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Autonomous Motivation and Fruit/Vegetable Intake in Parent–Adolescent Dyads

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Abstract

Introduction—Autonomous motivation (motivation to engage in a behavior because of personal choice, interest, or value) is often associated with health behaviors. The present study contributes to research on motivation and eating behaviors by examining: (1) how autonomous motivation is correlated within parent–adolescent dyads; and (2) whether parent- and adolescent-reported autonomous motivation predicts the parent–adolescent correlation in fruit and vegetable (FV) intake frequency.

Methods—Data were drawn from the Family Life, Activity, Sun, Health, and Eating (FLASHE) Study, a cross-sectional U.S. survey of parent–adolescent dyads led by the National Cancer Institute and fielded between April and October 2014. In 2016, data were analyzed from dyads who had responses on a six-item self-report measure of daily frequency of FV consumption and a two-item self-report measure of autonomous motivation for consuming FVs.

Results—Parents' and adolescents' reports of autonomous motivation and FV intake frequency were positively correlated. Both parents' and adolescents' autonomous motivation predicted higher levels of their own FV intake frequency and that of their dyad partner (p -values < 0.001). These effects of autonomous motivation explained 22.6% of the parent–adolescent correlation in FV intake frequency. Actor effects (one's motivation predicting their own FV intake frequency) were stronger than partner effects (one's motivation predicting their partner's FV intake frequency).

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Conclusions—Parent–adolescent similarity in autonomous motivation for healthy eating may contribute to similarity in eating behaviors. Future research should further examine how individual-level health behavior correlates influence health behaviors within dyads.

Introduction

The majority of Americans do not consume recommended amounts of fruits or vegetables (FVs). Rates are low among adolescents, who are recommended to consume 1.5–2 cups of fruit and 2–2.5 cups of vegetables daily.¹ Adolescents consuming lower than the recommended amount of FVs is of public health concern given the known health benefits associated with adequate FV consumption.^{2,3}

Several studies have examined theory-based psychosocial factors to understand and promote FV intake. Self-determination theory (SDT)⁴ is one theory that has been applied to understanding motivational mechanisms of health behaviors and designing health behavior interventions.⁵ SDT posits a motivational continuum from controlled (motivated by external factors) to autonomous (motivated for reasons associated with personal choice, interest, or value).⁴ Although intrinsic motivation (genuine enjoyment/interest in a behavior) is the most autonomous form, there are other autonomous motivations often assessed in relation to healthy behaviors. These motivations include: identified (personally valuing a behavior) and integrated (valuing a behavior and viewing it as aligned with other personal values).^{4,6}

Being autonomously motivated can promote engagement in and maintenance of behaviors.^{4–6} Autonomous forms of motivation have been positively associated with adults' FV intake^{7,8} and can predict health-related behaviors among adolescents, such as greater physical activity and lower engagement in marijuana use, sexual intercourse, and smoking.^{9–12} Autonomous motivations can also be targeted in health behavior interventions. For example, autonomous motivation has been included in an intervention for diet and physical activity through motivational interviewing. A motivational interviewing component of an intervention to increase these behaviors among African American adults asked participants about their behavioral motivations and how they are linked to their personal goals.¹³ This strategy was associated with increased autonomous motivation, which partially mediated increased FV intake.¹³ Another study facilitated adolescents' autonomous motivation for healthy eating through team projects and personal commitments to healthy behaviors, as part of an intervention targeting psychosocial variables from SDT and social cognitive theory.¹⁴ This research suggests the relevancy of autonomous motivation for eating behavior interventions.

The social context is central to SDT. Autonomous motivation can be promoted via autonomy-supportive contexts in which an authority figure (e.g., parent) takes into account the individual's (e.g., child's) perspective, provides opportunity for choice, and supports the individual in feeling capable of enacting goal behaviors.^{5,15,16} These supports can promote autonomous motivation and behavior change.^{17,18} In one study, perceived autonomy support from parents was indirectly associated with adolescents' behavior intentions (including for FV intake) through autonomous motivation and theory of planned behavior constructs.¹⁹

However, research has not examined how parents' and adolescents' individually reported motivation affects both their own behavior and each other's behavior.

