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Co-action between physical activity and fruit and vegetable intake in racially diverse, obese adults

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Abstract

Purpose.—There is minimal understanding of the potential for coaction, defined as action on one behavior increasing the likelihood of taking action on another behavior, between physical activity (PA) and fruit and vegetable (FV) intake. The purpose of this study was to assess the bidirectional coaction between FV intake and PA, as well as self-efficacy for these behaviors, in a racially diverse sample of obese adults.

Design.—This is a secondary analysis using data collected from the Path to Health study, a randomized controlled trial. ClinicalTrials.gov Identifier: .

Sample.—Obese adults who completed baseline and 6 month follow-up assessments.

Measures.—For this study, data on FV intake, leisure-time PA, and seven-day accelerometer data were analyzed at baseline and 6-month follow-up.

Analysis.—We interchanged modeling the FV intake and PA change variables as the independent and dependent variables. Multiple imputations were conducted; linear and multinomial regression models.

Results.—The sample (n=168) was 59% female and mainly split between white (42%) and African American (42%). Change in self-efficacy for PA was predictive of change in self-efficacy for FV intake, and vice versa. As compared to participants with no change in FV intake, someone with a positive change in FV intake was more likely to have a positive change in self-reported PA (Adjusted RR=6.72, 95% CI 1.69–26.68). Likewise, as compared to no change, participants with a positive change in self-reported PA were more likely to report a positive change in FV intake (Adjusted RR=6.79, 95% CI 1.70–27.17).

Conclusion.—Findings suggest coaction between self-efficacy for FV intake and PA, as well as between FV intake and PA. Coaction could be capitalized on to more effectively promote both energy-balance behaviors.

Keywords

physical activity; nutrition; weight control interventions; coaction

Purpose

Obesity prevalence continues to increase in the U.S. [1,2] In addition to the need to continue with prevention efforts, this trend indicates that there will be even more individuals in future years in need of obesity treatment and weight management programs (WMPs). Initially, WMPs focused on dietary behavior, but given the evidence that the inclusion of physical activity (PA) behavior change alongside dietary changes improves weight loss,[3–7] WMPs now tend to include both behaviors.

Previous literature indicates that there can be coaction[8] between behaviors, with variations of the concept called carry-over,[9] co-variation,[10] spill-over,[11] or transfer.[12] Coaction is defined as behavior change for one behavior resulting in change in another behavior.[8,13,14] Coaction between PA and dietary behaviors may produce greater change than targeting each behavior separately, which is especially relevant to WMPs.[13] A better understanding of how the two behaviors influence each other can guide decisions on curriculum content and ordering of content in WMPs to achieve better outcomes.[14,15]

For fruit and vegetable (FV) intake, just one facet of dietary behavior, it is hypothesized that it shares contexts, regulatory resources, and skills with PA that allow change in one behavior to facilitate or quick-start change in the other.[16–18] Achieving positive change in PA and FV intake typically requires the addition of something new (e.g. unfamiliar produce, additional activities), as opposed to modification or elimination. While coaction between these two behaviors has been investigated using cross-sectional and longitudinal studies,[19–23] only recently has coaction been studied within the context of multiple-behavior change (MBC) interventions. In particular, results of stage-based models of behavior change have found that participants who are able to progress from action to maintenance of one behavior (healthy eating or PA) are more likely to progress from action to maintenance for the other behavior.[8,17,24]

The few studies that have found coaction between two behaviors outside the scope of the Transtheoretical Model or other stage-based MBC interventions have focused on how PA impacts diet[25,26] or the theoretical determinants of diet, such as motivation,[11] self-regulation,[26] and self-efficacy.[26] The positive influence of PA on healthy eating and subsequent weight loss has been hypothesized to be because PA helps to control binge eating, improve body image, and enhance mood and affect.[27–29] However, this relationship is not true for all individuals, as positive change in one behavior can lead to negative change in the other. For example, compensatory eating may occur after PA.[30,31] There have been few studies within the context of WMPs investigating how healthy eating can influence PA.[9,25] There is a need to further explore coaction in both directions during WMPs with obese individuals, especially with more rigorous assessments of these behaviors.[16]

