Global Pediatric Health
Volume 6: 1–10

DOI: 10.1177/2333794X19855292
journals.sagepub.com/home/gph
SAGE

Implementation of Parental Strategies to Improve Child Vegetable Intake: Barriers and Facilitators

Lauren Millen, MS[1], Francine Overcash, PhD[1], Zata Vickers, PhD[1], and Marla Reicks, PhD, RD[1]

Abstract

Purpose. To qualitatively assess barriers and facilitators to implementing specific behavioral strategies to increase child vegetable intake during home dinner meals by low-income parents. *Method*. Parents (n = 49) of children (9-12 years) were asked to implement 1 behavioral strategy following each of 6 weekly cooking classes at community centers. Example strategies included serving vegetables first, serving 2 vegetables, and using a bigger spoon to serve vegetables. The following week, parents discussed how they used the strategy and barriers and facilitators to its use. Discussions were recorded, transcribed verbatim, and coded separately by strategy using NVivo Pro 11 software. Inductive, comparative thematic analyses were used to identify themes by strategy. *Results*. Most participants were multiethnic women aged 30 to 39 years with low food security. Time and scheduling conflicts limited involvement of children in vegetable preparation (Child Help strategy). The type of foods served and an unfamiliar serving style inhibited use of the MyPlate and Available/Visible strategies, respectively. Children's dislike of vegetables limited use of the Serve Vegetables First and Serve 2 Vegetables strategies. Ease of use promoted use of the Bigger Spoon strategy. *Conclusion*. Educators could tailor application of specific parent strategies for low-income families based on child and environmental characteristics.

Keywords

vegetable intake, low-income children, parent behavioral strategies, barriers, facilitators

Received October 29, 2018. Received revised May 14, 2019. Accepted for publication May 15, 2019.

Introduction

US national dietary intake data from 2003 to 2010 showed that no sociodemographic subgroup of children (2-18 years) met the Healthy People 2020 goal for total vegetable intake.[1] The lack of children meeting recommendations, in spite of the recognized health benefits of vegetable intake, has led to many studies of the effectiveness of strategies that can influence child vegetable intake at the individual, family, and community level.[2-4] At the family level, parents influenced child vegetable intake based on physical- and socioenvironmental factors including modeling, availability, rules, and family meals.[5,6] Individual factors including taste preference and liking were also important predictors of child vegetable intake.[7] Results from a recent meta-analysis of parent-targeted home-based interventions indicated that increased taste exposure resulted in significant improvements in child vegetable intake.[3]

Experimental studies involving young children and school-aged children have shown that several strategies influenced child vegetable intake at home or school.[4] For example, child involvement in food preparation increased vegetable consumption.[8,9] Assortment allocation cues to promote healthy eating in school meal trays also increased vegetable consumption.[10] Serving style has been described in various ways with mixed results on vegetable or food intake (size and shape of vegetables),[11] ways food was presented on plates,[12] and family style versus pre-plated style.[13] Allowing children a choice of vegetables also produced mixed results in influencing vegetable intake among

[1]University of Minnesota, St. Paul, MN, USA

Corresponding Author:
Marla Reicks, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108, USA.
Email: mreicks@umn.edu

young children and school-aged children.[14-16] Two studies found that serving vegetables first in isolation increased the number of students eating vegetables at an elementary school.[17,18] Young children self-served a larger amount of a dinner meal entrée using a tablespoon compared with a teaspoon,[19] indicating that a larger serving utensil could also influence the size of self-served or pre-plated vegetable portions. These strategies were tested across a wide range of sociodemographic subgroups, with implications for their effectiveness based on barriers and facilitators that may be specific to certain subgroups. For example, family income presented barriers regarding the ability to implement in-home strategies based on limited access to vegetables.[20] Results of a systematic review showed that only 2 of 7 in-home interventions to increase vegetable intake of children (2-12 years) yielded positive findings in the short term, indicating that possible barriers existed to parent-implemented intervention strategies.[2]

Studies are limited that specifically examined barriers that parents encounter when using strategies to influence the home physical food environment with the goal of increasing child vegetable consumption. However, several studies have examined general parental barriers to providing a healthy home food environment for children that could directly affect the ability to implement intervention strategies to increase child vegetable intake.[21,22] Surveys with Canadian parents showed that limited availability of time was a common barrier for meal preparation regardless of employment status.[21] Consistent with these findings, time use studies have shown that adults now spend less time preparing meals compared with several decades ago.[23] Focus group interviews with low-income, urban parents identified issues with accommodating child food preferences and opposition of the family as barriers to providing healthy foods to children.[22] Food costs were also identified as a barrier to trying new healthy food practices for some low-income parents based on in-depth, individual interviews.[24]

As part of a cluster-allocated–controlled intervention study, low-income parents in a large Midwestern metropolitan area were asked to implement 6 behavioral strategies at home during dinner meals over 6 weeks to increase child (9-12 years) vegetable intake.[25] The purpose of this study was to qualitatively assess parent-reported barriers and facilitators to implementing these strategies.