Examining how psychosocial variables affect parent–adolescent dyads can build understanding of how family context relates to FV intake. Reviews have found parent and adolescent FV intake to be positively correlated.^{20,21} In addition, multiple theoretical approaches, including social cognitive theory,²² family systems theory,²³ and the model of family reciprocal determinism,²⁴ propose that characteristics of an individual and their environment (including the family environment) are inter-related. This suggests the importance of examining the interplay of social (e.g., familial) contexts and individual characteristics shaping FV intake.

Few dyadic analyses have examined individual-level factors that may explain associations in obesity-related behaviors among members of a dyad (dyadic interdependence). The studies that have been done suggest that the dyad is an important social unit to consider when understanding psychosocial influences on health behaviors. One study found that attitudes, self-efficacy, and barriers related to FVs were positively correlated between parents and their adolescent children, and that parents' reports on these variables influenced their adolescent's diet.²⁵ Using an actor–partner interdependence model (APIM), a statistical technique that accounts for dyadic interdependence, another study found that young adults' health behavior attitudes predicted their mothers' diet and physical activity behaviors in addition to their own behaviors.²⁶ Another APIM found that one's perceived behavioral control (perception of ability to do a particular behavior with ease)²⁷ predicted their romantic partner's physical activity intentions.²⁸

These cross-sectional dyadic surveys demonstrate that theory-informed health behavior constructs can correlate with the behavior of another person. However, these dyadic analyses have not incorporated variables included in SDT. The current study expands upon emerging evidence that an individual's psychosocial variables may affect others' health behaviors, and the salience of the social context in SDT, by examining dyadic associations between autonomous motivation and FV intake. This analysis uses publicly available data from the Family Life, Activity, Sun, Health, and Eating (FLASHE) Study, and illustrates how FLASHE data can be utilized to study interdependence among parent-adolescent dyads.

Methods

Data Source and Sample

The FLASHE study is a U.S. survey funded by the National Cancer Institute. FLASHE assessed diet and physical activity behaviors (and their correlates) among a national sample of dyads of parents and their adolescent children (aged 12–17 years). As described in this issue,²⁹ the FLASHE conceptual model was informed by existing literature and frameworks related to health behavior, including family systems theory,²³ social ecological models,³⁰ and SDT.⁴

This cross-sectional study was fielded by Westat, Inc. between April and October 2014. Parents were recruited through the Ipsos Consumer Opinion Panel. Ipsos selected a sample

of panel members to be screened for FLASHE eligibility, and this sample was selected to be similar to U.S. population on: parent gender, Census division, household income and size, and race/ethnicity. Parents were eligible if they were aged 18 years and lived with at least one child aged 12–17 years for at least 50% of the time. One eligible adolescent from the household was randomly selected for the study. A total of 5,027 dyads were invited to participate in FLASHE, and 1,945 dyads enrolled. Details on the study methods are presented in this issue.³¹

The FLASHE Study involved two online surveys for each participant: one focused on physical activity and another focused on diet. Survey order was counterbalanced across dyads, and the first survey asked about demographic information. FLASHE was reviewed and approved by the U.S. Government's Office of Management and Budget, National Cancer Institute's Special Studies IRB, and Westat's IRB.

Dyads were included in this analysis if they had non-missing data on: parent and adolescent FV intake frequency and autonomous motivation for consuming FVs, parent sex, adolescent sex, adolescent age, and parent education. Mean autonomous motivation and FV frequency did not significantly differ by whether or not dyads were missing data on other variables in this analysis (t -statistics 0.09, p -values 0.08). Of 1,646 dyads who completed the parent and adolescent diet surveys, 1,443 (87.7%) met inclusion criteria.

