

Using a Mixed-Effects Location Scale Model to Examine Factors That Influence Overeating Behaviors Among College Students

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Background: Subjective overeating is conceptualized as a construct that is changeable and responsive to contextual factors. The current study applied mixed-effects location scale modeling to examine within-subject variability in subjective overeating among college students (N = 11 adults, mean age = 23.92 years). Understanding what impacts overeating in college students can help us design strategies to prevent unhealthy habits in young adults.

Purpose: The primary objective of our study was to examine the effects of proximal contextual features surrounding eating episodes on within-subject variability of overeating. We also studied environmental factors that can impact overeating such as being alone, with family, or at a restaurant, or eating at night, as well as potential putative causal mechanisms such as loss of control (LOC), anxiety, stress, positive and negative affect, energy, and motivation. Through a mixed-effects location scale model, we aimed to determine which of these factors impact the mean (location) of overeating and the within-subject variability (scale), with the goal of identifying key factors that can be targets of intervention to prevent unhealthy habits. We also built personalized machine learning models that predict overeating episodes through a small subset of personalized features.

Methods: An electronic diary was used to record self-reported food intake and contextual features surrounding each eating episode throughout the day. Data was collected from 190 episodes of food intake over two weeks and analyzed using a Mixed-Effects Location Scale Model in R. When possible, subjects matched their food intake with an extensive database of food items and their associated nutritional information. If a particular food item was not present in the database, the subject was asked to enter as much detail as possible regarding food item consumed, serving size, calorie count, and fat content. Personalized models which predict the probability of overeating for each participant were developed using a generative Naïve Bayes classifier.

Results: Participants exhibited on average about 5 overeating episodes in two weeks. Participants' within-subject variability of subjective overeating varied from one another ($p = .001$). Loss of control (LOC) had a positive effect on participants mean subjective overeating ($p = .0003$). Stress ($p = .03$) had a significant effect on within-subject variability of subjective overeating, and stress was positively linearly correlated with negative affect ($\rho = 0.73$, $p < .0001$). The personalized models predicted overeating episodes with an average F-Measure of 82%. Each participant had a unique group of factors that predicted their overeating behavior. For some participants, overeating occurred when they were hungry, at home, and watching television at night. However, for others it was in the

presence of positive affect. If compensated 75% and 63% of participants reported willingness to record eating habits using the electronic diary app for 30 and 60 days, respectively.

Conclusions: Preliminary results suggest that LOC is a strong predictor of subjective overeating, and while stress and negative affect significantly impact within-subject variability of overeating, some participants overeat in the presence of positive affect, which highlights the potential need for tailored strategies to predict unhealthy habits in young adults.