Methods

Participants

Parent-child dyads (n = 103) were enrolled in a cluster-allocated–controlled intervention study. Participants were recruited through flyer/email campaigns at 11 host locations serving low-income populations, including subsidized housing, community centers, and churches. Recruitment and data collection were conducted from September 2014 to June 2016 in the Minneapolis–Saint Paul metropolitan area. Eligibility criteria included the following: (1) participant child was 9 to 12 years old; (2) parent was the main food preparer for the household; (3) family qualified for public food assistance (Special Supplemental Nutrition Program for Women, Infants, and Children, Supplemental Nutrition Assistance Program, free/reduced price school meals) or recently used food pantries as an indicator of low-income status; (4) parent had not participated in a Cooking Matters Course in the past 3 years; and (5) parent was able to read, speak, and understand English (or Spanish for Spanish-only courses). To enhance study retention, parents and children were compensated for their participation.

This article specifically focused on the intervention group parents (n = 49) who were asked to implement 1 behavioral strategy per week during a 6-week Cooking Matters course and participate in a group discussion regarding in-home implementation of the strategy the following week.[25] The intervention cooking classes were conducted at 8 different locations with 5 to 8 parents per group (n = 49 total).

Data Collection Procedures

The behavioral strategies introduced each week to intervention group parents were intended to be simple, low-cost strategies that could be easily incorporated into existing home dinner meal routines. For the first strategy (Child Help), parents were encouraged to have their child help prepare vegetables for the dinner meal. To implement the second strategy (MyPlate), parents were given acrylic MyPlates, which identified the portion of the plate to cover with vegetables. Parents were encouraged to use the MyPlates for family dinner meals. For the third strategy (Available/Visible), parents were asked to leave vegetable serving dishes on the table and remove all other foods after serving all foods. To implement the fourth strategy (Serve 2 Vegetables), parents were asked to serve 2 different vegetable side dishes or to serve a mixed dish that included vegetables and 1 vegetable side dish. To implement the fifth strategy (Serve First), parents were asked to serve any type of vegetable before the meal. The sixth strategy (Bigger Spoon) was intended to increase the dinner vegetable portion size. Parents were encouraged to use a bigger spoon (provided) than usual for serving vegetables to their child.

During the weekly cooking classes, trained nutrition educators introduced the upcoming week's strategy and led a group discussion of how the previous week's

strategy was implemented and barriers and facilitators to implementation. Four educators were involved in facilitating the group discussions throughout the course of the intervention. All had 2 to 30 years of experience as community-based nutrition educators providing food and nutrition learning activities for low-income adults. Educators used interview scripts to ensure consistent discussion across staff and locations. Discussion questions included, "How did you use last week's strategy, what helped you use it, and what kept you from using it?" A series of training sessions were held for nutrition educators by researchers prior to holding group discussions. These sessions included demonstration and practice activities to allow educators to use the interview scripts as intended. Researchers also attended the group discussions and provided feedback to educators as needed regarding consistent use of the interview scripts. All group discussions were audio recorded and transcribed verbatim.

Parents completed a survey at baseline to report demographic characteristics including age, sex, race/ethnicity, education level, household size, child demographic information, and food security. Food security was assessed with the 6-item short form of a standardized Food Security Survey Module.[26]

Data Analysis

A grounded theory approach was used to analyze data involving an inductive, comparative methodology initially described by Glaser and Strauss[27] and further characterized by Miles et al.[28] The grounded theory approach uses coding cycles and reflection to develop categories for theory generation to explain behaviors of interest. For the current study, researchers wanted to understand the barriers and facilitators that were influential in determining whether behavioral strategies introduced in cooking classes to improve youth vegetable intake would be practiced by parents at home. Researchers (LM and MR) participated in NVivo tutorials. MR has extensive experience in qualitative data analysis and reporting regarding food parenting issues. MR and LM jointly completed the data analysis steps in consultation with each other. FO and ZV reviewed procedures and results at critical points in the process.

