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Effects of Family-Centered Media Literacy Training on Family Nutrition Outcomes

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Abstract

Parents frustrated about food marketing influences need media management skills to challenge marketing messages and interpret factual content. We tested a media literacy-based, family-centered intervention to reduce effects of appealing, but unrealistic, food marketing. We hypothesized that participation would facilitate family discussion that improves the home dietary environment and increases youth consumption of fruits and vegetables. Parent-child (age 9–14) dyads ($N = 189$) participated in a matched-group, pretest/posttest field experiment testing a 6-week media literacy-based curriculum. Hypothesis testing employed multiple analysis of covariance and Bayesian multigroup structural equation modeling (MGSEM). Improved nutrition outcomes for parents included *talk with youth about food nutrition labels* ($d = 0.343$) and *ratio of healthy to unhealthy food in home* ($d = 0.232$); youth improved *talk with parent about food nutrition labels* ($d = 0.211$), *vegetables eaten yesterday* ($d = 0.264$), and *fruit eaten yesterday* ($d = 1.386$). Bayesian MGSEM revealed that in the intervention group, 12 of 17 tested paths were significant ($p < .05$), compared with only 4 in the control group, with average effect size magnitudes of 0.236 and 0.113, respectively. Media literacy education can empower parents and improve youths' critical thinking to reduce negative effects of food marketing on families and improve use of media to obtain nutrition information that aids dietary choices. This approach reduces the risk for reactance from youth who like media and resist limiting media use, while helping families use media together to make better nutrition decisions.

Keywords Parents · Youth · Dietary · Media literacy · Health literacy · Family · Marketing · Intervention · Communication · Decision making

Abbreviations

CI	Bayesian credibility interval
DIC	Deviance information criterion
MANCOVA	Multiple analysis of covariance
MGSEM	Multigroup structural equation model
MIP	Message interpretation process model
ML	Maximum likelihood
PPP	Posterior predictive probability
SD	Standard deviation
SE	Standard error

Food marketing affects both parents and youth. While parents choose food for the home and influence youths' eating behaviors (Pettigrew et al. 2013), marketing appeals independently affect food preferences and selection for youth, who influence family food purchases (Carter et al. 2011; Harris and Bargh 2009; Sadeghirad et al. 2016). Food marketing tends to promote nutritionally poor foods with high fat, sugar, and salt contents (Batada et al. 2008) that comprise risk factors for obesity (Boynton-Jarrett et al. 2003; Ebbeling et al. 2002; Powell et al. 2013). Effects emerging among toddlers and increasing with age create family conflict and alter food selections (Buijzen and Valkenburg 2008; Chamberlain et al. 2006; Kraak et al. 2006; Linn and Novosat 2008; Rummel et al. 2000). Effective media management to improve nutrition requires more than limiting home screen time, a common focus for nutrition interventions (Flattum et al. 2015; Katz et al. 2008).

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Family members encounter food marketing from a saturated media environment in and outside of the home including the Internet, school, billboards, bus signs, and magazines. In addition, families require sustained media management skills because brief, parental appeals are largely ineffective at reducing marketing influences (Goodell et al. 2012). Fortunately, the skills to recognize, understand, and resist persuasive media messages can be taught and can mitigate the impact of desirable, but unrealistic, marketing messages (Kupersmidt et al. 2010; Austin et al. 2015, 2007).

This study tested a media literacy-based, family-centered intervention to reduce the effect of food marketing on youths' nutrition behaviors without necessarily reducing enjoyment of message content. An approach that *recognizes and leverages youths' and parents' affinity for media use* is more likely to be accepted by youth who like media than demonizing the media (Bijvank et al. 2009), and interventions focused on problematic information, without providing sufficient skills practice or parental reinforcement, can backfire (Byrne 2009; Nathanson 2004).

This study tested whether a family-centered media literacy intervention would facilitate media management processes to improve the home dietary environment and youths' consumption of fruits and vegetables. We anticipated that the intervention would facilitate the development of beneficial paths of influence that would be weak or non-existent in the control group. Figure 1 summarizes the basic intervention model.

We hypothesized that compared with participants in a control group, participants in a family-centered media literacy intervention will demonstrate improved media literacy skills and family communication dynamics regarding food-related media messages, an improved ratio of healthy to unhealthy food in the home environment, and increased youth consumption of fruits and vegetables (H1). To test the intervention model, we hypothesized that for participants in a family-based media literacy intervention, significant relationships as shown in Appendix Figure A1 (available online) will be established as a result of the curriculum, paths that will not be significant in the control group (H2). Specifically, we hypothesize that *child-initiated discussion* about food marketing and family *discussion about nutrition labels* will positively affect the *ratio of healthy to unhealthy food in the home environment* and youths' *consumption of fruits and vegetables; parental negative mediation* of food marketing messages will positively predict the youth's *critical thinking about content*, and family *discussion and use of nutrition labels; Critical thinking about content* will positively predict *child-initiated discussion* about media content, and *child-initiated discussion* will positively predict family *discussion of nutrition labels*. We also assessed how youth age will affect the efficacy of the intervention (RQ1).

