Research Brief

An Electronic Ecological Momentary Assessment Study to Examine the Consumption of High-Fat/High-Sugar Foods, Fruits/Vegetables, and Affective States Among Women

Yue Liao, MPH, PhD[1]; Susan M. Schembre, PhD, RD[1]; Sydney G. O'Connor, BS[2]; Britni R. Belcher, PhD, MPH[2]; Jaclyn P. Maher, PhD[2,3]; Eldin Dzubur, PhD[2]; Genevieve F. Dunton, PhD, MPH[2]

ABSTRACT

Objective: To examine the associations between high-fat/high-sugar foods (HFHS) and fruit and vegetable (FV) consumption and affective states in women.

Methods: The researchers used electronic ecological momentary assessment to capture HFHS and FV consumption in the past 2 hours (predictor) and current affective states (outcome) across 1 week among 202 women. Multilevel linear regression was conducted. Weight status was tested as a moderator.

Results: Consumption of FV in the past 2 hours was positively associated with feeling happy ($P < .05$). Women who consumed more HFHS or fewer FV than others in the study reported higher average sadness (both $P < .05$). Overweight or obese women who reported more frequent HFHS consumption than others had higher average stress than normal weight women ($P < .05$).

Conclusions and Implications: The association between HFHS consumption and stress might be stronger in overweight or obese than normal weight women. Future studies could further enhance the electronic ecological momentary assessment method to explore other time-varying moderators and mediators of food consumption and affect.

Key Words: dietary intake, free-living, overweight, smartphones, stress (*J Nutr Educ Behav.* 2018;■■:■■–■■.)

Accepted February 10, 2018.

INTRODUCTION

Unhealthy eating is a major modifiable lifestyle risk factor that contributes to the development of chronic conditions, such as cardiovascular diseases, diabetes, and cancer.[1] Some important components in healthy eating patterns include consuming a variety of fruits and vegetables (FV) and limiting high-fat, high-sugar foods (HFHS). However, >75% of Americans do not meet the FV recommendations, and approximately 70% exceed the recommendations for added sugars and saturated fats.[2] Furthermore, adherence to meeting the dietary guidelines has remained low for the past few decades.[2] Therefore, there is a need to help individuals improve dietary behaviors and achieve healthy eating patterns.

Previous research suggested that food consumption could lead to improved mood and positive affect as a result of its nutritional and physiological effects[3] and that eating is a pleasurable experience in itself.[4,5] Food consumption could affect affective states through several potential physiological mechanisms. For example, consumption of energy-dense foods (eg, HFHS) may increase positive affect as a result of the release of endorphins.[6] However, frequent consumption of HFHS could induce plasticity-related changes in brain reward circuitry that are associated with depressive-like phenotype.[7] Furthermore, compared with HFHS, FV are believed to be conducive to increasing levels of brain-derived neurotrophic factors, which are thought to have a central role in negative mood states and depression.[8] In addition to the physiological mechanisms, food consumption could influence affective states via cognitive expectations and perceptions of the health value of certain foods,[9,10] which might differ across gender,

[1]Department of Behavioral Science, University of Texas MD Anderson Cancer Center, Houston, TX
[2]Department of Preventive Medicine, University of Southern California, Los Angeles, CA
[3]Department of Kinesiology, University of North Carolina, Greensboro, NC

Conflict of Interest Disclosure: The authors' conflict of interest disclosures can be found online with this article on www.jneb.org.

Address for correspondence: Yue Liao, MPH, PhD, Department of Behavioral Science, University of Texas MD Anderson Cancer Center, 1515 Holcombe Blvd, Unit 1330, Houston, TX 77030; Phone: (713) 745-6605; Fax: (713) 745-4286; E-mail: yueliao@mdanderson.org

https://doi.org/10.1016/j.jneb.2018.02.003

weight status, and cultural background. For instance, in many western cultures, there is a greater societal pressure for women to be physically attractive and thin compared with men.[11] Moreover, HFHS could be considered as a threat to being thin and are associated with negative affect, especially among overweight or obese women who are trying to lose weight.[12] Previous studies showed that overweight or obese women experience more intense negative affect than do normal weight women after consumption of HFHS.[13] A better understanding of the association between HFHS/FV consumption and affective states in women could inform nutrition educators to help women recognize the possible consequences of consuming these foods and change their eating patterns to optimize physical and mental health.

