Podcast available online at www.jneb.org

Research Brief

Daily and Seasonal Influences on Dietary Self-monitoring Using a Smartphone Application

Christine A. Pellegrini, PhD[1]; David E. Conroy, PhD[1,2]; Siobhan M. Phillips, PhD, MPH[1]; Angela Fidler Pfammatter, PhD[1]; H. Gene McFadden, BA[1]; Bonnie Spring, PhD[1]

ABSTRACT

Objective: To examine within-person variation in dietary self-monitoring during a 6-month technology-supported weight loss trial as a function of time-varying factors including time in the study, day of the week, and month of the year.

Methods: Smartphone self-monitoring data were examined from 31 obese adults (aged 18–60 years) who participated in a 6-month technology-supported weight loss program. Multilevel regression modeling was used to examine within-person variation in dietary self-monitoring.

Results: Participants recorded less as time in the study progressed. Fewer foods were reported on the weekends compared with weekdays. More foods were self-monitored in January compared with October; however, a seasonal effect was not observed.

Conclusions and Implications: The amount of time in a study and day of the week were associated with dietary self-monitoring but not season. Future studies should examine factors that influence variations in self-monitoring and identify methods to improve technology-supported dietary self-monitoring adherence.

Key Words: self-monitoring, adherence, diet, obesity, technology, diet tracking, apps (*J Nutr Educ Behav*. 2018;50:56-61.)

Accepted December 7, 2016.

INTRODUCTION

Dietary self-monitoring is a key component of successful behavioral weight loss interventions[1-3] and is essential for facilitating other behavior change techniques (eg, setting goals, providing behavioral feedback).[4] As part of self-regulation, individuals monitor their behavior, evaluate how that behavior compares with behavioral goals, and then use methods of self-control and reinforcement to modify behaviors and reduce future discrepancies between the goal and actual behaviors.[5,6] Daily dietary self-monitoring generally entails tracking all foods and drinks consumed, the portion size of each item, and the corresponding calorie and fat gram totals. Ideally, this recording occurs as foods are consumed; yet in practice, many people do not record near the time they ate.[7] Awareness of caloric intake is expected to align eating behaviors with goals to create a negative energy balance and facilitate weight loss.

Patterns in short-term dietary intake have also been identified, including consuming more calories[8,9] and fat[10] on the weekends, particularly among those who are overweight/obese, of high income, or aged 18–64 years.[11] In addition to these increases in calories and fat, diet quality is poorer on the weekends.[11] The increase in caloric and fat intake corresponds with weekly fluctuations in weight: weight is higher on Sundays and Mondays and decreases as the end of the week nears.[12] In contrast to the increase in caloric consumption and body weight, self-monitoring was recently found to be less frequent on weekends than weekdays.[13] The holidays are another time when increased caloric intake and weight gains of 0.4–0.7 kg are seen.[14-16] Self-monitoring consistency during this high-risk time is associated with better weight management[2,17]; yet it is unclear whether self-monitoring patterns vary during the winter months. Few studies examined weekly and seasonal patterns of dietary self-monitoring, particularly when using a smartphone application (app), in individuals enrolled in a weight loss trial.

The purpose of the current study was to examine the temporal patterning of dietary self-monitoring across multiple time scales (ie, time since the start of intervention, day of the week, and

[1]Department of Preventive Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL
[2]Department of Kinesiology and Human Development and Family Studies, Pennsylvania State University, University Park, PA

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

Address for correspondence: Christine A. Pellegrini, PhD, Department of Preventive Medicine, Northwestern University, 680 N Lakeshore Dr, Ste 1400, Chicago, IL 60611; Phone: (312) 503-1395; Fax: (312) 908-9588; E-mail: c-pellegrini@northwestern.edu

http://dx.doi.org/10.1016/j.jneb.2016.12.004

month of the year). To accomplish these goals, the authors evaluated self-monitoring records from adults participating in a technology-supported weight loss program.[18] Adjusting for age, sex, baseline weight, and daily weight change, the authors hypothesized that participants would report fewer food items, calories, and fat as their time in the study progressed (owing to a combination of the effects of the intervention and fatigue with protocol demands [hypothesis 1]). In addition, the authors hypothesized that participants would self-monitor less on weekends than weekdays because of changes in typical weekday routines (hypothesis 2) and less during winter months compared with summer months owing to the holiday season (hypothesis 3). By identifying time-varying factors that influence self-monitoring, behavioral interventions may be refined to reduce the impact of these factors on the frequency and comprehensiveness of self-monitoring.