Methods

We developed a family-centered, media literacy and nutrition curriculum called *FoodMania!* in a collaboration among Washington State University and University of Washington faculty, including WSU extension faculty (Austin et al. 2017). Extension faculty are ideally suited for development and implementation of a family-centered curriculum due to their statewide infrastructure and well-established relationships with families through 4-H youth development, nutrition, and parenting programs. Their expertise in education and evaluation also facilitated fidelity in implementation and data collection.

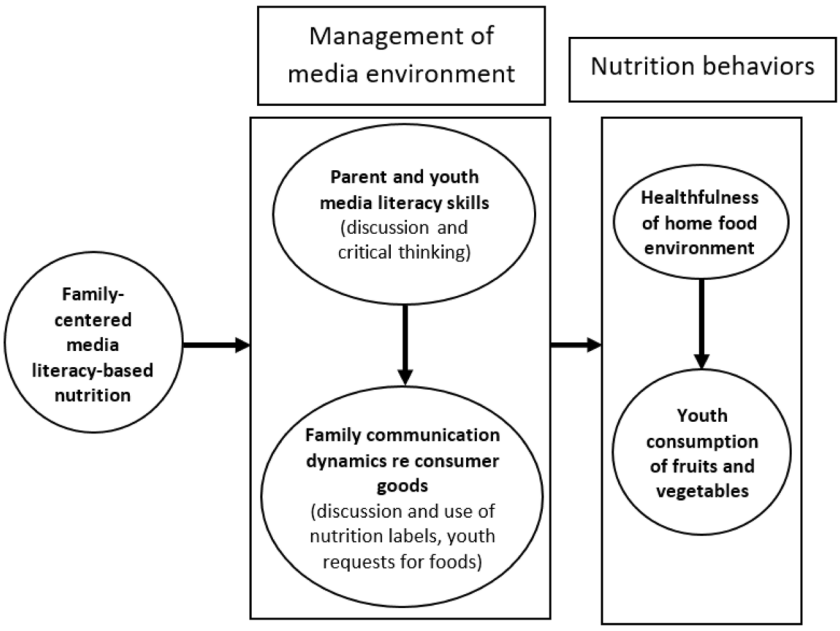

Fig. 1 Basic intervention model

Curriculum development incorporated both focus and work groups with parent and youth involvement and is based on the message interpretation process model (MIP; Austin et al. 2000, 2007; Pinkleton et al. 2013) in addition to following the family-based organizational structure of the Strengthening Families Program design, which has been applied successfully to substance abuse prevention content (Nathanson 2004; Molgaard and Spoth 2001). A matched-group sample of parent-child dyads ($N = 189$) was recruited from three urban and two rural counties in Washington state from families with similar backgrounds to match for local sociocultural factors. Participants were recruited from youth-focused extension programs, including SNAP-Ed and 4-H, and families self-selected into the intervention or control group. The intervention group filled first, and then staff recruited for comparable control group members. We tested the measures for homogeneity of variances and mean differences at pretest, between the treatment and condition groups, and found no significant or meaningful differences. Parent refers to primary caregivers who may or may not be the biological parents of youth for whom they provide care. The relationship to the child was mothers (86.2%), fathers (9.0%), grandparents (3.2%), and other family members (0.5%). In addition, the gender of the parent was more often female than male, with 89.4% and 10.1%, respectively. See Appendix Table A1 (available online) for additional demographic information about this sample.

The 6-week program, run in two waves in 2015 and 2016, employed a 2-h unit each week that dedicated 1 h to parents and youth meeting separately followed by a 1-h joint meeting. Each unit was held at a community location (e.g., school, community center) and was administered by university extension faculty. Lessons included information about food marketing techniques, comparisons of nutrition facts' labels, expectancies related to mediating advertising influences and eating fruits and vegetables, and how to apply critical thinking toward food advertising. The curriculum also included learning activities such as deconstructing food ads, reading food labels, tasting foods and drinks, designing a media campaign, and discussion strategies. Data collection procedures and the intervention were approved by the authors' institutional review board for the use of human subjects.

The curriculum design incorporated media as a catalyst to engage youth and encourage critical thinking and reflection, including through conversations between youth and parents. Activities incorporated humor (e.g., revising an existing ad), fact-finding games, developing marketing strategies to mimic or counter those used in food marketing, and activities to become a family "brand ambassador" for fruits and vegetables in their home. The emphasis is on looking "behind the scenes" to understand how foods are made to seem (often unrealistically) attractive rather than on condemning brands or foods. The Go/Slow/Whoa framework is used to introduce the concept of balanced decision making rather than elimination of certain foods (Gavin 2018).

