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Frequency and Consistency of Self-Weighing to Promote Weight Loss Maintenance

Andrea N. Brockmann, M.A., Abraham Eastman, M.S., Kathryn M. Ross, Ph.D. M.P.H.

Department of Clinical & Health Psychology, University of Florida, Gainesville, FL

Abstract

Objective: To investigate the roles of frequency and consistency of self-weighing in promoting weight loss maintenance.

Methods: Participants were 74 adults who completed a 3-month Internet-based weight loss program followed by a 9-month no-intervention maintenance period. *Frequency* of self-weighing was defined as the number of days that participants self-weighed during the maintenance period via a study-provided smart scale. *Consistency* was defined as the number of weeks that participants self-weighed at a certain frequency, with multiple minimum thresholds examined. Hierarchical regression analyses were used to assess associations between frequency, consistency, and weight change during the maintenance period.

Results: Greater consistency was significantly associated with less weight regain when defined as the number of weeks that participants self-weighed 6 or 7 days per week, $p < .05$. Contrary to hypotheses, frequency was not associated with weight change, $p = .141$, and there was not a significant interaction between frequency and consistency.

Conclusions: Results demonstrate that consistency of self-weighing may be more important than total frequency for preventing weight regain after the end of a weight loss program. Further, results suggest that a high level of consistency (self-weighing 6 or all 7 days/week) may be necessary to promote successful weight loss maintenance.

Keywords

Self-Weighing; Obesity; Overweight; Weight Change; Weight Maintenance

Introduction

Self-monitoring of weight (self-weighing) is a key component of behavioral weight management programs;^{1,2} greater adherence to self-weighing has been shown to be associated with both greater weight loss³ and less weight regain.⁴ Within this literature, adherence has typically been operationalized as frequency of self-weighing during a time period, assessed by self-report questionnaires (e.g., asking participants if they self-weigh

Corresponding Author: Kathryn M. Ross, Ph.D. M.P.H., Department of Clinical & Health Psychology, College of Public Health & Health Professions, University of Florida, PO Box 100165, Gainesville, FL 32610-0165, Phone: 352-294-8433, kmross@php.ufl.edu.

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daily, weekly, monthly, or less frequently) or counting days of self-weighing using self-monitoring logs/objective data from smart scales (with data often coded into similar categories). Despite its common use, this definition obscures variability in self-weighing habits, combining true *frequency* (i.e., number of days of self-weighing during a specific time period) with *consistency* (i.e., the amount of time that a person weighs themselves at a certain frequency). This distinction may have important implications; for dietary self-monitoring, Peterson and colleagues⁵ demonstrated that greater frequency only improved weight maintenance for participants who were also highly consistent (with consistency defined as the number of weeks that participants self-monitored ≥ 3 days). Although some researchers have speculated that *consistency* of self-weighing may be important,⁶ no studies have investigated the roles of frequency and consistency in relation to self-weighing.

The current study investigated the association between frequency and consistency of self-weighing and weight regain after the end of a weight loss program. Following the framework of Peterson and colleagues,⁵ we hypothesized that greater frequency of self-weighing would be associated with less weight regain and that, after controlling for frequency, greater consistency of self-weighing would also be associated with less weight regain. Finally, we hypothesized that there would be a significant interaction between consistency and frequency, such that consistency would strengthen the association between frequency of self-weighing and weight change.

Methods

Participants

The current study conducted secondary analyses on data collected during and after a 12-week, Internet-based weight loss program.⁷ Participants of the initial study were 75 adults with overweight or obesity who were employees or dependents of employees at a large healthcare corporation in Providence, RI; of these, 74 completed at least one week of the program and were included in current analyses. Approval for the parent study was obtained from the Miriam Hospital Institutional Review Board, and approval for the current study was obtained from the University of Florida Institutional Review Board.

Initial Weight Loss Intervention and Maintenance Period

A complete description of the intervention has been published previously.⁷ Briefly, participants were provided with 12 online multimedia lessons and encouraged to self-monitor caloric intake, physical activity, and weight each day using study-provided self-monitoring tools (including a smart scale that sent weights directly back to researchers via the cellular network). Participants were asked to complete a brief questionnaire and self-report self-monitoring data weekly via the study website. After the end of the program, participants were asked to continue to self-monitor and to complete the weekly questionnaire and report summaries of self-monitoring on the study website for an additional 9 months; however, no additional intervention was provided. Throughout the entire study, small financial incentives (\$1–10 each week) were provided for completion of the questionnaire and report of self-monitoring habits each week.

Measures

Body weight was measured to the nearest 0.1 kg using a calibrated digital scale, with participants in light indoor clothing and shoes removed, at in-person assessment visits at Month 3 (end of intervention) and Month 12 (end of maintenance period). Self-weighing adherence was assessed using data from the study-provided smart scales (BodyTrace, Inc.). Methods for cleaning these smart-scale data have been described previously.⁸

Data Preparation.

Missing data for assessment weights were imputed under a missing-not-at-random approach described previously (94.6% of participants attended the Month 3 visit and 89.2% attended Month 12).⁹

Frequency.—Frequency of self-weighing was defined as the number of days during the maintenance period that participants self-weighed via the smart scale.

