

Daily Self-Weighing to Prevent Holiday-Associated Weight Gain in Adults

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Authors:

Sepideh Kaviani¹, Ph.D

Michelle vanDellen², Ph.D

Jamie A. Cooper¹, Ph.D

Author Affiliations:

¹Department of Foods & Nutrition, University of Georgia, Athens, GA.

²Department of Psychology, University of Georgia, Athens, GA.

Corresponding Author:

Jamie A. Cooper, Department of Foods and Nutrition, University of Georgia, 305 Sanford Drive, Athens, GA 30622, Phone: 706-542-4903, Fax: 706-542-5059; Email: jamie.cooper@uga.edu

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Study Protocol

A screening visit occurred in Human Nutrition Lab (HNL) from late September to early November during which a Likert item was administered to measure self-weighing frequency habits. Existing (or history of) eating disorders was determined by Drive for Objective Thinness Questionnaire which resulted in study exclusion. Qualified subjects were randomized into either the DSW+GF or control group (balanced blocks by age, sex, and BMI) by research personnel.

Pre-Holiday Visit (v1)

This visit occurred in HNL within a one-week period prior to Thanksgiving after an 8-12h overnight fast and 12h without exercise. Height, body weight (BW), waist and hip circumference (WC and HC), blood pressure, and body composition using Dual Energy X-Ray Absorptiometry (DXA™; Hologic Inc., Discovery A, Bedford, MA) were measured. A fasting blood draw was taken for blood lipids. Questionnaires administered at this visit included the Perceived Stress Scale (PSS), Three factor Eating Questionnaire (TFEQ), Power of Food Scale, National Insomnia Screening Questionnaire, self-weighing frequency Likert item, Mindful Eating Factors Questionnaire and Fat Preference Questionnaire. To assess participants' perceptions of healthy and unhealthy foods, participants categorized a series of 60 images of different foods accompanied by their names (e.g., pizza, pancake, and broccoli). Participants selected 'healthy' or 'unhealthy' for each food item. This was done to examine whether daily self-weighing with graphical feedback (DSW+GF) would alter subjects' perception of foods, and whether these perceptions, as well as data from our other questionnaires, would be significant mediators for the effects of DSW+GF on BW.

Intervention Period (Holiday Season)

Intervention group: At the conclusion of v1, participants in the DSW+GF group received the Wi-Fi scale (Nokia (Withings®), Paris, France). They were asked to start DSW the day after v1 until their post-holiday visit (v2). They weighed themselves first thing in the morning after voiding (and defecating if that is their normal pattern). Once they stepped on the scale, their data would automatically transfer to their Withings® account and their Withings® mobile app (Nokia Health Mate app). Immediately after a weight measurement, electronic graphical feedback of weight fluctuations appeared on the scale's screen and the app. The average of the first 4 days of BW served as the "baseline" weight, which was then set as the participant's "target" weight in

their Withings® account. This target weight showed up as a straight line on their graph of daily weights. Participants were instructed to try not to gain weight above this target line, and no additional instructions on how to achieve that goal were provided. The GF component of the DSW was the immediate graphical feedback of their weight fluctuations from the scale and how their weight compared to their target “baseline” weight.

Control group: Control participants did not receive any intervention; however, they completed the same study visits as the intervention group.

Post-Holiday Visit (v2)

This visit occurred in HNL within a one-week period after New Year’s Day with the same conditions and procedures as v1. The DSW+GF group was told they could discontinue DSW; however, they were allowed to keep the scales until the follow-up visit and were told to use it as they saw fit.

Follow-up Visit (v3)

This visit occurred in HNL 14 weeks after v2 under the same conditions and procedures as v1 and v2. The scales were collected from the DSW group and weighing frequency data during the follow-up period was obtained from their Withings® accounts. All participants were debriefed as to the true intent or purpose of the study at the conclusion of this visit.

Statistical Analysis

Statistical analyses were performed using JMP Pro 13 (Statistical Discovery™, From SAS Institute Inc., Cary, NC). A sensitivity power analysis to determine the smallest detectable effect size (was performed using G*Power, 3.1.9.2). Assuming scores at pre-holiday were

correlated with post-holiday with at least a correlation of $r = .40$, our study was poised to detect differences in change scores from time 1 to time 2 of Cohen's $f = .15$ (small-to-medium) effects. To test the treatment effects on BW across visits, as well as on the change between visits, a full factorial repeated measures ANOVA (mixed-methods) was conducted based on sex and initial BMI (normal weight (NW), and overweight and obese (OW&OB)). Participants with the BMI of 18.5-24.9kg/m² were categorized as NW and those with a BMI ≥ 25 kg/m² were grouped into the OW&OB category. This grouping was done due to the relatively lower number of subjects in the OW or OB categories compared to NW (control group was 69% NW (n=38) and 31% OW&OB (n=17) while the DSW+GF group was 75% NW (n=42) and 25% OW&OB (n=14)). A two-way repeated measures ANOVA was used to test the treatment effects on other anthropometrics (body fat, WC, HC, and waist-to-hip ratio (WHR)), systolic and diastolic blood pressure (SBP and DBP), and blood markers (Total Cholesterol (TC), Triglyceride (TG), High-density Lipoprotein (HDL), Low-density Lipoprotein (LDL), and TC/HDL) across all visits. Post hoc analyses were performed using a Tukey's test. Significance was set at $p < 0.05$, and data are presented as mean \pm SEM unless otherwise specified. Additionally, data collected from questionnaires (except the Likert item), was analyzed using a parallel multiple mediator model to test whether any component of participants' responses was a mediator for the impact of treatments.