The research team collected pretest and posttest data from both parents and youth using a self-administered survey prior to the start of the intervention and following the final session. Measures were designed to assess changes in the use of discussion strategies concerning the content and sources of media, such as the negative reinforcement of marketing content, understanding information found on nutrition labels, and critical assessment of food advertising. Measures also assessed attitudes as possible precursors for behavior change concerning media literacy and healthy eating. Appendix Table A2 (available online) shows all measures with corresponding descriptive statistics and the internal reliability (Cronbach's alpha) of the items constituting the latent constructs. Reliability estimates for parents and youth ranged from .79 to .88 and .70 to .78, respectively. Information collected about media use revealed that roughly two thirds of parents and children share television time more than three times per week ($M = 3.52$, SD = 1.23); however, over half of parents disagree that their families watch television during dinner ($M = 2.48$, SD = 1.43). On the other hand, roughly 60% of parents state that they use the Internet with their child two times or less per week ($M = 2.84$, SD = 1.43), but 88.9% of parents report using a Facebook account. Parents also assessed the healthiness of their family's diet, with 57.7% agreeing that their family members eat enough fruits and vegetable ($M = 3.42$, SD = 1.14) and 42.4% agreeing that they do not eat too much fat in their foods ($M = 3.23$, SD = 1.08). Based on information about the availability of different types of food available in the home, this study also created a mathematical ratio of healthy to less health foods ($M = 1.22$, SD = .40), with a higher ratio indicating a larger proportion of healthy foods available.

Analysis

Multiple analysis of covariance (MANCOVA) was used to estimate mean differences between the intervention and control groups on latent constructs and measures in the model. The MANCOVA controlled for *pretest levels* of model elements as well as the *age* of the youth.

We then fit a multigroup structural equation model (MGSEM) to the data to test the hypothesized model (Appendix Figure A1, available online). The MGSEM groups were the control ($n = 82$) and intervention ($n = 97$) conditions after 10 of the 189 cases were excluded due to excessive missing data. The MGSEM directly tests our hypothesis that the intervention helps to establish relationships between process measures by facilitating new interactions between parents and youth. We controlled for *pretest levels* of all elements in the MGSEM as well as *age* of the youth. Pretest and posttest

construct items were correlated with themselves across time (Little et al. 2007). The model was fit using MPLUS 8.0.

Multivariate normality was problematic for three of our primary outcomes, *ratio of healthy to unhealthy food in the home environment*, *fruit eaten yesterday*, and *vegetables eaten yesterday*, which were significantly skewed or platykurtic ($p < .05$). While maximum likelihood (ML) estimates are highly robust to non-normality, their standard errors can lead to higher rates of type I or type II errors (Finney and DiStefano 2013). Therefore, for the MANCOVA models, we made use of the MLM estimator in MPLUS which uses the Satorra-Bentler adjustment to standard errors for non-normal data. We also chose to use the Bayes estimator in conjunction with the likelihood function as initial hyperparameter values with large distribution variances for our MGSEM model (Akaike 1998). Large distribution variances indicate a moderate level of certainty about the specified estimates on the part of the authors and allow the data to drive the estimation process as opposed to prior beliefs (Levy and Choi 2013; van de Schoot et al. 2015). We also used the Bayes estimator to verify the significance of our ML MANOVA results for the three non-normal outcomes.

Bayesian estimation loosens distributional assumptions needed in frequentist approaches, such as multivariate normality, and provides greater accuracy under small sample size conditions (Levy and Choi 2013; van de Schoot et al. 2015). The deviance information criteria (DIC) and the posterior predictive *p* value (PPP) were used to assess model fit and compare models (van de Schoot et al. 2015; Zyphur and Oswald 2015). Model fit assessment included a sensitivity analysis to test our hyperparameter specifications by examining a wide range of values.

The data also were fit to the Bayesian MGSEM as a baseline model where no distinction was made between control and intervention groups, under the assumption of no meaningful differences in structural paths between groups. We then estimated a Bayesian version of the model with both intervention and control group paths constrained to use the same set of hyperparameters. Estimation of the final model freed the two groups to be estimated independently while applying a unique set of hyperparameters obtained from the ML estimates to each group. The results were compared using the DIC criteria to determine the best fitting model (Zyphur and Oswald 2015) and to test group equivalency between intervention and control.

Results

Confirming hypothesis 1, the MANCOVA showed significant ($p < .05$) posttest improvements in all outcomes in the intervention group, compared with no improvement in the control, with the exception of youth *attitude toward vegetables* ($d = 0.052$, $p > .05$). Standardized mean differences shown in Appendix Table A1 (available online) ranged in magnitude from 0.052 to 1.386. All parent outcomes showed increases by the intervention group compared with control. The primary parent outcomes of *talk with youth about food nutrition labels* ($d = 0.343$) and *ratio of healthy to unhealthy food in the home environment* ($d = 0.232$) showed significant increases compared with the control.