Analysis was conducted for each strategy separately using transcribed audio files from 48 group discussions with 8 discussions per each of the 6 strategies. A codebook was developed for each strategy within NVivo software (version 11, QSR International Pty Ltd, Burlington, MA, 2017) by researchers (LM and MR) and reviewed by other researchers (FO and ZV). Major coding categories were created based on the scripted interview questions regarding the predetermined factors of interest (deductive analysis) including barriers, facilitators, and how each strategy was implemented. One or 2 transcripts for each strategy were coded by 2 researchers together (LM and MR) to determine subcategories based on discussion and consensus. Next, another transcript was coded independently by 2 researchers (LM and MR), and NVivo was used to calculate interrater reliability (IRR). IRR measures the agreement between coders with Cohen's κ coefficient taking into consideration the amount of agreement by chance. After an acceptable IRR was reached (~0.60 Cohen's κ coefficient), all remaining transcripts for that strategy were coded by 1 researcher (LM).[29]

Focusing on one strategy at a time, NVivo matrix queries were used to sort coded transcript segments for further inductive analysis. Matrix queries sorted coded transcripts to quantify the number of transcript segments coded as subcategories under each major coding category. For example, for the Child Help strategy, the subcategory code of Enjoyment was frequently coded under a major code of Facilitator. Coded segments were carefully read to extract themes for each subcategory where 10 or more transcript segments were coded. To reduce bias, all themes were extracted independently by 2 researchers (LM and MR), and then researchers came together to discuss differences (LM, MR, FO, and ZV). Discussion occurred until 100% agreement was reached. Representative quotes were obtained for each strategy using word/text searches within NVivo.

Each strategy had unique factors that could affect implementation frequency indicating that transcripts related to each strategy should be analyzed separately. For example, some strategies required that the child and/or parent be present before the dinner meal, that families were able to serve more vegetables, or were able to prepare vegetables in a different way. The information obtained from this study was intended to help educators select specific strategies for their particular audience based on these unique factors (ie, income, work schedules, children's age, cultural norms, and preferences for food types and serving styles).

Ethical Approval and Informed Consent

The University of Minnesota Institutional Review Board approved the study (Reference #: 1111S06501). Informed consent was obtained from parents for their participation.

Results

Most parents were women (89%), within 30 to 39 years (51%), and racially/ethnically diverse (Table 1). The majority had low/very low food security (69%), had a

Table 1. Baseline Demographic Characteristics for Intervention Participants.

Characteristic	N = 49, n (%)
Parent sex	
Female	44 (89)
Male	5 (10)
Parent age (age range)	
18-29	8 (16)
30-39	25 (51)
40-60+	16 (33)
Parent education (n = 1 missing)	
Less than high school diploma	16 (34)
High school diploma or GED	9 (19)
Some college/2-year degree	19 (40)
4-year college degree	3 (6)
Parent race	
White	7 (14)
Black/African American	13 (27)
Asian/Pacific Islander/American Indian	4 (8)
Other	21 (43)
Mixed race	4 (8)
Parent Hispanic ethnicity	19 (39)
Household size (number)	
≤3	8 (16)
4-5	32 (65)
6 or more	9 (18)
Food security (n = 1 missing)	
Food secure	15 (31)
Low food security	21 (44)
Very low food security	12 (25)
Child sex	
Female	27 (55)
Male	22 (45)
Child age (years)	
9	15 (31)
10	13 (27)
11	11 (22)
12	10 (20)

high school diploma or less (53%), and were from households with 4 to 5 members (65%). About half of the children were female (55%) and 9 or 10 years old (58%).

Key barrier and facilitator themes were summarized for each strategy and listed in Table 2. Selected representative quotes are also provided in the following text and in Table 2.

Child Help

Parents reported that children commonly helped prepare vegetables by cutting, chopping, or peeling vegetables, opening cans, and stirring. Barrier themes included having minimal time available to involve a child in vegetable preparation and scheduling conflicts, which limited time to work together to prepare vegetables for the dinner meal. Parents indicated that with limited time, having the child help would have been an inconvenience. Some parents indicated that the child was not able to help because of homework or after-school activities, and because of work conflicts, some parents prepared the meal when the child was not home. Facilitator themes included positive attitudes of children, which promoted parents' willingness to involve their child in vegetable preparation for the dinner meal and that preparing vegetables together was enjoyable. Parents mentioned that children often felt proud of their accomplishments and were excited to help prepare vegetables. Many families reported that preparing vegetables together was fun.

MyPlate

The most common ways the MyPlate strategy was implemented was (1) having the child make the effort to use the plates during meals and (2) interacting with parents or siblings to classify foods into the appropriate sections of the plate. A barrier theme included the impracticality of using the MyPlates when combination foods (eg, lasagna, tacos) were prepared and served. Parents mentioned that allocating foods in combination dishes to the various sections of the plate was difficult. This barrier was especially prevalent among Hispanic parents who traditionally served many combination foods. Another barrier theme was that using the MyPlates was more appropriate for younger rather than older children. Facilitator themes included enjoyment from using the MyPlates because children liked to sort the foods into the appropriate sections and to explain to siblings how the plate should be used. One parent mentioned, "It really worked with my daughter, she really enjoyed deciding where everything went and you know figuring out . . . and she had a lot of fun with it." Another facilitator theme was that parents perceived that the child ate a more balanced meal and learned about nutrition when the MyPlates were used for dinner meals.