Self-efficacy,[32,33] or the confidence to perform a specific behavior, is one of the strongest predictors of both PA and FV intake.[34–36] Though initially only part of the Social Cognitive Theory (SCT), the ability of self-efficacy to predict behavior[37] has since led to its incorporation into many behavioral theories. Despite Bandura’s original definitions of self-efficacy as being highly contextual and behavior- and domain-specific,[32,33,38] the possibility of self-efficacy co-varying between behaviors with similar contexts was subsequently acknowledged by Bandura.[38] Thus, coaction between self-efficacy for PA and self-efficacy for healthy eating is also possible, as there may be facilitating patterns between the psychological constructs (i.e. self-efficacy) that are thought to precede the behaviors.[17] Indeed, some initial studies have shown that within the context of WMPs, self-efficacy developed for PA can be carried-over to self-efficacy for healthy eating.[9,17,26,39] Therefore, there is a need to better understand coaction both at the psychological level, e.g., self-efficacy and across the behaviors[40] so that researchers can design more effective, long-lasting WMPs that address each behavior when it is most appropriate within the course of treatment.

The purpose of this study was to assess the coaction over time between FV intake and PA, as well as between self-efficacy for FV intake and self-efficacy for PA, in a racially diverse group of obese participants using multiple data collection points. We hypothesized that there would be positive co-action between FV intake and PA, as well as between self-efficacy for FV intake and self-efficacy for PA.

METHODS

Design

This study was a secondary data analysis from the Path to Health study, which was a randomized controlled trial with 168 individuals conducted from 2015–2016.[41] Sample size for this study was thus predetermined by *a priori* power analysis for the parent study. This study was reviewed and approved by appropriate Institutional Review Boards. The goal of Path to Health was to facilitate enrollment to, use of and adherence to commercially-available, evidence-based WMPs, designed to increase PA and improve diet. Path to Health evaluated the efficacy of up to six brief calls with a telephone health coach to facilitate enrollment of participants in a WMP. Coaches provided information on features and other aspects of commercially-available WMPs to help participants find a program that fit their needs, with minimal direct assistance with behavior-specific questions. The health coaches were masters-level trained counselors who used a combination of motivational enhancement and social cognitive treatment techniques to problem solving derived from motivational interviewing and SCT.[42] Although we found a positive intervention effect on enrollment in WMPs by 6 months (39% of the intervention group vs. 29% of the control group), we did not find an intervention effect on FV intake or PA.[41] Thus, we treated the study as an observational study, and included both intervention and control group participants in these analyses focused on FV intake and PA.

Sample

Participants were patients from Internal Medicine or Family Medicine clinics affiliated with a large academic institution. To be eligible, patients had to: be referred by a health care provider; have a Body Mass Index (BMI) between 30 and 45 kg/m2; be ≥18 years of age; able to speak English; have a working telephone number and address where materials could be mailed; able to engage in moderate-intensity PA as determined by the Physical Activity Readiness Questionnaire (PAR-Q);[43] and have internet access at home or other community location.

Eligible individuals from participating clinics (n=1,554) were identified by electronic medical record (EMR) review. A signed letter from their physicians was sent to each potential participant recommending study participation, outlining study details, and providing the study phone number to call if interested in learning more. A week after letters were sent, automated calls were made that included similar information. Additional details on recruitment for the study are published elsewhere.[41] Briefly, of the 512 individuals that called the study line, 339 were interested after receiving more details. Of those, 245 were identified as potentially eligible based on preliminary phone screening using previously mentioned study criteria. If an individual was deemed eligible based on initial screening and remained interested in the study, they were scheduled for an in-person baseline visit at MD Anderson to confirm their eligibility based on their BMI (see next section for BMI calculation). Many individuals did not schedule an appointment (n=17), or canceled and noshowed for their appointment (n=50). Only 5 were ineligible at the in-person screening, 2 decided not to enroll, and 3 immediately withdrew. A total of 168 individuals were enrolled in this parent study.