Consistency.—Consistency was initially defined as the number of weeks that participants weighed themselves all 7 days, given that the initial weight loss program recommended daily self-weighing. The study by Peterson and colleagues⁵ defined consistency as the number of weeks that participants self-monitored for 3 days, based on the minimum number of days participants were encouraged to self-monitor dietary intake during the parent weight loss trial.¹⁰ In that trial, participants were encouraged to continue to self-monitor daily after the end of an initial weight loss program, but were asked to submit a minimum of three records each week during the maintenance program. A clinically-relevant minimum for assessing self-weighing consistency has not been established. Existing programs typically recommend either weekly^{11,12} or daily self-weighing;^{13,14} however, it is unknown whether there may be a clinically-important threshold between these recommendations. Thus, as preliminary analyses we calculated all other possible minimum thresholds for consistency (ranging from 1 to 6 days per week). We then benchmarked these thresholds against weight regain over the maintenance period to establish the minimum “dose” at which consistency remained significantly associated with weight change. An optimal threshold was defined a priori as the fewest number of days of self-weighing each week that remained significantly associated with weight change during this period.

Analyses.

Three hierarchical regressions were used to assess associations between frequency and consistency of self-weighing and percent weight change during the maintenance period, using three definitions of consistency (current minimum and maximum clinical recommendations of 1 day and all 7 days, and the threshold identified in our preliminary analyses). Total frequency was entered first, followed by consistency. Finally, a mean-centered interaction term was entered in order to assess whether consistency moderated the association between frequency of self-weighing and weight change.

Results

Table 1 provides sample characteristics and intervention outcomes. Across the maintenance period, participants self-weighed an average (mean $\pm$ SD) of 4.95 $\pm$ 1.58 days per week. Table 2 describes the change in frequency and consistency of self-weighing (using each possible definition for consistency) across the observational maintenance period. Table 3 provides average frequency and consistency across the entire maintenance period, along with the correlations between these variables and weight change. Consistency was only significantly correlated with percent weight change when defined as self-weighing 6 days or as all 7 days in a week; thus, 6 days was selected as the threshold.

Association between Frequency, Consistency, and Weight Regain

Frequency was significantly correlated with consistency using all three definitions of consistency, $r_s = 0.52$, $p < .0001$. Contrary to hypotheses, there was not a significant association between frequency and weight regain, $r^2_{adjusted} = 0.016$, $p = .141$. After controlling for frequency, there were significant associations between consistency and percent weight change when consistency was defined as the number of weeks that participants self-weighed all 7 days, $\beta = -0.19$, $SE = 0.07$, $t(71) = -2.56$, $p = .013$, $r^2_{change} = .071$, $F_{change}(1,70) = 6.41$, $p = .014$, or as 6 days, $\beta = -0.18$, $SE = 0.08$, $t(71) = -2.30$, $p = .025$, $r^2_{change} = .056$, $F_{change}(1,70) = 5.15$, $p = .026$; however, there was not an association between consistency and percent weight change when consistency was defined as 1 day, $p = .296$. Finally, regardless of the definition of consistency used, consistency did not modify the association between frequency and percent weight change, all $p > .05$. The same pattern of results was observed in models that controlled for weight loss during the initial intervention.

Discussion

The current study was the first to investigate the impact of frequency versus consistency of self-weighing on weight regain after a weight loss program. Results demonstrated that, when defined as the number of weeks that participants self-weighed either 6 or 7 days, greater consistency was associated with less weight regain. These results are consistent with literature demonstrating the importance of daily self-weighing for promoting successful weight management.^{4,6,15}

Contrary to hypotheses, a significant association was not observed between frequency and weight regain, and consistency did not significantly modify this association. These results are in contrast with previous literature demonstrating associations between frequency and weight maintenance;^{4,6,12,15} however, the previous definition of frequency used in these studies may have entangled true frequency with consistency of self-weighing. Our results suggest that consistency of self-weighing, rather than simple frequency, may be driving the associations documented previously. Given the proliferation of smart scales and other technologies that allow for separation of these constructs, future research should clarify and justify methods for operationalizing adherence to self-weighing.

The current study had several limitations. First, participants were not prospectively assigned to varying levels of self-monitoring frequency or consistency and thus we could not assess

causality. It may be that greater consistency is a consequence of weight loss success (e.g., successful individuals may be more likely to weigh themselves); while we did not look at this on a week-to-week basis, our results did not differ when models controlled for initial weight loss. It may also be that both consistency and weight change may be influenced by another factor (e.g., overall motivation for weight management). Second, participants were provided with small financial incentives for self-reporting self-monitoring data and completing a brief questionnaire each week on the study website; while these incentives were not provided for the behavior of self-monitoring, they nevertheless may have had an impact. Finally, the current sample was predominately female and White, limiting generalizability of results. Future studies should investigate whether frequency and consistency of self-monitoring are similarly associated with weight change in samples including more men and individuals from racial/ethnic minority groups.