Available and Visible

Parents reported that serving a salad with the dinner meal was the typical way they implemented the Available/Visible strategy. Parents mentioned that the main dish and other foods could be removed easily while the salad was left on the table during the meal. Barrier themes included the child's reported dislike of vegetables. As one parent mentioned, "If I make something they do not like, they are not going to eat it." Another barrier theme was that

Table 2. Themes and Representative Quotes for Each Behavioral Strategy.

Behavioral Strategy	Barrier Themes	Representative Quotes	Facilitator Themes	Representative Quotes
Child Help	Minimal time available limited ability to involve child	"I don't have too much time because I'm working in the afternoon."	Positive child attitudes promoted parents' willingness to involve child.	"I was just like a standby coach and he did it all, everything himself. The results were good and everyone liked it, it was really good."
	Scheduling conflicts limited time together	"Because of the school time, plus they go to the Y and they kind of stay here until 6 and by the time they get home dinner is actually already done."	Preparing vegetables together was enjoyable.	"He'd never peeled a carrot before. His first time, you know. And then he said 'mom, I like this, this is fun.' The 2 together, in the kitchen, me and him only, so it was good that night."
MyPlate	MyPlates were impractical for use with combination foods.	"We would have rice and beans, and we had the same thing with the soup, everything was mixed together like carrots and potatoes and more. When the meals were all mixed together like that it was hard to use the plate."	Children liked sorting foods into MyPlate sections.	". . . the kids wanted to put things where it's supposed to be."
		"It was hard with Mexican food because things that we would normally cook together, needed to be separated on the plate. So that was a lot different and extra work."	Children ate balanced meals and learned about nutrition.	"You know, it's a kind of game, just, they like it, to eat all of them."
	Using MyPlates was more appropriate for younger than older children.	"I would say that for children spanning age ranges, the portions shouldn't be the same. A 2 year old receives the same portions on the plate as a 14 year old."		"They want me to sort it out on the plate. One time I did it wrong just to see what he would do, and he caught it right away."
Available/Visible	Child disliked vegetables or only liked them in combination dishes.	"It was a little difficult because my daughter does not like vegetables. So when I make salads, she leaves it. If it's mixed in the meal she will eat it, but it is not easy for her to eat the salad."	Child liked vegetables.	"It was easy, because my daughter likes vegetables. We had vegetables flavored with lime."
	Unfamiliar serving style limited use.	"I'm so used to doing what I've been doing but I have been trying to use it. I have to put everything on the same table so they will eat everything."	Serving a salad with dinner was easy.	"It was easy for me. We had salad with lettuce and other vegetables."
			Child liked eating salads with dinner.	"I found myself making more salads last week because I knew that they would eat the salads a lot more and just put it in the middle of the table."

(continued)

Table 2. (continued)

Behavioral Strategy	Barrier Themes	Representative Quotes	Facilitator Themes	Representative Quotes
Serve 2 Vegetables	Child disliked vegetables so unwilling to eat 2 types.	"He hate it! He is the picky one! Very picky! He says 'not at all, not at all!'"	Parent already served 2 vegetables with dinner.	"I almost always have 2 vegetables with the meal just because I have so many picky eaters."
	Child was not accustomed to being served more than one vegetable.	"For me, it was a little difficult, because my daughter said 'why so many?'"	Parent needed to serve vegetables child likes and prepared in a way child prefers.	"It's better to mix it with the other vegetables together they may eat it but separately, I don't think they'll try to eat it. So that's why it's good together."
Serve Vegetables First	Child disliked vegetables or had limited liking.	"If they were cooked, then yes she liked them. But if I served them raw, then she did not like them."	Serving vegetables first was easy and took minimal time.	"As I was cutting them up to boil them I left some of the remainder of them sitting on the table while I cooked. Every night was a little different . . . so I'd just leave some extra out on the table while I was cooking."
	Lack of availability of fresh vegetables inhibited strategy use.	"Something that would impede this is if we needed to eat a fast meal or if I didn't have an easy vegetable on hand to serve before the meal."	Children were willing to eat vegetables first because they were hungry.	"The kids were coming 'What's for dinner?! What's for dinner?!' You know, they started pestering because they were hungry. And I said 'Food's on the table.' And they picked at it until it was gone."
		"We ended up running out of fresh veggies to have out while we were preparing the other stuff, and instead of cooking corn or green beans and putting them out, I just skipped it those nights after we ran out of the fresh stuff."		
Bigger Spoon	Logistical concerns limited use.	"Yes. We just, we haven't been home."	Easy to use and resulted in greater vegetable intake.	"Yeah, I mean they liked to use the spoon, I mean I'd kind of dish some or they'd dish themselves. I'd dish a whole spoonful and they'd eat all their vegetables."
		". . . just time. Didn't have enough time."		
	Using the spoon could result in food waste.	"I do not want to serve them more than they can eat and waste the food."		