Data Collection

At the baseline in-person visit, participants completed a written consent. Data were collected on participants at baseline and 6-month follow-up at in-person assessments. Study staff collected height with a stadiometer and weight using the Tanita integrated bioelectrical impedance body fat monitor scale (Tanita Body Fat Analyzer TBF 350, Tanita Corporation of America, Inc., Arlington Heights, IL). Participants removed shoes and heavy outer clothing prior to measurements. These two measures were used to determine BMI and served as a final screener for inclusion in the study. Participants then completed a self-administered demographic, psychosocial and behavioral questionnaire using REDCap.[44] Participants received $40 gift cards.

Measures

Measures collected included basic demographics from the Behavioral Risk Factor Surveillance System (gender, race/ethnicity, and age),[45] as well as psychosocial and behavioral variables, including self-efficacy, PA, and FV intake.[46–50] Self-efficacy for FV intake and PA were measured using questions from the Patient-Centered Assessment and Counseling for Exercise (PACE+) psychosocial measures.[46,47] Responses for both self-efficacy scales were on a 5-point scale from “Not at all confident” to “Extremely confident”. Self-efficacy for FV intake included six items assessing how confident an individual was that they could eat five servings of FV every day, drink 100% fruit juice instead of soda or fruit punch, eat FV for a snack instead of chips or candy, eat FV when eating out at a restaurant, eat FV when upset or having a bad day, and eat FV when at a social event.[46] The scale had good internal consistency at each time point (Cronbach’s alpha at baseline=0.81, 6 month=0.82). Self-efficacy for PA included 5 items assessing how confident an individual was that they could exercise when tired, in a bad mood, feel like they don’t have time, on vacation, or when the weather is bad.[47] The scale had good internal consistency at each time point (Cronbach’s alpha at baseline=0.81, 6 months=0.79).

The NCI/NIH FV intake all-day screener, which is comparable to the 24-hour dietary recalls,[48] is a 19-item screener used to capture FV intake. Items include questions on frequency (per day, week or month) and usual quantity consumed at each occasion of various fruits and vegetables. Using established protocols,[48] responses are used to calculate average daily FV servings. Participants wore an Actigraph (ActiGraph wGT3X+) accelerometer for 7 consecutive days during waking hours, starting on the first full day after the visit. They completed an accompanying log, indicating what time they put the accelerometer on in the morning and what time they took it off at night, as well as any other instances where it may have been removed. After 7 days, participants mailed back the accelerometers with a pre-paid envelope given to them at their in-person visit. Study staff extracted data from the accelerometer using ActiLife software. To be included in analyses, participants had to have 10 or more hours of valid wear time each day for at least 3 non-consecutive days (2 weekdays and 1 weekend) with bouts of activity defined as 8 out of 10 minutes.[51] Any time interval with 60 or more minutes of continuous zero counts, allowing for a 1 to 2 minute interruption was categorized as non-wear time.[52] We used established cut-points for adults with 2020 – 5998 counts per minute categorized as moderate-intensity and 5999 counts per minute and above categorized as vigorous-intensity,[52] to generate the average minutes of moderate-to-vigorous intensity PA per week. The Godin-Shephard Leisure-Time PA Questionnaire, modified to include duration, captured self-reported leisure-time PA with 7 items.[49,50] Responses for moderate and vigorous activity were used, with times per week and duration multiplied and then aggregated to produce the total minutes per week of moderate-to-vigorous intensity PA.