In response to research question 1, youth outcomes showed similar increases as the parent outcomes for the intervention group compared with the control. The primary youth outcome measures *talk with parent about nutrition labels* ($d = 0.211$), *vegetables eaten yesterday* ($d = 0.264$), and *fruit eaten yesterday* ($d = 1.386$) showed significant increases compared with the control. Two of the youth outcomes revealed significant interaction effects between *age of youth* and *condition*. Figure 2a illustrates that there was an overall increase for the intervention group, compared with the control, for *fruit eaten yesterday*. The increase was larger, however, for younger intervention youth compared with older. The youth report of *child-initiated discussion* also displayed an interaction effect between the age and the treatment condition, as shown in Fig. 2b. Youth in the intervention group, except the 9-year-olds, reported more occasions when they initiated discussion with their parents than the control group. The older youth in the intervention group also reported more occasions compared with younger children in the intervention. No significant age differences were observed in the control group, which remained close to the construct mean of 0.0 for control participants.

Bayesian MGSEM Results

The DIC of our hypothesized model was the lowest (DIC = 24,941.516) of all estimated Bayesian models, pointing to it as the best fitting model examined and providing evidence for meaningful path differences between the intervention and control groups. The PPP values for all models were less than .01, indicating an underestimation of the observed data by the models. This underestimation is reflected in effect size estimates that are on average 15% smaller than the ML estimates and what would presumably be expected in the population based on the data. This underestimation reflects a *conservative* model as opposed to one that overestimates the true effects in the population. Furthermore, the significant relationships and differences between the intervention and control groups reflect a minimum standard based on these results.

The estimates of the Bayesian MGSEM process model appear in Appendix Table A2 (available online), which compares coefficients for both the control and intervention groups. Figure 3 provides a visual representation of which paths in the hypothesized model Appendix Figure A1 (available online) were significant in one or both groups. The most dramatic

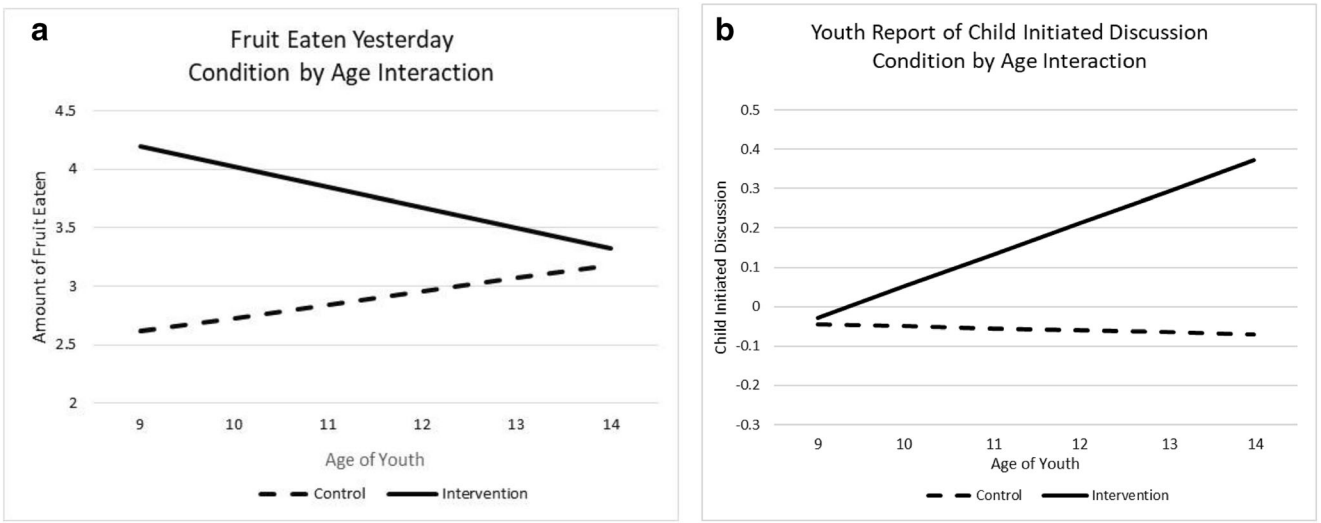

Fig. 2 Interactions between *age of youth* and the treatment *condition*. The intervention group in **a** displays an overall increase in the consumption of fruit with younger intervention youth reporting a larger increase compared with older youth with respect to the control group. The intervention group in **b** displayed larger increases in the youth report of *child-initiated discussion* as the age of the youth increased compared with youth in the control group, who were not significantly different from the construct mean of 0