children only liked vegetables when served as part of a combination dish. Therefore, it was not possible to leave only the vegetables from a combination dish at the table during the meal. For example, one mother indicated " . . . everything was really combined so I didn't have separate foods. Like when I do stews, I add vegetables to it but everything was mixed in." Additionally, a barrier theme was the unfamiliarity of the serving style, which made the strategy difficult for some families to use. Parents indicated that the serving style was contrary to how foods were usually served during dinner meals. For example, some parents reported that they usually served the child a pre-plated meal. A facilitator theme included the child liking vegetables or being willing to try vegetables. Another facilitator theme was that serving salads was an easy way to implement the strategy. Parents indicated that it was easy to plan and serve dinner meals when the salad could be left on the table after the rest of the foods were served because children enjoyed eating salads with dinner. As one mother said, "After they finished their salad and their rice and fish, they actually grabbed more off of the bowl and I had no salad in my bowl."

Serve 2 Vegetables

To implement the Serve 2 Vegetables strategy, the most common preparation/serving methods reported by parents included stir-frying, serving raw/fresh vegetables, or serving vegetables with the child's favorite seasoning/condiment. Some parents used the strategy to replace an after-school snack or substitute for other parts of the meal. A barrier theme included the child's inclination not to eat vegetables, which reduced interest in using the strategy. Some parents reported that children disliked vegetables, preferred to eat other foods, or were unwilling to try new vegetables. One mother indicated, "Yeah, I mean I tried it . . . My kids just don't like vegetables." In addition, a barrier theme was that the child was accustomed to only being served 1 vegetable at dinner meals. A facilitator theme was that using the strategy was easy because it was part of an existing routine. Some parents indicated that they already served 2 vegetables with dinner. As 1 parent indicated " . . . pretty much every supper, we always have 2 just because there's a couple of kids that don't like one thing or another." Other facilitator themes involved needing to prepare the vegetables in a way the child preferred and to serve vegetables the child liked.

Serve Vegetables First

The Serve Vegetables First strategy was typically implemented by serving raw vegetables while the rest of the meal was being prepared, or as an after-school snack. Barrier themes included the child's dislike or limited liking of vegetables and that the vegetables were not always available in the home to serve first. Parents indicated that children did not or would not eat vegetables served before the dinner meal because children did not like vegetables or only liked selected vegetable types. A few parents mentioned that they were unable to continue serving vegetables first when fresh vegetables were not available at home. A facilitator theme was that serving vegetables first took minimal time and effort, especially if the vegetables were available. An additional facilitator theme was that children were willing to eat vegetables first. This typically occurred while a parent prepared the dinner meal because the child was hungry and wanted to eat.

Bigger Spoon

The Bigger Spoon strategy was implemented in 2 ways; either the parent used the large spoon (provided) to serve vegetables for the child or the child used the spoon to serve their own portion of vegetables. Barrier themes included an inability to use the spoon based on logistical concerns. Parents indicated they could not use the Bigger Spoon strategy because they did not have enough time to prepare a meal, the family was not home to use the spoon, or they forgot to use the spoon. Several parents mentioned that the spoon served too much food for their child. A facilitator theme was that using the Bigger Spoon strategy was easy and resulted in positive reactions from parents. One parent indicated greater vegetable intake among her children, "They eat more vegetables using the spoon, and they will continue to eat more."

Discussion

This study separately assessed barriers and facilitators to 6 different strategies that parents could use at home during the dinner meal to increase child vegetable intake. Unique factors that affect the frequency of use of each strategy were identified.

Parents indicated that use of the Child Help strategy was dependent on whether they had time, which was in part based on scheduling conflicts. If either the parent or the child was not available when dinner was being prepared, this strategy was not feasible. Participation of women in the work force has drastically decreased the amount of time women spent cooking over the past few decades, with low-income families having a more rapid decrease in time spent cooking than other economic groups.[23] Parents in low-income families may have less flexibility in work schedules and work multiple jobs,

which could contribute to less time to cook and involve children in food preparation. A cross-sectional study showed that more frequent family meals was associated with greater parental support for healthy eating,[30] indicating that limited time for family meals may constrain the ability of parents to practice supportive strategies during dinner meals such as involving children in food preparation.