Analysis

Prior to analyses, we removed extreme values from the analyses, including observations of more than 840 minutes of self-reported (n=3) or accelerometer-measured (n=2) PA a week and more than 14 servings of FV a day (n=4). For analyses, we generated continuous change scores by subtracting the baseline values from the values at the 6-month follow-up. We used linear regression to generate unadjusted estimates as well as estimates that controlled for covariates, including gender, age, and race/ethnicity. In addition to the continuous variables, we generated a 3-category variable to indicate if an individual 1) decreased over time, 2) stayed the same over time, or 3) increased over time their self-efficacy for FV intake, self-efficacy for PA, PA or FV intake. As we did not expect individuals to maintain the same score even if they had not truly altered their behavior, we allowed a tolerance in either direction (an interval within which people were allowed to fluctuate), with 20 minutes per week for both accelerometer-measured and self-reported PA, ¼ cup for FV intake per day, and 0.25 units for both self-efficacy scales. The latter value was picked as it represented a shift in answering at least one of the self-efficacy questions within the larger scale. For these categorical variables (decreased, stayed the same, increased), we conducted multinomial logistic regression controlling for gender, age, race/ethnicity. For all analyses, we first modeled PA as the independent variable and FV intake as the dependent variable. We then performed the reverse, with FV intake treated as the independent variable and PA treated as the dependent variable. Prior to analyses, we conducted multiple imputation with 50 iterations given the amount of missing data in variables used for analyses due to lost to follow-up (n=42 for both change in self-efficacy for FV intake and change in self-efficacy for PA; n=48 for change in FV intake, n=45 for change in self-reported PA, and n=72 for change in accelerometer-PA). All analyses were conducted using Stata/SE 14.2 (College Station, TX).

RESULTS

The sample was 59% women, with the majority of participants having a 4-year college degree (54%) and were married or living with a partner (53%) (Table 1). The average age was 58 and average BMI was 36 kg/m^2 (range from 28.9 to 47.4). The sample was racially diverse, with 42% white, 42% African American, 11% Hispanic, and 5% other.

Linear regression

Summary statistics for the linear change scores are presented in Table 2. The medians for changes in FV intake, self-reported PA and accelerometer-measured PA were all close to 0. On average, most individuals had a slight decrease in their self-reported self-efficacy at the 6-month follow-up compared to baseline.

Results indicate that in both unadjusted and adjusted models, change in self-efficacy for PA for the 6-month period was significantly associated with change in self-efficacy for FV intake over the same 6-month period (Table 3). Similarly, change in self-efficacy for FV intake for the 6-month period was significantly associated with change in self-efficacy for PA over the same 6-month period, indicating coaction. There was no coaction between PA and FV intake.

Multinomial logistic regression

We also examined the behaviors and self-efficacy as categorical variables, with positive, negative, or no change. About 19% and 14% of the sample had a positive change in self-efficacy for FV intake and self-efficacy for PA, respectively (data not shown). About 28% of the sample increased their FV intake by more than ¼ cup daily. Lastly, about 18% and 30% of the sample increased their accelerometer-measured and self-reported PA, respectively, by more than 20 minutes a week.

As compared to participants who experienced no change in self-reported PA over the six month period, someone with a positive change in self-reported PA was nearly 7 times more likely ($p<.01$) to have a positive change in FV intake (Table 4). Similarly, compared to individuals who experienced no change in FV intake over the six month period, someone who experienced a positive change in FV intake was about 7 times more likely ($p<.01$) to have a positive change in self-reported PA. In the multinomial analyses, coaction was not identified between accelerometer-measured PA and FV intake or between self-efficacy for FV intake and self-efficacy for PA.