Measures

The FLASHE survey items were selected through: literature reviews, feedback from scientific advisors, development of new items, and cognitive testing that identified participants' understanding of items and any necessary edits.²⁹

Items assessing food and beverage consumption were modified from the Dietary Screener Questionnaire³² and the National Youth Physical Activity and Nutrition Survey.³³ Six items assessed frequency of intake for several FVs during the past 7 days via parents' and adolescents' self-report: 100% pure fruit juice, fruit, green salad, non-fried vegetables, cooked beans, and other (non-fried) potatoes. Response options included: *did not consume in past 7 days*, *1–3 times in past 7 days*, *4–6 times in past 7 days*, *1 time per day*, *2 times per day*, and *3 or more times per day*. Full item wording is shown in Table 1. Items were recoded to reflect daily frequency (values for each item ranged from 0 to 3) and summed to arrive at a total score of daily FV frequency. Extreme values (z -scores 3.29) were top-coded.³⁴ More details on the FLASHE dietary screener are provided in this issue.³⁵

Parents and adolescents reported their own autonomous motivation for consuming FVs on two items selected from those on the autonomous motivation subscale of the Treatment Self-Regulation Questionnaire:³⁶ *It is an important thing for me to do*, and *I have thought about it and decided that I want to eat fruits and vegetables every day*. Responses ranged from 1 (*strongly disagree*) to 5 (*strongly agree*) and were averaged. Inter-item correlations were 0.53 ($p < 0.001$) for parents and 0.54 ($p < 0.001$) for adolescents.

Statistical Analysis

Parent-adolescent interdependence in frequency of FV intake and autonomous motivation was examined using Pearson correlations^a in SAS, version 9.3. APIMs were run in MPlus, version 7.3 to examine whether parent- and adolescent-reported autonomous motivation predicted their own FV intake frequency (actor effects) and the FV intake frequency of their partner (partner effects). When analyzing data from dyads, an approach such as APIM is advisable because it does not assume that participants are independent of each other.^{37,38} In APIMs, one's self-reported variables are allowed to predict their own outcome (actor effects) and one's partner's outcome (partner effects), with actor and partner effects being estimated when controlling for each other. Control variables included parent sex, adolescent sex, adolescent age, and parent education. Parent and adolescent autonomous motivation were regressed on the control variables, and parent and adolescent FV intake frequency were regressed on the control variables, parent autonomous motivation, and adolescent autonomous motivation. Path-tracing techniques were then applied,³⁹ using unstandardized estimates from both the final APIM and an APIM including only control variables as predictors, to determine the percent of interdependence in FV intake frequency that was accounted for by actor and partner effects of autonomous motivation. Calculations to arrive at these percentages are in the Appendix. Analyses were completed in 2016.

Results

Descriptive information about the sample is presented in Table 2. Parent and adolescent FV intake frequency were positively associated and demonstrated a good amount of within-dyad similarity ($r=0.51$, $p<0.001$). Parent and adolescent autonomous motivation were also positively correlated ($r=0.29$, $p<0.001$).

Table 3 shows associations between demographic variables and the predictors and outcomes in the APIM. Female participants and parents with a 4-year college degree reported greater autonomous motivation than did male participants and parents with less than a 4-year degree (p -values <0.001). FV intake for parents and adolescents was higher when parents had a 4-year college degree (p -values <0.001). Older adolescent age predicted somewhat lower adolescent FV intake ($p=0.04$).

Figure 1 shows standardized and unstandardized estimates from the APIM predicting FV intake frequency from autonomous motivation. The model explained 16.7% of the variance in parents' FV intake and 16.3% of the variance in adolescents' FV intake. Both actor effects were statistically significant: Parents' autonomous motivation was positively associated with parents' FV intake frequency ($\beta=0.31$, 95% CI=0.26, 0.36, $p<0.001$), and adolescents' autonomous motivation was positively associated with adolescents' FV intake frequency ($\beta=0.35$, 95% CI=0.30, 0.40, $p<0.001$). Both partner effects were also statistically significant, although smaller than actor effects: Parents' autonomous motivation was

^aIn addition to Pearson correlations, the authors also examined intraclass correlations (ICCs). Both are useful metrics for assessing the degree of interdependence among distinguishable dyads (e.g., dyads in which members can be distinguished from one another on a variable, such as parent-adolescent).³⁸ The Pearson and ICC often have similar values, but the ICC can be smaller than the Pearson when distribution of behavior (e.g., mean or variance) varies between dyad members.⁵¹ For autonomous motivation and FV intake frequency, the Pearson and ICC were equivalent, so only the Pearson is reported.