Parents suggested that children enjoyed using the MyPlate strategy and learned about nutrition; however, the strategy was thought to be more useful for younger versus older children. Authors of a systematic review of nutrition education interventions concluded that successful interventions used age-appropriate activities to achieve outcomes regarding knowledge, self-efficacy, and behavior change.[31] Children may be more engaged and find the activity enjoyable when intervention strategies are age-appropriate. Some parents in the current study indicated that children enjoyed teaching younger siblings to use the MyPlate; therefore, the strategy could be useful for some older children as a teaching tool and for younger children as a learning tool.

Some parents found the Available/Visible strategy difficult to use when combination dishes were served. A substantial proportion of total vegetable intake (41%) for children and adolescents came from mixed dishes based on US nationally representative dietary intake data.[32] These findings support the concept that the form or type of vegetables typically consumed by children are important considerations when promoting specific parent-implemented home dinner–based strategies. The Hispanic families in the current study were especially likely to mention the use of mixed dishes containing vegetables as foods that were typically consumed. Similarly, in focus group interviews conducted among low-income families after participating in a family-based obesity treatment program, Spanish-speaking parents identified difficulty in implementing lifestyle changes based on consuming traditional foods.[33]

Use of the Serve Vegetables First strategy was reported to be moderated by children's disliking of vegetables. Other studies reported that children would rather eat something with preferable (sweet) flavors, (ie, fruit or junk food), or associated vegetables with negative taste experiences (bitter, sour, bland).[34,35] Alternatively, children who reported a greater liking for vegetables indicated that they consumed more vegetables.[36] Individual and focus group interviews with children in 3 age groups (4-5 years, 7-8 years, and 11-12 years) indicated that the number of fruits and vegetables liked by children increased with age.[37] The determinants of liking fruit and vegetables also shifted from being primarily based on appearance and texture for younger children to taste for older children. Therefore, application of the Serve Vegetables First strategy may be most useful for older compared with younger children based on improved vegetable preferences and perceptions.

Familiarity and automaticity may have contributed to the likelihood that parents used the Serve 2 Vegetables strategy in the current study. These concepts related to parenting practice behaviors have been shown to increase behavioral frequency[38,39] consistent with parents in the current study indicating greater ease of use of strategies they had previously used.

Barriers based on limited availability of vegetables, cost and/or concern about food waste were identified by some parents regarding use of the Bigger Spoon strategy in the current study where all parents were eligible for public food assistance or had recently used food pantries. Other studies have found access and cost to be important factors related to vegetable consumption,[40,41] with cost a more important barrier for lower income adults.[42] Interviews with low-income household members about their grocery shopping experiences also showed that cost was related to vegetable purchasing.[41] Dickin and Seim[24] asked low-income parents of children (3-11 years) to select general nutrition goals and parenting practices to try at home. One of the 4 clusters of parenting practices addressed home food availability and healthy routines. Two weeks later, parents participated in in-depth individual interviews to identify barriers and facilitators to the new behaviors. Although limited household resources and food insecurity were identified as barriers for some families, parents were more likely to consider child food preferences, habits, and convenience as common barriers.

This study had several strengths and limitations. Participants were racially and ethnically diverse allowing for sharing of experiences from different cultural perspectives. Barriers and facilitators were identified after parents had implemented the strategies at home, based on first-hand experience rather than hypothetical situations. Because the discussions were conducted in a group setting, some parents may have felt social acceptability pressure when responding to questions.

Conclusions

Previous studies have characterized general barriers to healthy eating especially among low-income families; however, this study specifically identified barriers and facilitators to simple strategies that could be employed by parents to increase child vegetable intake at home during dinner meals. In the current study, specific barriers and facilitators were identified that parents indicated had affected their ability to use certain strategies. For

example, barriers to having children involved in vegetable preparation included time and scheduling conflicts. Serving combination-type foods was a barrier to using the MyPlate strategy, while using an unfamiliar serving style inhibited use of the Available/Visible strategy. Children's dislike of vegetables limited use of 2 strategies, Serve Vegetables First and Serve 2 Vegetables, while children's liking of vegetables was a facilitator for the Available/Visible strategy. Ease of use promoted use of the Bigger Spoon and Serve Vegetables First strategies. Educators could use these results to selectively promote specific parent-implemented strategies to increase child vegetable intake based on likely challenges and facilitators based on child and household environmental factors particular to certain audiences.