DISCUSSION

In this study, we assessed the potential for coaction between self-efficacy for PA and self-efficacy for FV intake, as well as coaction between FV intake and PA, using both self-reported and accelerometer-measured PA. As hypothesized, in multinomial analyses, there was a significant positive relationship between positive change in self-reported PA and positive change in FV intake over the 6-month period. This finding has been seen previously in intervention studies,[8,12,16,24] and extends the work of Prochaska and colleagues by showing that coaction also occurs in multiple behavior change interventions that are not based on the Transtheoretical model.[8] Our results further reveal that within the course of a weight management intervention where there was actually little to no significant intervention effect on PA and FV intake behavior in the sample as a whole, individuals who did make positive change on one behavior were more likely to make a positive change on another. Given the burden of obesity in the U.S.,[1,2] interventions targeting one behavior should also consider including the other behavior to capitalize on coaction and help adults achieve better health outcomes. For WMPs in particular, the presence of coaction should be monitored and additional intervention content could explicitly draw participants' attention to the potential to transfer acquired self-efficacy, skills learned and/or processes used for one behavior to the other.[18] While this may enhance the overall success of WMPs, testing of this type of explicit intervention content highlighting coaction vs. standard WMPs content is needed.

We also found that there was a direct association between self-efficacy for PA and self-efficacy for FV intake over time. This finding is in line with the common factor approach proposed by Prochaska[14] and the limited research that has been conducted in this area.[9,17,26,39] As demonstrated by Miao and colleagues, as self-efficacy for one energy-balance behavior increases, a more general sense of efficacy to deal with obstacles and barriers increases and likely promotes transfer of self-efficacy for the other energy-balance behavior.[9] In two separate studies by Annesi and colleagues, which assessed the directionality from self-efficacy for PA to self-efficacy for FV intake, a significant positive relationship was found between changes in the two self-efficacies over a 6-month period in a group of obese adults.[26,39] A positive relationship between the self-efficacy variables was not present in the multinomial analyses, which assessed the association of positive-positive and negative-negative changes, as opposed to raw change scores. This finding is likely due to a reduction in power caused by the increase in parameters to be estimated in the multinomial models. It is also important to note that in the overall intervention, self-efficacy actually decreased slightly; this may point to the spiral of difficulties that many individuals may face in weight loss attempts. The directionality of self-efficacy for these two energy balance behaviors needs to be explored within the context of MBC programs, especially the potential effect of self-efficacy for FV intake on self-efficacy for PA.

This study has several null findings that differ from results from previous studies. Negative change in self-reported PA was not associated with negative change in FV intake over the 6-month period. This phenomenon has been rarely studied, though epidemiology studies have shown clustering of unhealthy behaviors.[53–55] There were no associations between accelerometer-measured PA and self-reported FV intake in either linear or multinomial regression analyses. Accelerometer-measured PA is considered more objective than self-reported PA, the latter of which often may produce bias,[56] since many people fail to accurately judge their lifestyle behaviors. It is thus conceivable that self-reported measures of PA and FV intake are more closely associated with one another and that accelerometer-measured PA would be associated with measures of dietary intake that are more objective and that limit recall and response bias. In our results, only changes in self-reported behaviors were associated with one another, that is, perceived change on one behavior was associated with perceived change on the other behavior. However, this may be advantageous for achieving eventual coaction between the actual energy-balance behaviors. Lastly, the relation between a positive change in self-reported PA and a negative change in FV intake was not significant, which is in contrast to existing literature on compensatory eating of more calorie-dense and less nutrient-dense foods (i.e. fruits and vegetables) occurring with increases in PA.[30,31]

This study had several limitations. We acknowledge that the original study was not powered for these specific analyses. However, we conducted sensitivity analyses with complete cases only, which confirmed the same overall findings. Additionally, our sample was particularly well-educated, limiting the generalizability of results to a more diverse population. Future research is needed with samples that represent a wider variety of socioeconomic statues, but that are also ethnically/racially diverse. Lastly, although the NCI/NIH FV intake screener has been used in a wide variety of intervention studies, a stronger measure such as the ASA24 hour dietary recall may have been more sensitive to individual change over time. However, this study used strong validated measures of PA and self-efficacy, including accelerometer-measured PA, that were assessed over time within the course of an intervention aiming for weight loss or management. We also conducted sensitivity analyses with complete cases, which produced the same overall findigs.