outcome, as shown in Fig. 3 and Appendix Table A2 (available online), was the number of paths that were significant ($p < .05$) in the intervention group but not in the control group, in support of hypothesis 2. In the intervention group, 12 of 17 tested paths were significant ($p < .05$), compared with only four in the control. Moreover, the four significant paths in the control also were also significant in the intervention group. On average, effect size magnitudes were 0.113 in the control group and 0.236 in the intervention. All the significant effect sizes in the intervention group model indicated positive effects for intervention participants compared with the control. Regardless of levels of significance, the differences in effect size magnitudes between the two groups were often large and, in some cases, strikingly different. For example, the parent report of *child-initiated discussion* predicting *talking with youth about nutrition labels* was significant in both groups, but the estimate for the intervention group ($b^* = .545$) was over twice as large as that in the control ($b^* = .253$). Furthermore, the differences provide evidence for the effectiveness of the curriculum and confirm that the curriculum facilitates the development of interpersonal paths of beneficial influence that are weak or non-existent in the control group.

Direct and Total Effects for the Path Model

Direct effects for *age of the youth* were tested as controls on *fruit eaten yesterday* and the youth report of *child-initiated discussion* because of the significant interaction effects found in the MANCOVA. We also tested the effects of *age* on the youth measure *critical thinking about content* because it served as a dependent outcome for the parent measure of *parental negative mediation*. *Age* was not a significant control on either *fruit eaten yesterday* or *child-initiated discussion* ($p > .05$) which was likely because *age* effects were completely mediated in the intervention group by *critical thinking about content* ($b^* = 0.081$, $p = .007$).

Table 3 presents the total effects in the path model of our primary predictors on the primary outcomes of *fruit eaten yesterday*, *ratio of healthy to unhealthy food in the home environment*, and *talk with parent about nutrition labels*. Total effects for *vegetables eaten yesterday* do not appear because there were no significant primary paths to this outcome in the model. *Vegetables eaten yesterday*, however, was significantly impacted by an increase in intervention youth *attitudes toward vegetables* ($b^* = 0.425$).

The significant total effects in Table 3 appear modest, with the exception of *critical thinking about content* on *talk with parent about nutrition labels* (TE = 0.279, $p < .001$). This was not unexpected given that effects can be attenuated across a process model that may reflect short-term changes over the study period expected to accumulate over a longer period of time with respect to the impact of the curriculum on the overall process of parent and youth interactions regarding behavior, consumption, and critical thinking.

Discussion

This study tested the efficacy of media literacy, family-centered intervention as a nutrition improvement strategy for 9–14-year-old youth and parents. The matched-group design involving 189 families in five Washington state counties assessed the extent to which a nutrition intervention model based on improving families' management of the media