Acknowledgments

The authors thank the community agencies where the study was implemented and the Nutrition Educators who participated in the study: Gloria Wolf, Nancy Brewster, Megan King, and Andrew Doherty.

Author Contributions

LM, FO, ZV, and MR conceived of the study and designed the analysis. FO, ZV and MR collected the data. LM and MR performed the analysis with contributions and review from FO and ZV. LM took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This project was supported by the Agriculture and Food Research Initiative (Grant No. 2012-680001-19631) from the USDA National Institute of Food and Agriculture under the Childhood Obesity Prevention Program (Code A2101): Integrated Research, Education, and Extension to Prevent Childhood Obesity. The USDA NIFA had no role in the design, analysis, or writing of this article.

ORCID iD

Marla Reicks https://orcid.org/0000-0001-6726-9408

References

1. Kim SA, Moore LV, Galuska D, et al; Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, CDC. Vital signs: fruit and vegetable intake among children—United States, 2003-2010. *MMWR Morb Mortal Wkly Rep*. 2014;63:671-676.
2. Hendrie GA, Lease HJ, Bowen J, Baird DL, Cox DN. Strategies to increase children's vegetable intake in home and community settings: a systematic review of the literature. *Matern Child Nutr*. 2017;13(1). doi:10.1111/mcn.12276
3. Touyz LM, Wakefield CE, Grech AM, et al. Parent-targeted home-based interventions for increasing fruit and vegetable intake in children: a systematic review and meta-analysis. *Nutr Rev*. 2018;76:154-173.
4. DeCosta P, Møller P, Frost MB, Olsen A. Changing children's eating behaviour—a review of experimental research. *Appetite*. 2017;113:327-357.
5. Rasmussen M, Krølner R, Klepp KI, et al. Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: quantitative studies. *Int J Behav Nutr Phys Act*. 2006;3:22.
6. Pearson N, Griffiths P, Biddle SJH, Johnston JP, Haycraft E. Individual, behavioural and home environmental factors associated with eating behaviours in young adolescents. *Appetite*. 2017;112:35-43.
7. Wadhera D, Phillips EDC, Wilkie LM. Teaching children to like and eat vegetables. *Appetite*. 2015;93:75-84.
8. Allirot X, da Quinto N, Chokupermal K, Urdaneta E. Involving children in cooking activities: a potential strategy for directing food choices toward novel foods containing vegetables. *Appetite*. 2016;103:275-285.
9. Jarpe-Ratner E, Folkens S, Sharma S, Daro D, Edens NK. An experiential cooking and nutrition education program increases cooking self-efficacy and vegetable consumption in children in grades 3-8. *J Nutr Educ Behav*. 2016;48:697-705.e1.
10. Reicks M, Redden JP, Mann T, Mykerezi E, Vickers Z. Photographs in lunch tray compartments and vegetable consumption among children in elementary school cafeterias. *JAMA*. 2012;307:784-785.
11. Olsen A, Ritz C, Kramer L, Møller P. Serving styles of raw snack vegetables. What do children want? *Appetite*. 2012;59:556-562.
12. Zampollo F, Kniffin KM, Wansink B, Shimizu M. Food plating preferences of children: the importance of presentation on desire for diversity. *Acta Paediatr*. 2012;101:61-66.
13. Loth KA, Horning M, Friend S, Neumark-Stzainer D, Fulkerson J. An exploration of how family dinners are served and how service style is associated with dietary and weight outcomes in children. *J Nutr Educ Behav*. 2017;49:513-518.e1.
14. de Wild VW, de Graaf C, Boshuizen HC, Jager G. Influence of choice on vegetable intake in children: an in-home study. *Appetite*. 2015;91:1-6.
15. Domínguez PR, Gámiz F, Gil M, et al. Providing choice increases children's vegetable intake. *Food Qual Prefer*. 2013;30:108-113.
16. Bucher T, Siegrist M, van der Horst K. Vegetable variety: an effective strategy to increase vegetable choice in children. *Public Health Nutr*. 2014;17:1232-1236.