Future research should continue to assess coaction between nutrition and PA and its mechanism in obese populations, as both behaviors are important for weight loss and maintenance.[6,57] This research could use larger samples so that moderators can be assessed to identify subgroups of individuals for whom there is positive coaction between energy-balance behaviors. Lastly, we did not investigate the timing for the delivery of the FV intake and PA content, so future research could explicitly test the timing of the delivery, as it is still unclear whether simultaneous or sequential interventions are superior.[15]

Conclusions

Study results indicate coaction between self-efficacy for FV intake and self-efficacy for PA, as well as between the two energy-balance behaviors. The coaction between these behaviors could be capitalized on within the course of an intervention to efficiently and effectively improve both behaviors, ultimately increasing weight loss and health outcomes.

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So What?

What is already known on this topic?

There is some evidence for the presence of co-action (action on one behavior increasing the likelihood of taking action on another behavior) between fruit and vegetable (FV) intake and physical activity (PA).

What does this article add?

In alignment with previous research, findings suggest the presence of co-action between FV intake and self-reported PA in a sample of obese adults. We also found that co-action extended to self-efficacy; change in self-efficacy for one behavior was predictive of change in self-efficacy for the other behavior.

What are the implications for health promotion practice or research?

Coaction could be capitalized on to more effectively promote both of these behaviors. For WMPs in particular, the presence of coaction should be monitored and additional intervention content could explicitly draw participants' attention to the potential to transfer acquired self-efficacy or other skills from one behavior to the other.

Table 1.

Demographic characteristics of obese adult participants in Houston (n=168)

	N =168	**(%)**
Age, Mean (SD)	57.5	12.9
BMI, Mean (SD)	36.0	4.3
Gender		
Male	69	41.1
Female	99	58.9
Race/Ethnicity		
Hispanic	19	11.3
White	71	42.3
Black	70	41.7
Other	8	4.7
Education		
Grades 9 through 12 (Some high school)	2	1.2
High school graduate or GED	16	9.5
College 1 year to 3 years (Some college or technical school)	58	34.5
College 4 years or more (College graduate)	92	54.8
Marital Status		
Married or living with a partner	89	53.0
Divorced, separated or widowed	42	25.0
Never married	36	21.4
Refused to answer	1	0.6

Note: SD, standard deviation; BMI, body mass index (kg/m^2).

Table 2.

Descriptive statistics for continuous change scores

Variable	N	Median	Mean	SD	Range	
					Min	Max
Δ Self-efficacy for PA	126	−0.40	−0.35	0.86	−3.00	2.00
Δ Self-efficacy for FV intake	126	−0.17	−0.22	0.77	−3.00	2.67
Δ FV intake	120	0.05	0.03	2.43	−7.12	7.02
Δ Self-reported PA	123	0	19.08	150.70	−461.00	625.00
Δ Accelerometer PA	96	−0.05	−33.85	142.15	−498.63	369.50

Notes: FV, fruit and vegetable; PA, physical activity; Δ, difference between 6-month follow-up score and baseline score; SD, standard deviation.

Table 3.

Regression coefficients for linear regression models assessing coaction between behaviors and types of self-efficacy in an obese sample of Houston adults

Independent	Dependent	Unadjusted B	95% CI	Adjusted[a] B	95% CI
Δ Self-efficacy for PA	Δ Self-efficacy for FV intake	0.22**	0.07–0.36	0.20*	0.05–0.35
Δ Self-efficacy for FV intake	Δ Self-efficacy for PA	0.27**	0.08–0.45	0.25*	0.05–0.45
Δ Self-reported PA	Δ FV intake	0.00	0–0	0.00	0–0
Δ FV intake	Δ Self-reported PA	3.03	−9.64–15.69	3.28	−9.37–14.93
Δ AccelerometerPA	Δ FV intake	0.00	0–0	0.00	0–0
Δ FV intake	Δ Accelerometer PA	4.75	−7.50–17.00	3.26	−8.65–15.17

Notes:

** p<.01,

* p<.05,

[a] models controlled for gender, age, and race/ethnicity; Δ, difference between 6-month follow-up score and baseline score; PA, physical activity; FV, fruit and vegetable; CI, confidence interval.

