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Differences in Mothers' and Children's Dietary Intake during Physical and Sedentary Activities: An Ecological Momentary Assessment Study

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ABSTRACT

Background Physical activity and diet are major modifiable health behaviors contributing to obesity risk. Although patterns of these behaviors tend to cluster within individuals and within family units, it is unknown to what extent healthy and unhealthy dietary intake might differentially accompany sedentary and physical activities in mothers compared with their children.

Objective Our goal was to examine differences in co-occurrence of activities and dietary intake between mothers and children, as measured in real time using ecological momentary assessment.

Participants/setting This study examined cross-sectional data from 175 mothers and their children aged 8 to 12 years.

Main outcome measures Participants completed 8 days of ecological momentary assessment surveys, reporting on whether the following activities had occurred during the past 2 hours: sedentary screen activity, physical activity, and intake of healthy (ie, fruits and vegetables) and unhealthy (ie, fast food, chips/fries, pastries/sweets, and soda/energy drinks) foods.

Statistical analyses performed Multilevel logistic regression models estimated the adjusted odds of consuming healthy and unhealthy dietary intake for mothers and children during time periods reporting physical activity (vs no physical activity) or sedentary screen activity (vs no sedentary screen activity). Post hoc tests compared estimates for mothers vs children.

Results Children were significantly more likely than their mothers to consume unhealthy foods during 2-hour windows that included physical activity (odds ratio [children] 1.85, 95% CI 1.47 to 2.31; odds ratio [mothers] 0.83, 95% CI 0.58 to 1.20; $P_{diff}<0.05$), but not sedentary screen activity ($P_{diff}=0.067$). In addition, children and their mothers did not differ in their likelihood of consuming healthy foods during 2-hour windows with sedentary screen activity ($P_{diff}=0.497$) or physical activity ($P_{diff}=0.170$).

Conclusions Results indicate that the consumption of unhealthy foods may be more likely to co-occur within a 2-hour window including physical activity in children as compared to their mothers. Future research should examine reasons for this difference, and potential areas for intervention.

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SEDENTARY BEHAVIOR, DEFICIENT PHYSICAL ACTIVITY, intake of high-calorie, low-nutrient (HCLN) foods, and underconsumption of nutrient-dense foods (eg, fruits and vegetables [F/V]) are each modifiable health behaviors increasing obesity risk.[1-4] Previous evidence suggests that these unique behaviors tend to cluster together within people.[5,6] For example, regular engagement in physical activity in the form of sports or other exercise has been associated with a generally healthier diet, including greater intake of F/V.[7] Conversely, time spent in television viewing is associated with increased consumption of sweetened carbonated beverages, snacks, and fast food[8] and decreased consumption of F/V.[9] A more robust understanding of associations among weight-related behaviors may allow for more effective targeting of behavior change in prevention or intervention programs.

One limitation of previous studies examining associations of activity and dietary behaviors within individuals is an inability to determine temporal co-occurrence. Thus, although there appears to be an association between sedentary screen activities and HCLN intake over a period of days, months, or years on a between-person level (eg, those who engage in one unhealthy behavior tend to engage in other unhealthy behaviors),[6] this association may not hold on a momentary, within-person level (eg, at moments when an individual engages in one unhealthy behavior, he or she also tends to

engage in other unhealthy behaviors simultaneously). Consequently, individuals who engage in frequent sedentary activities might eat more unhealthy food overall, but this excess HCLN intake may or may not aggregate among time spent engaging in sedentary activities. For example, children with higher sedentary screen time may consume more unhealthy foods across various circumstances (eg, walking to school, during meal time, and playing with friends) and not necessarily during sedentary activity, which would suggest that interventions should not necessarily assume that intervening on screen time would have collateral effects on HCLN intake. Although individuals who engage in physical activity generally have elevated intake of F/V,[6] studies have shown that youth who participate in organized sports tend to have elevated intake of HCLN foods—including fast food[10] and sugar-sweetened beverages—as well as elevated overall caloric intake.[11] Thus, when physically active children consume HCLN foods, it may be relatively limited to certain time windows, such as during periods of activity, which would call for interventions that identify periods of activity as possible triggers for HCLN intake and would require proactive planning (eg, making healthy food and drinks available at sporting events). Therefore, general patterns of healthy and unhealthy activity and eating behaviors may cluster at the person level and differ across individuals, yet may or may not co-occur within the same periods of day.