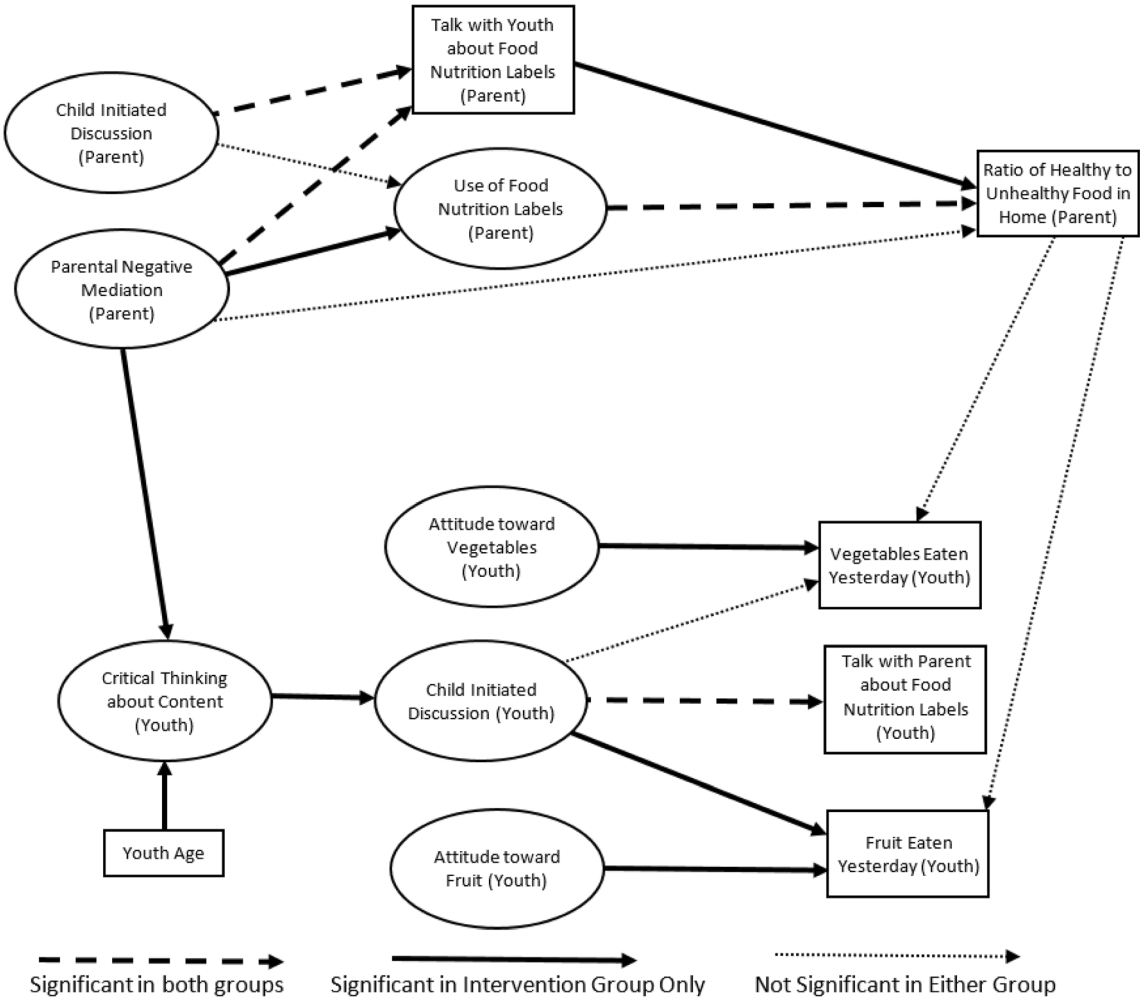

Fig. 3 The significant paths ($p < .05$) in the hypothesized model indicating group. All elements in the model were controlled for pretest levels (not shown)

environment would produce positive changes in nutrition behaviors.

As hypothesized, program effects were confirmed in two ways. First, MANCOVA analysis demonstrated mean differences (Table 1) between the Control and Intervention groups on eight of nine process variables tested and on all three nutrition outcome variables (*ratio of healthy to unhealthy food in the home environment*, youths' *fruit eaten yesterday*, and *vegetables eaten yesterday*). Second, MGSEM analysis (Table 2) showed, as hypothesized, that new relationships were created among the process variables for the intervention group, not existing in the control. These relationships demonstrated that an improved process of family communication about media, including family discussion of nutrition labels, ultimately drove improvements in targeted nutrition behaviors. Communication skills providing social support are among health literacy skills necessary for families to sustain healthy behavior change, representing moderating and mediating components of health literacy difficult to detect but able to produce sustained effects on behavior (Carbone and Zoellner 2012). The underestimation by the model of the observed data reflects a conservative model with significant relationships and differences between the intervention and control groups achieving a minimum standard, meaning the results are responsive to the need for robust designs and analyses that can detect the potential for cumulative change (Chambers et al. 2015).

For parents, an improved home nutrition environment was predicted by *discussion of nutrition labels with youth* and *use of nutrition labels*. These behaviors were influenced by *parental negative mediation* (critical discussion) of media, which was the focus of the intervention for parents. The results further indicated that *critical thinking about content* and family discussion of media, not *attitudes toward fruits and vegetables*, explained most improvements in youths' targeted outcome behaviors (Table 3).

It is important to note that this analysis, beyond demonstrated effects of the intervention, provides evidence regarding the paths of influence responsible for these effects. The intervention was based on social, cognitive, and dual-processing

Table 1 Standardized mean differences between intervention and control from the MANCOVA

	Dependent	Mean difference	SE
Parent report	Parental negative mediation	0.454**	0.062
	Child-initiated discussion	0.455**	0.054
	Use of food nutrition labels	0.292**	0.069
	Talk with youth about food nutrition labels	0.343**	0.061
	Ratio of healthy to unhealthy food in home	0.232**	0.048
Youth report	Critical thinking about content	0.313**	0.068
	Child-initiated discussion	− 0.661*	0.380
	Age of youth (main effect)	− 0.013	0.065
	Age by condition (interaction)	0.846*	0.378
	Attitude toward vegetables	0.052	0.050
	Attitude toward fruit	0.100*	0.058
	Talk with parent about food nutrition labels	0.211**	0.056
	Vegetables eaten yesterday	0.264**	0.057
	Fruit eaten yesterday	1.386**	0.366
	Age of youth (main effect)	0.115*	0.066
	Age by condition (interaction)	− 1.073**	0.352