Table 4.

Relative risks for multinomial logistic regression models assessing coaction between behaviors and self-efficacy

Independent	Dependent	Unadj RR	95% CI	Adj. RR [a]	95% CI
Δ Self-efficacy for PA	**Ref: No change**				
−Δ Self-efficacy for PA	−Δ Self-efficacy for FV intake	0.89	0.33–2.41	1.11	0.41–2.99
	+Δ Self-efficacy for FV intake	0.43	0.11–1.69	0.53	0.13–2.26
+Δ Self-efficacy for PA	−Δ Self-efficacy for FV intake	0.80	0.24–2.66	0.89	0.28–2.82
	+Δ Self-efficacy for FV intake	1.51	0.38–6.02	1.80	0.47–6.87
Δ Self-efficacy for FV intake	**Ref: No change**				
−Δ Self-efficacy for FV intake	−Δ Self-efficacy for PA	0.89	0.33–2.41	1.10	0.41–2.97
	+Δ Self-efficacy for PA	0.80	0.24–2.66	0.89	0.28–2.81
+Δ Self-efficacy for FV intake	−Δ Self-efficacy for PA	0.43	0.11–1.69	0.52	0.12–2.21
	+Δ Self-efficacy for PA	1.51	0.38–6.02	1.78	0.47–6.75
Δ Self-reported PA	**Ref: No change**				
−Δ Self-reported PA	−Δ FV intake	1.93	0.61–6.14	2.11	0.64–6.94
	+Δ FV intake	2.97	0.82–10.70	3.47	0.93–12.98
+Δ Self-reported PA	−Δ FV intake	2.01	0.55–7.30	2.32	0.63–8.59
	+Δ FV intake	**5.23** *	1.32–20.73	**6.79** **	1.70–27.17
Δ FV intake	**Ref: No change**				
−Δ FV intake	−Δ Self-reported PA	1.93	0.61–6.14	2.18	0.66–7.21
	+Δ Self-reported PA	2.01	0.55–7.30	2.36	0.64–8.72
+Δ FV intake	−Δ Self-reported PA	2.97	0.82–10.70	3.48	0.93–12.98
	+Δ Self-reported PA	**5.23** *	1.32–20.73	**6.72** **	1.69–26.68
Δ Accelerometer PA	**Ref: No change**				
−Δ Accelerometer PA	−Δ FV intake	0.40	0.07–2.32	0.38	0.06–2.57
	+Δ FV intake	0.17	0.03–1.02	0.15	0.02–1.07
+Δ Accelerometer PA	−Δ FV intake	0.30	0.05–1.79	0.33	0.05–2.22
	+Δ FV intake	0.23	0.04–1.32	0.26	0.04–1.74
Δ FV intake	**Ref: No change**				
−Δ FV intake	−Δ Accelerometer PA	0.40	0.07–2.32	0.41	0.06–2.71
	+Δ Accelerometer PA	0.30	0.05–1.79	0.40	0.06–2.26
+Δ FV intake	−Δ Accelerometer PA	0.17	0.03–1.02	0.17	0.02–1.18
	+Δ Accelerometer PA	0.23	0.04–1.32	0.28	0.04–1.86

Notes:

** p<.01,

* p<.05,

[a] models controlled for gender, age, and race/ethnicity; Δ, difference between 6-month follow-up score and baseline score; PA, physical activity; FV, fruit and vegetable; RR, risk ratio; CI, confidence interval; Ref,