Further, the strength and direction of these activities and dietary behavior clusterings may differ between adults and children. A review of the association between individuals' total time spent in television viewing, a common indicator of sedentary behavior, and their overall unhealthy dietary intake concluded that there is a stronger association between these two behaviors in children and adolescents compared with adults.[9] Developmental differences between children and adults in dietary decision-making processes or access to foods may result in different degrees of clustering among activity and dietary behaviors. Thus, although mothers and children are part of the same family unit and weight-related behaviors tend to cluster in family units,[12] differences between the co-occurrence of these behaviors in children and mothers may suggest differing approaches to prevention and intervention programs.

This study used intensive repeated participant surveys obtained via ecological momentary assessment (EMA) methods to obtain ecologically valid information on mothers' and children's physical activity, sedentary screen activity, and dietary intake as they occur in daily life.[13] Our goal was to determine whether mothers and children differ in the likelihood of consuming healthy or unhealthy foods during the same time periods where physical activity or sedentary screen activities were also reported. Increased consumption of unhealthy food intake in children during exercise or sports and during sedentary screen activities was expected based on evidence that youth sports[11] and television viewing[8] are associated with unhealthy food intake. In addition, it was hypothesized that these associations would be weaker in mothers.

METHODS

Participants

Participants were ethnically and racially diverse mother–child dyads from the Mothers' and their Children's Health Study, a longitudinal study of the effects of maternal stress and behavior on their children's stress, weight-related behaviors, and obesity trajectories. Dyads were recruited from elementary schools and after-school programs in the greater Los Angeles metropolitan area through the distribution of informational flyers and in-person recruitment events from 2014 to 2015. Analysis for the current study was limited to the first wave (cross-sectional) of data collection. Inclusion criteria consisted of the following: child currently in third to sixth grade, child resides with mother at least 50% of time, and both mother and child able to speak and read in English or Spanish. Mothers provided written informed consent for themselves and their children, and children provided written informed assent before beginning any study procedures. The Institutional Review Board at the University of Southern California approved all aspects of this research.

Procedures

Following an initial visit to a local school or community center and the completion of anthropometric measurements, paper-and-pencil questionnaires, and instructions on how to use the study equipment, mothers and children each completed 8 days of EMA, responding to randomly timed (ie, signal contingent) survey prompts via a custom smartphone application (app) for the Android operating system (Google Inc). Eight days were selected for the monitoring period to obtain a representation of at least a full week while limiting participant burden. Mothers and children each used a unique smartphone; participants who owned an Android smartphone were invited to download and use the app on their own smartphone, and participants who did not wish to use their own smartphone, who had an incompatible smartphone, or who had no smartphone borrowed a MotoG (Motorola Inc) study smartphone for the duration of the study period. Participants were instructed to complete a short (ie, 2 to 3 minutes) EMA survey upon hearing the signal, unless engaging in incompatible activities (eg, sleeping). On weekdays after school time, surveys were prompted up to three times for children and four times for mothers, from 3:00 PM to 8:00 PM (children) or 9:30 PM (mothers). On weekend days, children received up to seven and mothers up to eight surveys, from 7:00 AM to 8:00 PM (children) or 9:30 PM (mothers). Thus, children received up to 29 surveys and mothers up to 36 surveys across the study period. Detailed information on the full Mothers' and Their Children's Health Study procedure is published elsewhere.[14]

Measures

EMA surveys asked participants to report whether they had engaged in any of the following activities during the past 2 hours: "Exercise or Sports," "TV/Videos/Video Games," (including tablet or smartphone) "Eaten Fruits or Vegetables," "Eaten Fast Food," "Eaten Chips or Fries," "Eaten Pastries or Sweets," and "Drank Soda or Energy Drinks (not counting diet)." All response options were binary ("Yes" or "No"), and each response window was classified as consisting of physical activity (ie, "Exercise or Sports"), sedentary screen activity (ie, "TV/Videos/Video Games"), and healthy dietary intake (ie, "Fruits or Vegetables") as well as unhealthy dietary intake (at least one of the other dietary items).

Only "Fruits or Vegetables" were selected to represent healthy items due to concern over children's ability to