*$p < .05$; **$p < .01$

Table 2 MGSEM standardized coefficients for the control and intervention groups

			Control				Intervention			
			95% CI				95% CI			
	Dependent	Predictor	Estimate	SD	Lower	Upper	Estimate	SD	Lower	Upper
Dependent is parent report	Use of food nutrition labels	Child-initiated discussion	0.056	0.114	− 0.173	0.273	0.121	0.112	− 0.108	0.335
		Parental negative mediation	0.065	0.109	− 0.149	0.274	0.317**	0.099	0.115	0.505
	Talk with youth about food nutrition labels	Child-initiated discussion	0.253*	0.117	0.019	0.473	0.545**	0.085	0.359	0.691
		Parental negative mediation	0.404**	0.092	0.209	0.568	0.296**	0.084	0.137	0.465
	Ratio of healthy/unhealthy food	Talk with youth about food nutrition labels	0.031	0.069	− 0.100	0.172	0.114*	0.050	0.020	0.214
		Use of food nutrition labels	0.154*	0.088	− 0.021	0.324	0.17**	0.070	0.028	0.309
		Parental negative mediation	− 0.007	0.087	− 0.182	0.165	− 0.035	0.066	− 0.161	0.099
Dependent is youth report	Critical thinking about content	Parental negative mediation	0.008	0.120	− 0.223	0.259	0.195*	0.097	0.003	0.374
		Age of youth	0.037	0.088	− 0.150	0.204	0.081**	0.045	0.013	0.188
	Child-initiated discussion (youth)	Critical thinking about content	− 0.055	0.151	− 0.349	0.242	0.431**	0.098	0.223	0.603
	Talk with parent about food nutrition labels	Child-initiated discussion (youth)	0.418**	0.096	0.213	0.59	0.641**	0.073	0.478	0.768
	Vegetables eaten yesterday	Child-initiated discussion (youth)	0.163	0.099	− 0.035	0.352	0.101	0.089	− 0.078	0.269
		Attitude toward vegetables	0.032	0.112	− 0.175	0.258	0.425**	0.088	0.241	0.58
		Ratio of healthy/unhealthy food	0.004	0.008	− 0.012	0.021	0.004	0.010	− 0.014	0.024
	Fruit eaten yesterday	Child-initiated discussion (youth)	0.093	0.103	− 0.114	0.291	0.195*	0.090	0.005	0.365
		Attitude toward fruit	0.132	0.091	− 0.040	0.317	0.336**	0.093	0.150	0.507
		Ratio of healthy/unhealthy food	0.006	0.009	− 0.012	0.023	0.007	0.010	− 0.014	0.027

CI Bayesian credibility interval

*$p < .05$; **$p < .01$

Table 3 Total effects for primary predictors on primary study outcomes

Outcome	Predictor	Total effect	95% CI	
			Lower	Upper
Ratio of healthy/unhealthy food	Child-initiated discussion (parent)	0.103*	0.018	0.196
Ratio of healthy/unhealthy food	Parental negative mediation (parent)	0.108**	0.038	0.203
Fruit eaten yesterday	Parental negative mediation (parent)	0.014	−0.002	0.049
Talk with parent about food nutrition labels	Parental negative mediation (parent)	0.050*	0.001	0.124
Talk with parent about food nutrition labels	Critical thinking about content (youth)	0.279**	0.135	0.418
Fruit eaten yesterday	Critical thinking about content (youth)	0.082*	0.002	0.183
Talk with parent about food nutrition labels	Age of youth	0.016**	0.002	0.046
Fruit eaten yesterday	Age of youth	0.005*	0.000	0.018

CI Bayesian credibility interval

*$p < .05$; **$p < .01$

theories, applying the MIP model to demonstrate how these theoretical principles apply to family members' interactions and decision-making regarding food marketing and food consumption. The results confirm how family interactions about media lead to a more or less productive use of media content in food selection. For parents, the results confirm that discussion of media can provide enjoyable opportunities to teach critical thinking and engage in healthy decision-making together with their children. Attempts to limit media use in our media-saturated society may produce conflict and is unlikely to eliminate media influence and the social conflict that can result from food marketing youth encounter outside the home. Instead, skills for critical discussion of media content and for use of media for credible information—such as through nutrition labels—can provide opportunities for mutually supportive and empowering discussion that ultimately help youth learn how to draw their own conclusions as they gain independence in adolescence and emerging adulthood.

Supporting the realistic nature of this approach to nutrition education, a unique feature of this intervention is that it produced paths of family-centered influence that did not exist previously (e.g., Fig. 3), but which were scaffolded onto existing paths of influence. In particular, the intervention group uniquely demonstrated relationships between *parental negative mediation* and *use of nutrition labels*, *parental negative mediation* and youths' *critical thinking about content*, *discussion of nutrition labels* and the *ratio of healthy to unhealthy food in the home environment*, *critical thinking about content* and *child-initiated discussion*, youths' *attitudes toward fruits and vegetables* and their consumption of them, and *child-initiated discussion* and consumption of fruit. That so few paths were significant in the control showed that the intervention impacted the relationships between the measures in addition to the measures themselves, reflecting both increasingly sophisticated individual cognitive processes and constructive interpersonal relationships. Newly created paths from *parental negative mediation* to youths' *critical thinking about content* led to increased youth *fruit eaten yesterday* for the intervention group, and parent-youth *discussion of nutrition labels* produced results for the home food environment only for those who participated in the intervention. Further, as an indication of intervention-participant youth's improved decision-making skill, their improvements in *critical thinking about content* led to more *child-initiated discussion* with parents, which led to increased *fruit eaten yesterday*. This path did not exist for the control group. It seems especially important that these newly created paths of influence for the parents intersected with existing paths of influence, such as between *child-initiated discussion* and *discussion of nutrition labels* and between parents' *use of nutrition labels* and the *ratio of healthy to unhealthy food in the home environment*. This suggests that the newly created paths of influence served to strengthen existing paths of influence, thereby helping families build on existing skill sets. Leveraging these naturally existing paths of influence could help families sustain effects of the newly learned skills acquired from the intervention.