17. Elsbernd SL, Reicks M, Mann T, Redden JP, Mykerezi E, Vickers ZM. Serving vegetables first: a strategy to increase vegetable consumption in elementary school cafeterias. *Appetite*. 2016;96:111-115.
18. Redden JP, Mann T, Vickers Z, Mykerezi E, Reicks M, Elsbernd S. Serving first in isolation increases vegetable intake among elementary school children. *PLoS One*. 2015;10:e0121283.
19. Fisher JO, Birch LL, Zhang J, Grusak MA, Hughes SO. External influences on children's self-served portions at meals. *Int J Obes (Lond)*. 2013;37:954-960.
20. Ganann R, Fitzpatrick-Lewis D, Ciliska D, Peirson L. Community-based interventions for enhancing access to or consumption of fruit and vegetables among five to 18-year olds: a scoping review. *BMC Public Health*. 2012;12:711.
21. Fernandez MA, Marquis M, Desroches S, Turcotte M, Provencher V. Full-time employment, diet quality, and food skills of Canadian parents. *Can J Diet Pract Res*. 2019;80:63-71. doi:10.3148/cjdpr-2018-041
22. Luesse HB, Paul R, Gray HL, Koch P, Contento I, Marsick V. Challenges and facilitators to promoting a healthy food environment and communicating effectively with parents to improve food behaviors of school children. *Matern Child Health J*. 2018;22:958-967.
23. Smith LP, Ng SW, Popkin BM. Trends in US home food preparation and consumption: analysis of national nutrition surveys and time use studies from 1965-1966 to 2007-2008. *Nutr J*. 2013;12:45.
24. Dickin KL, Seim G. Adapting the Trials of Improved Practices (TIPs) approach to explore the acceptability and feasibility of nutrition and parenting recommendations: what works for low-income families? *Matern Child Nutr*. 2015;11:897-914.
25. Overcash FM, Ritter A, Mann T, et al. Impacts of a vegetable cooking skills program among low-income parents and children. *J Nutr Educ Behav*. 2018;50:795-802.
26. USDA Economic Research Service. Six-Item Short Form of the Food Security Survey Module. http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/survey-tools.aspx#six. Accessed May 30, 2019.
27. Glaser GG, Strauss AL. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago, IL: Aldine; 1967.
28. Miles MB, Huberman AM, Saldaña J. *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. Thousand Oaks, CA: Sage; 2013.
29. Gisev N, Bell JS, Chen TF. Interrater agreement and interrater reliability: key concepts, approaches, and applications. *Res Social Adm Pharm*. 2013;9:330-338.
30. Utter J, Scragg R, Schaar D, Mhurchu CN. Relationships between frequency of family meals, BMI and nutritional aspects of the home food environment among New Zealand adolescents. *Int J Behav Nutr Phys Act*. 2008;5:50.
31. Murimi MW, Moyeda-Carabaza AF, Nguyen B, Saha S, Amin R, Njike V. Factors that contribute to effective nutrition education interventions in children: a systematic review. *Nutr Rev*. 2018;76:553-580.
32. Branum AM, Rossen LM. The contribution of mixed dishes to vegetable intake among US children and adolescents. *Public Health Nutr*. 2014;19:2053-2060.
33. Cason-Wilkerson R, Goldberg S, Albright K, Allison M, Haemer M. Factors influencing healthy lifestyle changes: a qualitative look at low-income families engaged in treatment for overweight children. *Child Obes*. 2015;11:170-176.
34. Poelman AAM, Delahunty CM, de Graaf C. Vegetables and other core food groups: a comparison of key flavour and texture properties. *Food Qual Prefer*. 2017;56:1-7.
35. Krølner R, Rasmussen M, Brug J, Klepp KI, Wind M, Due P. Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part II: qualitative studies. *Int J Behav Nutr Phys Act*. 2011;8:112.
36. Chu YL, Farmer A, Fung C, Kuhle S, Veugelers P. Fruit and vegetable preferences and intake among children in Alberta. *Can J Diet Pract Res*. 2013;74:21-27.
37. Zeinstra GG, Koelen MA, Kok FJ, de Graaf C. Cognitive development and children's perceptions of fruit and vegetables; a qualitative study. *Int J Behav Nutr Phys Act*. 2007;4:30.
38. McGowan L, Cooke LJ, Gardner B, Beeken RJ, Croker H, Wardle J. Healthy feeding habits: efficacy results from a cluster-randomized, controlled exploratory trial of a novel, habit-based intervention with parents. *Am J Clin Nutr*. 2013;98:769-777.
39. Diep CS, Beltran A, Chen TA, et al. Predicting use of effective vegetable parenting practices with the model of goal directed behaviour. *Public Health Nutr*. 2015;18:1389-1396.
40. Ong JX, Ullah S, Magarey A, Miller J, Leslie E. Relationship between the home environment and fruit and vegetable consumption in children aged 6-12 years: a systematic review. *Public Health Nutr*. 2017;20:464-480.
41. Webber CB, Sobal J, Dollahite JS. Shopping for fruits and vegetables. Food and retail qualities of importance to low-income households at the grocery store. *Appetite*. 2010;54:297-303.
42. Chapman K, Goldsbury D, Watson W, et al. Exploring perceptions and beliefs about the cost of fruit and vegetables and whether they are barriers to higher consumption. *Appetite*. 2017;113:310-319.