METHODS

Study Design

Participants were randomized into 1 of 3 weight loss conditions as part of the E-Networks Guiding Adherence to Goals in Exercise and Diet (ENGAGED) study: (1) technology-supported, (2) standard behavioral weight loss, or (3) self-guided behavioral weight loss.[18] Only participants in the technology-supported intervention were asked to self-monitor dietary intake on a study smartphone app. Thus, the current analyses focused on the self-monitoring records obtained from participants using the smartphone app.

Participants

Participants (n = 32) were adults aged 18–60 years with a body mass index (BMI) of 30–40 kg/m^2. All participants were weight stable and not enrolled in a weight management program, and did not have an unstable medical condition. In addition, participants were not pregnant and did not take medications that may have influenced weight. A full list of inclusion and exclusion criteria is described elsewhere.[18] Participants were recruited in 2 cohorts and started the intervention in either September, 2011 or April, 2012. All participants provided written informed consent; the study was approved by the Northwestern University Institutional Review Board.

Technology-Supported Intervention

Participants were given a 7% weight loss goal and encouraged to meet a calorie goal of 1,200–2,000 kcal/d based on starting body weight and a fat gram goal of 25% of total calories. They were also encouraged to engage progressively in 175 min/wk of moderate-intensity physical activity. Participants attended weekly in-person group sessions during weeks 1–8 and attended sessions on Monday, Tuesday, or Wednesday based on their availability. Each session lasted approximately 90 minutes and covered topics similar to the Diabetes Prevention Program (ie, problem solving, stimulus control, healthy eating).[19] In addition to group sessions, participants received regular telephone calls (Monday through Friday) from a coach during the 6-month intervention.

Participants were loaned a smartphone that contained the ENGAGED app at the first group session. The ENGAGED smartphone app allowed participants to self-monitor daily dietary intake using a food database of over 50,000 generic and name brand foods. Participants received visual feedback on calories and fat grams consumed and were encouraged to self-monitor everything they ate and drank on the app during months 1–6. Additional capabilities of the ENGAGED app have been described previously.[18] Participants received brief training at the first session on how to use the app and how best to estimate portion sizes.

Measures

Baseline body weight was measured using a calibrated balance beam scale, with participants wearing lightweight clothing without shoes. Daily dietary self-monitoring data were obtained from the ENGAGED smartphone app over the 6-month study. For each day in the study, the number of foods, calories, and fat grams that were recorded was summed over each day and a daily average for each participant was calculated. Daily self-weighing measurements were also obtained from the ENGAGED smartphone app to adjust for daily weight changes.

Data Analysis

Descriptive statistics were calculated for all study variables. The data had a hierarchical structure with multiple days nested within each participant, so random intercept multilevel regression models were estimated to accommodate dependencies between observations from each person over time.[20] The day of week and month of year for each level 1 observation were recoded as 2 sets of 6 and 11 dummy variables, respectively. The reference day and month were selected to indicate high (unadjusted) dietary self-monitoring so the remaining model coefficients would reveal significant deviations from the average timing of peak recording. For example, participants reported the lowest fat and calorie values on Fridays and in March, so they became the reference day and month in the models of those outcomes. Likewise, participants reported the greatest number of foods on Mondays and in October, so they became the reference day and month in that model. Daily self-reported weights were transformed into 2 variables using established techniques: a starting weight on the first day (between-person variable) and daily weight-loss progress representing the difference between a participant's starting weight and his or her daily weight (within-person variable).[21] The number of foods reported was transformed into 2 variables: a person-mean centered variable representing the average number of foods reported across days (between-person variable) and a daily deviation from that person-mean centered score representing whether a person reported more or fewer foods than usual that day. All analyses were completed using MPlus (version 7.31, Los Angeles, CA).

RESULTS

A total of 31 participants provided self-monitoring data during the 6-month intervention. Participants were 90% female and 42% black, average age of 40.7 years (SD, 10.8 years), and had a