Although several feeding studies (eg, certain types of food were provided) investigated the acute relationships between food consumption and subsequent affective states,[5,13] those studies did not reflect the dynamic situations that individuals experience in their everyday lives (eg, personal choices of foods in real-world situations). Understanding the association between HFHS/FV consumption and affective states could shed light on how to motivate individuals to avoid HFHS and consume more FV. Ecological momentary assessment (EMA), a real-time data capture method that allows individuals to self-report behaviors and experiences in their daily lives,[14] is a useful method to study the acute relationships between everyday food consumption and affective states. Prior studies using this method found that eating large quantities of food subsequently led to greater negative affect in women.[15] Nevertheless, the effects of different types of food was not investigated. The current study aimed to use EMA to (1) examine the association between consumption of HFHS and FV and affective states, and (2) explore the moderating effect of weight status on these associations among middle-aged women. It was hypothesized that consumption of HFHS would associate positively with negative affect and consumption of FV would associate positively with positive affect.

METHODS

Data Source

This study used data from the Mothers' and Their Children's Health (MATCH) study, a longitudinal observational dyadic study in a sample of mother–child pairs.[16] The MATCH study included a 1-week free-living EMA monitoring period, which was repeated across 6 waves separated by 6 months each. The current study used mothers' EMA data from the first wave. The MATCH study protocol was reviewed and approved by the Institutional Review Board at the University of Southern California. Reporting of this study followed guidelines from the Adapted Strengthening the Reporting of Observational Studies in Epidemiology Checklist for Reporting EMA Studies.[17]

Participants

Participants in the MATCH study were ethnically diverse mothers and their 8- to 12-year-old children recruited from public elementary schools and after-school programs in the greater Los Angeles area. Eligible participants were children in the third through sixth grade who resided with the mother at least 50% of the time; in addition, both mother and child had to be able to read English or Spanish. All study materials (eg, EMA surveys, instructions) were available in both English and Spanish. Mother–child pairs were excluded if they were taking medications for thyroid function or psychological conditions, using oral or inhalant corticosteroids for asthma, or had health issues that limited physical activity; if the child was enrolled in special education programs or classified as underweight; if mother was currently pregnant; or she worked >2 weekday evenings/wk or >8 hours on any weekend day.

Procedures

Details about the design and protocol for MATCH study were described elsewhere.[16] All mothers attended an in-person data collection session to complete anthropometric measurements and paper-and-pencil questionnaires. They also received instructions on how to use study equipment, which included the smartphone EMA app.

The EMA surveys were delivered via a custom Android app that was developed specifically for the study. Mothers who owned an Android smartphone downloaded the app on their own smartphone. For those who did not wish to use their own smartphone, whose smartphone was incompatible, or who did not have a smartphone, a MotoG (Motorola, Inc, Chicago, IL) was provided for the duration of the study period. The researchers collected EMA data over 8 days after the end of the in-person data collection session. The EMA prompts started after 5 PM on the day of the in-person data collection session (day 1) and continued for the next 6 days (days 2–7), up until 5 PM on the last day (day 8). The EMA surveys were randomly prompted 4 times/d on weekdays between 3:00 and 9:30 PM and 8 times/d on weekend days between 7 AM and 9:30 PM. The EMA data were wirelessly uploaded and stored on a secure Internet-accessible server during the monitoring period.

Electronic Ecological Momentary Assessment Measures

The researchers assessed food consumption by asking women to indicate which of the following foods they had eaten over the past 2 hours (ie, chips or fries; pastries or sweets; fast food; FV). Women were instructed to choose all that applied. Each food item was then converted into a dichotomous response of yes/no. For the purpose of the current study, selection of chips or fries, pastries or sweets, or fast food was recoded as HFHS consumption (yes/no). The researchers excluded from the analysis EMA entries that indicated both HFHS and FV consumption, to examine the effects of these 2 food groups on affect separately.

For affective state, women were asked, *Right before the phone went off, how (happy, calm/relaxed, frustrated/angry, stressed, sad/depressed) were you feeling?* Response choices were *Not at all*, *A little*, *Quite a bit*, and *Extremely*. Each affect was analyzed separately because previous research showed distinct associations between single-item affect and eating.[5,13] Composite scores for positive and negative affect were computed to explore the effect of food consumption on the 2 funda-