positively associated with their adolescent's FV intake frequency ($\beta=0.08$, 95% CI=0.03, 0.13, $p=0.001$), and adolescents' autonomous motivation was positively associated with their parent's FV intake frequency ($\beta=0.15$, 95% CI=0.10, 0.20, $p<0.001$). The actor and partner effects were not moderated by sex; the effect of autonomous motivation on one's own or their partner's FV intake frequency did not significantly vary between parents and adolescents ($p=0.64$ and 0.35 , respectively).

The authors tested the degree of covariation between parent and adolescent FV intake that was uniquely explained by the effects of autonomous motivation in the APIM. Detailed in Appendix Figure 1, actor effects of autonomous motivation explained 6.4% of the parent–adolescent interdependence in FV intake, while partner effects of autonomous motivation explained 0.7% of this interdependence. In addition, 10.4% of the interdependence was driven by adolescent autonomous motivation, while 5.1% was driven by parent autonomous motivation. Therefore, actor and partner effects of autonomous motivation explained a combined 22.6% of the parent–adolescent interdependence in the frequency of FV intake.

Discussion

Autonomous motivation was associated with one's own FV intake frequency and that of their partner (parent or adolescent). Within dyads, parent and adolescent reports of their own autonomous motivation were positively correlated, which contributed to parent–adolescent interdependence in FV intake frequency.

Actor effects (one's autonomous motivation predicting their own FV intake frequency) were larger in magnitude than the partner effects (one's autonomous motivation predicting their partner's FV intake) and CIs for actor and partner effects did not overlap. Actor effects also explained a greater proportion of dyadic interdependence in FV intake than did partner effects. These findings suggest that this dyadic interdependence in autonomous motivation may translate to dyadic interdependence in FV intake through strong actor effects.

Though some have argued that interventions to increase FV intake have been largely ineffective,⁴⁰ few studies have adequately accounted for the interdependence between parents and their adolescent children. An implication from the current study that deserves further research is the possibility of encouraging autonomous motivation at the level of the dyad or family, as this study found that parents and their adolescents had correlated autonomous motivation. Interventions to promote autonomous motivation for healthy behaviors have involved supporting autonomy in various ways. Motivational interviewing interventions and encouraging linkages between health behaviors and personal goals may promote autonomous motivation and FV intake.^{5,13} Motivational interventions may also be delivered within the family. A potential opportunity is to provide parents with training sessions that emphasize skills for supporting adolescents' autonomy and other needs (e.g., structure and involvement).^{41,42} In a recent family-based intervention, parents received training sessions including examples of need-supportive behaviors and opportunities for modeling them.^{41,42} Parents were encouraged to be autonomy supportive by: providing options for healthy eating, encouraging adolescents' ability to make their own choices for their health behaviors, using less demanding language, and engaging in behavior with their

adolescents. This approach can promote autonomous motivation among adolescents, which may affect FV intake.^{41,42}

One potential implication from this study is the idea that an individual's motivation may be intervened upon to affect the FV intake of other family members, consistent with prior findings that effects of interventions delivered to one individual can extend within the family^{43,44} and that adolescents can influence their parents eating behavior.⁴⁵ However, although other studies examining psychosocial variables on diet and physical activity have found actor effects to be larger than partner effects,^{26,28} parameter estimates for partner influence and the percentage of dyadic interdependence explained by them (versus actor effects) were small. Future studies, including longitudinal designs, are needed to investigate whether there is potential for family-based health behavior interventions to affect behavior via partner effects and whether partner effects are stronger for other dyad types. Studying how bidirectional influences of motivation on FV intake vary as a function of other influences on adolescent health behaviors can also help identify whether there are features of the home environment and family relationships that can promote shared autonomous motivations for healthful eating or that may be mechanisms for partner effects on healthy behavior. It is possible that one's autonomous motivation for FV intake may prompt efforts by others to support the individual in consuming FVs within the home.

