was unexpected as research shows that preference is a product of repeated exposure.³⁹ One possible explanation is that recall is more difficult than recognition.⁴⁰ A one-time exposure may spark easy recognition, but not recall. Many children in this study recognized a fruit or vegetable and stated their preference before naming the item. Some eventually named it and received a score for knowledge. However, others used child-friendly names like trees instead of broccoli or could not name it at all. Additionally, prototyping commonly occurred when peaches and plums were misnamed as apple, the prototype fruit.⁴¹ In these scenarios, the child may have received a preference score, but not knowledge, therefore creating this disparity. These are examples of how cognitive abilities and experience must be considered when working with this age group.

The open-ended questions were effective in getting children to report a variety of messages they hear related to why they should eat fruits and vegetables. Initial child responses should be viewed as a reflection of what a parent or caregiver has said to them. The messages may be salient in the child's mind, but it may have no actual meaning to the child. To assess meaning, children were specifically asked what they thought about the outcome. Knowing if they like an outcome is important information as motivation

to do a behavior arises from positive outcome expectancies and value for the outcome.^{22,23} Hence, it is encouraging that more children (54.3%) reported more positive outcome expectancy messages compared with other messages. After responding whether they liked or did not like the outcome, they were then asked why. Knowing why helps understand more specifically what may motivate a child to eat fruits and vegetables. The impression many children made on the researcher was that they seemed to connect a like or dislike to an outcome, like being strong, to a specific activity they liked or wished they could do, such as beating up a brother. More work using experimental trials and tailored messages needs to be done to see if children make this association independently and if such messages will then increase FVC.

Alternately, child self-reported messages may solely be a reflection of what parents say. This is still helpful as it provides teachers with insight into what feeding practices a child may be familiar with and what parents and caregivers do to motivate a child to eat. If a child is used to one form of motivation only, other forms may not work. For example, a child may not initially respond to the positive outcome expectation "you will be smart" if a positive reinforcement "you can have a candy" is all the child knows. In this study, children in >\$20,000 households stated more positive outcome expectancy messages and positive prompts than children in ≤\$20,000 households. Previous research, using only parent reports, demonstrates that parents with lower income utilize more authoritarian-type (high demandingness with low receptiveness) parenting and feeding practices.²⁴ Also, in this study,

children of $\leq \$20,000$ households stated slightly more positive reinforcement messages. These messages included gaining a dessert or other desired food. This feeding style can be considered coercive and is not considered a best practice.²⁴

Correlations give some more insight into observed differences; however, interpretation should be done cautiously as *r*-coefficients were low. Some simple explanations may be most logical for trends observed. The association between knowledge and prompting, or demanding language, for children in $\leq \$20,000$ households may imply that while children are exposed to the item, hence increasing knowledge, they are also consistently prompted to eat. This may increase FVC behavior, but only resulting in acute compliance while the external reinforcement is present.^{35,42-44} It is preferable to foster value for the outcome of FVC through outcome expectancies. This intrinsic motivation for FVC allows the behavior to become part of the individual's identity, hence maintained without an external reinforcement.⁴²⁻⁴⁴ We suggest that children who are used to experiencing authoritarian type feeding practices, in which rationale for FVC is not provided, may initially be less receptive to interventions using expectancy messages.

The expression of positive outcome expectancies, negative outcome expectancies, and the total number of messages was higher with higher knowledge. This may imply that these children were: (1) cognitively more capable and had better recall;⁴⁰ (2) more social, therefore more likely to talk during interviews; (3) more exposed to fruits and vegetables accompanied by parents discussing more about them; or (4) a combination of the above. Disliking fruits and vegetables was higher with greater expression of negative outcome expectations like "you're wasting" and expectancies such as "you'll get sick." A child may hear these messages more when presented with food they do not like, and therefore, resist eating. Interestingly, when children were asked what they thought about wasting, not one child could state a like or do not like, rather all shrugged their shoulders. Hence, the item was coded an expectation over expectancy.

Liking fruits and vegetables was higher with the expression of more negative reinforcements among children in $> \$20,000$ households. One theory is that the desire to remove a threat like "can't watch TV" or "you'll get a spanking" is a powerful motivator for some children of this age. Every exposure to the food accompanied by a threat may encourage frequency of tasting. As exposure and tasting frequency increases so does familiarity and ultimately preference.^{39,45} This reinforces the need to consider the individual if a tailored message intervention is used. Another consideration this assessment has demonstrated includes increasing knowledge among children in $\leq \$20,000$

households to help them name fruits and vegetables, thereby increasing self-efficacy to ask for^{21,46} a fruit or vegetable they like and want to eat. In contrast, children in $> \$20,000$ households may need motivation to try more fruits and vegetables to increase preference.

Limitations to consider when interpreting these results exist. Although the play-based picture card game and interview process were developed using developmentally appropriate principles, developmental limitations related to social and cognitive skill are still evident. This also limits the type of assessments utilized along with collectible data. The total sample size and number of child reported messages were high; however, the number of messages stated for some SCT constructs was low. The context in which SCT was utilized to interpret data potentially omitted informative data. Only messages specifically about fruits and vegetables were operationalized into SCT. Other information about the food environment may have been described, but was not utilized.

Strengths of the study included teacher buy-in and assistance with methodology and trust building with children. Teachers recognized the time commitment and genuine concern given to the children by the researcher. The researcher had previous teaching experience and was able to relate to the teachers and asked relevant, meaningful questions concerning child well-being. The consistent presence prior to interviews increased children's familiarity with the researcher potentially enhancing participation rates and willingness of children to converse. Interviews were guided by a standard script to maintain consistency in questioning. Pictures included multiple forms of fruits and vegetables to increase chances of recognition. Redundancy in data collection with notes and audio ensured minimal information was missed. Message coding was done with 3 raters, increasing the reliability of coding. The use of theory employed by previous studies and replication of previously used methods provided a solid and efficient framework from which methods were developed. SCT allowed for the operationalization of messages into standardized constructs of behavior explanation.

IMPLICATIONS FOR SCHOOL HEALTH

Assessments from this study can provide valuable information regarding knowledge and preference that can inform food preparation at schools and lessons that involve new food introduction. Additionally, insight into a child's vision of their own food environment and what they are used to hearing related to FVC is gained. Research and educational best practices are clear about discouraging prompting statements like "eat your vegetables" and that this type of communication can be counterproductive.¹² Discussion about taste, texture, color, nutritional benefits, and portion size is

encouraged. However, best practice teaching styles used at school may conflict with styles at home, for example, encouraging FVC with sound rationale versus external reward. When messages are used as part of this encouragement process, the line between what works for a child versus what is best to say to a child can be blurred. Preassessments can help teachers and caregivers adjust teaching methods to navigate delicately and progressively through the nutrition education process with parents.

In conclusion, a multifaceted theory-based approach that includes child input is beneficial and viable to assess and understand the determinants influencing a child's FVC. Parenting practices should be assessed concurrently to determine their influence on child perceptions outside the home. Evidence is needed to gauge if children aged 4 years make the association between activities they like and valuing the outcome of FVC. Experimental trials using tailored outcome expectancy messages may provide such insight. A longitudinal research perspective is recommended as children's motivation for FVC and preferences will likely evolve with age.

Human Subjects Approval Statement

The protocol for this study was reviewed and approved by the Institutional Review Board of Georgia Southern University.

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