Younger youth demonstrated more change on *fruit eaten yesterday* than older youth, illustrating the typically greater direct effects that parents have on younger youth behavior. Meanwhile, older youth demonstrated greater change in *child-initiated discussion*, which in turn predicted *fruit eaten yesterday* for the intervention group youth. *Child-initiated discussion* was predicted by *critical thinking about content*, the focus of the intervention for youth. This could indicate an improving ability for older youth to make healthy decisions independently. The results suggest that a family-centered approach targeting youth 9–14 can be effective despite the developmental differences represented across such a broad age range. Parents, of course, commonly guide and teach children across wide age ranges. Youth in this particular age group are just beginning to make independent food choices, while gaining experience

at influencing the purchases made by other family members. They also are developing cognitive sophistication that enables a better understanding of persuasive intent.

For nutrition educators and school personnel, these results underscore the importance of involving parents to reinforce and sustain nutrition education efforts undertaken in the school environment. The influences of family communication and food marketing precede the school day and continue after school, making them difficult to counterbalance and valuable to leverage. Given that parents and youth in this study commented that they enjoyed the opportunities to interact with each other and with other families, it could be possible to incorporate enjoyable media-related activities into existing programming. Given the important role of *child-initiated discussion*, it may be productive to provide youth with activities they can initiate with their parents, such as they did in this program as brand ambassadors for fruits and vegetables.

Involvement of university extension educators also can provide ways to extend and sustain school-based efforts and community-based campaigns that may take place. Every state has university extension, and their educators are experienced in community-based education and outreach. Their established relationships in communities make them trusted information sources, and they possess particular expertise for developing and delivering engaging activity-based learning opportunities for both youth and parents.

It will be useful to investigate the extent to which the newly created paths of influence might naturally strengthen over time, as well as how they respond to reinforcement. Booster sessions to reinforce media management behaviors might magnify the results manifested in this study as family members increase their use of newly developed skills through practice and the rewards gained from positive interactions. Adjustments to the curriculum length and content also could increase its resonance and concomitant effectiveness. For example, Latino/a participation was limited relative to the population due to the frequent presence of a language barrier, and curriculum content did not reflect cultural differences in media use. Similar to most media literacy and nutrition research, our study had limited male parent participation, at about 10% male parent respondents. This low participation rate made us contemplate the differences that might occur if more fathers participated, or the different perspectives that they might be able to offer. Family communication research might benefit from future considerations of the male parent's role in home food environments and media literacy.

Because this study employed self-report measures, limitations exist regarding potential measurement bias. From a communication standpoint, the issue of correspondence between parent and youth merits further investigation. In these data, there was a very low non-significant raw correlation between parent and youth reports of talking about food nutrition labels in both the treatment and control groups ($r \approx .10$, $p > .05$). These results emphasize the value of the approach we employed, in which we examined the complex relationships that result from such interventions in terms of a process model rather than focusing on raw uncontrolled relationships.

It should be noted that results obtained in this study could reflect a Hawthorne effect, given that control group participants did not participate in a scripted alternative activity, but instead continued in their regularly scheduled activities. Many of these activities, however, included regular extension-led programs from which they had been recruited, providing some parallels. A total of 8.3% of families in the control group and 7.2% of families in the intervention group reported having participated in another nutrition education program during the study period. In open-ended comments in the posttest, many of the parent participants noted the uniqueness of this program approach, mentioning in particular learning about nutrition labels, learning about marketing strategies, and having related discussions with their children. This suggests that the content and structure of the program were responsible for observed changes, rather than a more generalized effect of experimenter attention received by participating families.

These results provide support for an approach to nutrition intervention that leverages the family communication environment as a catalyst for both direct and indirect parental influence as youth approaching adolescence develop increasing independence. The results suggest that educators and health providers can benefit from involving parents in nutrition education and that media literacy can provide a catalyst for doing so. *FoodMania!'s* use of media literacy to improve nutrition outcomes uniquely harnesses youths' and parents' affinity for media without depending on parents to prohibit media use or condemn media sources. This approach appears to successfully promote engagement and reduce reactance from youth who like media and must navigate a marketing-saturated environment outside the home.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the Washington State University institutional review board in compliance with the 1964 Helsinki declaration and its later amendments.

Informed Consent Informed consent was obtained from each participant included in the study. This article does not contain any studies with animals performed by any of the authors.

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