These efforts may include healthier food purchases, and making FVs more available—home environment characteristics that are related to adolescents' FV intake^{46,47} and that may have a broader effect on the behaviors of the family. Other analyses can also examine the degree to which psychosocial factors, versus shared contexts, explain interdependence in health behaviors. These studies could also incorporate other psychosocial variables that have been associated with health behaviors and intentions across dyad members, including attitudes, self-efficacy, barriers, and perceived behavioral control,^{25,26,28} in addition to other constructs from SDT such as perceived support for autonomy and other psychological needs.⁴

Other dyadic analysis opportunities to expand upon this study include: examining the role of peer influence, time, and other types of dyads. Peer influence increases as children age, and parental influence on health behaviors can potentially change over time.^{46,48,49} Using dyadic analyses to understand the interplay of parent–adolescent dyads and friend dyads can provide more understanding of how psychosocial variables influence health behaviors within various social relationships. Dyads may also show interdependence in their trajectories of behavior over time,^{43,50} and motivation can become more autonomous over time.¹⁶ Longitudinal designs in the context of the current research question could have implications for how dyadic associations in autonomous motivation influence long-term behavior maintenance. Longitudinal studies can also help clarify the processes underlying associations between dyadic interdependence in psychosocial variables and dyadic associations in health behaviors. The present analysis can also be expanded by looking at different types of parent–adolescent dyads. Although a strength of the present study is the large, national sample, examination of dyadic influences on health behaviors is also needed among dyads who are at high risk of negative health outcomes.

Limitations

Though a strength of FLASHE is the assessment of multiple health behavior correlates, the inclusion of many constructs required concise measures to limit burden on respondents. Multiple researchers provided input on the survey content and items, and items were cognitively tested.²⁹ However, replicating this analysis with a full-length measure of autonomous motivation³⁶ would provide a more comprehensive assessment. Although the dietary screener items were feasible for a survey delivered to adolescents, other measures of dietary intake, including 24-hour recalls, could also strengthen the analysis. Another limitation is the cross-sectional nature of these data.

Conclusions

The present study investigated how parents' and adolescents' autonomous motivation is associated with their own FV intake, their partner's FV intake, and the interdependence in FV intake within dyads. The results are consistent with prior findings that parent and adolescent FV intakes are interdependent.^{20,21} This analysis also contributes to the few existing studies that have incorporated constructs from health behavior theories into a dyadic context and demonstrates that autonomous motivation was correlated between parents and adolescents. The family is salient for health behavior, and the current study presents an example of how the family plays a role in FV intake. Modeling the association between motivation and FV intake in a dyadic analysis suggested that the autonomous motivation of both parents and adolescents partially explained the dyadic association in FV intake.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Actor-partner interdependence model predicting FV from autonomous motivation.

Note: Standardized parameter estimates from MPlus are shown first (followed by unstandardized parameter estimates in parentheses). Paths from the control variables to both the predictors and outcomes were estimated and are shown in Table 3. Boldface indicates statistical significance ($p < 0.001$).

FV, fruit and vegetable

Table 1
FLASHE Survey Items Assessing Fruit and Vegetable Intake Frequency and Autonomous Motivation for Fruit and Vegetable Consumption