The current study also had several important strengths. First, an objective method of assessing frequency and consistency of self-weighing was used, overcoming known challenges related to self-report.^{16,17} Second, these objective scale data allowed us to separately assess frequency and consistency of self-weighing behavior, allowing us to investigate the independent contributions of these constructs to weight change during a post-treatment maintenance period. Finally, although our results did not provide strong evidence for an alternative threshold, the current study extended past work by investigating potential clinical thresholds for self-weighing between existing recommendations (once per week vs. daily).

Overall, the current results suggest an important distinction between frequency and consistency as definitions of self-weighing adherence. Moreover, the current results suggest that a high level of consistency in self-weighing may be necessary to promote weight loss maintenance. Taken together with existing trial data,¹⁵ these results support clinical recommendations of daily self-weighing to promote weight loss maintenance.

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What is already known about this subject?

- Greater adherence to self-monitoring of weight (“self-weighing”) has been shown to be significantly associated with successful weight loss maintenance following the end of behavioral weight management programs.
- Adherence to self-weighing has typically been operationalized as the *frequency* of self-weighing during a given time period (e.g., through use of self-report questionnaires asking participants if they weigh daily, weekly, monthly, or less frequently); less is known regarding the role of *consistency* of self-weighing (e.g., the amount of time that a person weighs themselves at a certain frequency).
- One study demonstrated that greater frequency of dietary self-monitoring only improved weight maintenance for participants who were also highly consistent with this self-monitoring; no studies have investigated these associations in relation to self-weighing.

What does this study add?

- When consistency was defined as the number of weeks that participants self-weighed either 6 or 7 days/week, greater consistency of self-weighing was found to be significantly associated with less weight regain during a “maintenance” period following the end of an initial behavioral weight loss program.
- Contrary to hypotheses, there was no association observed between frequency of self-weighing and weight change, and no evidence of an interaction between frequency and consistency.
- Taken together, results suggest that consistency of self-weighing may be more important than frequency for promoting weight loss maintenance.

How might your results change the direction of research or the focus of clinical practice?

Results of the current study suggest that a high level of consistency in self-weighing may be necessary to promote weight loss maintenance, supporting recommendations for daily versus weekly self-weighing.

Table 1.

Participant Demographics, Baseline Characteristics, and Intervention Outcomes.

Variable	Included Participants n=74	
Age, mean (SD), y	50.65	(10.41)
Weight, mean (SD), kg	86.65	(16.76)
BMI, mean (SD), kg/m ²	31.20	(4.51)
Initial Weight Loss (Baseline to Month 3), mean (SD), kg	-5.78	(4.91)
Weight Regain (Month 3 to 12), mean (SD), kg	2.42	(3.64)
Gender, <i>n</i> (%)		
Female	51	(68.9)
Male	23	(31.1)
Race, <i>n</i> (%) *		
American Indian or Alaska Native	1	(14)
Asian	2	(2.7)
Black or African American	7	(9.5)
White	64	(86.5)
Other	4	(5.4)
Ethnicity, <i>n</i> (%)		
Hispanic or Latino	2	(2.7)
Not Hispanic or Latino	72	(97.3)

* Participants could self-select more than one race/ethnicity category, thus totals may exceed 100%

Table 2.

Frequency and Consistency of Self-Weighing Throughout the Maintenance Period, by 3-Month Intervals

Variable	Months During the Maintenance Program					
	Months 4–6		Months 7–9		Months 10–12	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Frequency, percentage of possible days	72.35	22.27	70.30	23.24	69.62	23.24
Consistency, percentage of possible weeks						
7 days/week	24.22	28.80	21.31	26.48	20.75	27.17
6 days/week	49.48	35.97	45.84	37.35	43.92	36.51
5 days/week	69.02	37.23	66.42	36.23	66.22	36.16
4 days/week	80.67	31.74	79.42	33.08	78.48	32.58
3 days/week	89.29	25.36	88.05	26.89	86.97	28.38
2 days/week	94.91	19.36	93.35	22.61	93.44	21.54
1 day/week	98.86	6.20	97.71	12.39	97.59	14.20

NOTE: Months 4–6 and 7–9 had a total of 13 weeks, Months 10–12 had a total of 14 weeks.

Table 3.

Average Frequency and Consistency of Self-Weighing Across the Maintenance Period, and Association between Frequency and Consistency of Self-Weighing and Weight Change.

Variable	Average Across Participants		Association with Weight Change	
	<i>M</i>	<i>SD</i>	<i>r</i>	<i>P</i>
Frequency, number of days (of 280 possible days)	198.04	63.15	−0.17	.141
Consistency, number of weeks (of 40 possible weeks)				
7 days/week	8.82	10.19	−0.32	.005
6 days/week	18.54	13.97	−0.27	.019
5 days/week	26.88	14.15	−0.18	.120
4 days/week	31.80	12.70	−0.11	.351
3 days/week	35.23	10.63	−0.02	.836
2 days/week	37.55	8.31	0.04	.736
1 day/week	39.22	4.32	0.01	.909