Construct	Individual survey items
Fruit and vegetable intake frequency	<p>DURING THE PAST 7 DAYS, how many times did you drink...</p> <p>1. 100% PURE FRUIT JUICE like orange, apple, grape, etc.? DON'T COUNT fruit-flavored drinks with added sugar like Capri Sun, etc.</p> <p>DURING THE PAST 7 DAYS, how many times did you eat...</p> <p>2. Fruit like apples, bananas, melon, etc.?COUNT fresh, frozen, canned and dried fruit.DON'T COUNT fruit juices.</p> <p>3. a GREEN SALAD, with or without other vegetables?</p> <p>4. any OTHER KIND OF POTATOES that aren't fried like baked, boiled, mashed or potatoes used in soups or stews?</p> <p>5. other NON-FRIED VEGETABLES like carrots, broccoli, collards, green beans, corn, etc.? DON'T COUNT green salad or potatoes.</p> <p>6. refried beans, baked beans, pinto beans, black beans or other COOKED BEANS? DON'T COUNT green beans or string beans.</p> <p>Response options:</p> <p><i>Did not drink/eat ___ during the past 7 days</i></p> <p><i>1-3 times in past 7 days</i></p> <p><i>4-6 times in past 7 days</i></p> <p><i>1 time per day</i></p> <p><i>2 times per day</i></p> <p><i>3 or more times per day</i></p>
Autonomous motivation for fruit and vegetable consumption	<p>I would eat fruits and vegetables every day because...</p> <p>1. I have thought about it and decided that I want to eat fruits and vegetables every day.</p> <p>2. It is an important thing for me to do.</p> <p>Response options:</p> <p>1 (<i>strongly disagree</i>) – 5 (<i>strongly agree</i>)</p>

Note. The items shown here were included in both the adolescent and parent diet surveys.

FLASHE, Family Life, Sun, Health, and Eating Study

Table 2
Descriptive Information About Parents and Adolescents in FLASHE Dyads (N
dyads=1,443)

Dyad demographics	n	%
Parent sex		
Male	368	49.48%
Female	1,075	74.50%
Adolescent sex		
Male	714	49.48%
Female	729	50.52%
Dyad type		
Mother – Daughter	552	38.25%
Mother – Son	523	36.24%
Father – Daughter	177	12.27%
Father – Son	191	13.24%
Parent education		
Less than a 4-year college degree	763	52.88%
4-year college degree or higher	680	47.12%
Parent race/ethnicity		
Non-Hispanic white only	995	68.95%
Non-Hispanic black only	243	16.84%
Hispanic	104	7.21%
Other	88	6.10%
Adolescent race/ethnicity		
Non-Hispanic white only	909	62.99%
Non-Hispanic black only	237	16.42%
Hispanic	142	9.84%
Other	139	9.63%
Parent age		
18-34	158	10.95%
35-44	635	44.01%
45-59	608	42.13%
60+	42	2.91%
	M	SD
Adolescent age	14.48	1.61
Predictors and outcomes	Parent M (SD)	Adolescent M (SD)
Autonomous motivation	4.31 (0.71)	3.94 (0.88)
Fruit and vegetable intake frequency	3.03 (1.95)	2.78 (2.05)

Note: Values for the predictor (autonomous motivation) ranged from 1–5 for both parents and adolescents. Values for the outcome (fruit and vegetable intake frequency) ranged from 0–9.87 for parents and 0–10.29 for adolescents.

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Table 3
Demographic Correlates of Autonomous Motivation and FV Intake in the APIM

Correlate	Outcome											
	Adolescent autonomous motivation			Adolescent FV intake			Parent autonomous motivation			Parent FV intake		
	β	CI	p-value	β	CI	p-value	β	CI	p-value	β	CI	p-value
Adolescent sex (female) ^a	0.11	0.06,0.16	< 0.001	-0.01	-0.06,0.04	0.75	-0.01	-0.06,0.04	0.71	-0.03	-0.07,0.02	0.27
Parent sex (female) ^a	-0.01	-0.06,0.05	0.84	-0.07	-0.12,-0.02	0.003	0.08	0.03,0.14	0.001	-0.03	-0.08,0.02	0.24
Parent education (4-year college degree) ^a	0.04	-0.02,0.09	0.18	0.09	0.04,0.13	< 0.001	0.12	0.07,0.17	< 0.001	0.10	0.05,0.15	< 0.001
Adolescent age	0.01	-0.04,0.06	0.65	-0.05	-0.10,-0.00	0.04	0.00	-0.05,0.05	0.95	-0.04	-0.09,0.01	0.10

Notes: Boldface indicates statistical significance ($p < 0.05$).

^aVariables were dichotomous, and reference groups were: male adolescent; male parent, and parent education lower than a four-year college degree

APIM, Actor-Partner Interdependence Model; FV, fruit and vegetable