# ARTIGOS

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# THE HEALTHY EATING GOAL-SETTING AND THE PLANNING AND SCHEDULING SCALES FOR MEASURING SELF-REGULATION FOR HEALTHY EATING

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**ABSTRACT**

Objectives: Healthy eating is a central target in many obesity interventions. Self-regulations supported by theory and research as a key factor in behavior change. While a measure of self-regulation for physical activity has been developed, no such measure exists to quantify self-regulation for healthy eating. The aim of this research was to develop and validate two scales, one for Goal-setting (HEGS), and one for Planning and Scheduling (HEPS), for measuring self-regulation for healthy eating.
Methods: The scales were modeled after similar scales for self-regulation of physical activity and administered to 550 participants with obesity in a workplace weight management program at two time points. Principal component analysis (PCA) and correlations were used to investigate structural and criterion-related validity respectively.
Results: PCA indicated that HEGS contained one single factor corresponding to goal-setting, and HEPS two factors relating to planning. All displayed good internal consistency (Cronbach's alpha coefficient>0.7). The scales demonstrated strong criterion-related validity, evidenced by significant association with antecedents and consequences of self-regulation.
Conclusions: The scales for measuring self-regulation for healthy eating showed good internal consistency, structural validity, and criterion-related validity. They can be used to assess self-regulation in interventions, and to investigate interaction between self-regulation and healthy eating behavior change.

**Keywords:** Self-regulation, health eating, measure development, validation

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## INTRODUCTION

Healthy eating and physical activity can have significant health benefits (1, 2). Unfortunately, interventions for obesity that target these behaviors are often unsuccessful, and long term improvements are difficult to maintain (3-8). Therefore, it is important to understand the mediators of healthy eating and physical activity behavior change, to inform future interventions to reduce obesity.

Self-regulation, as defined by Bandura et.al. (9) is "Exercise of influence over one's own motivation, thought processes, emotional states and patterns of behavior." It includes processes like developing goals, partaking in actions to reach goals, and monitoring progress in goal achievement (10). In daily life, we pursue multiple goals simultaneously. To reach these goals, we must effectively prioritize, plan, allocate resources, and manage conflicts between goals. Understanding differences in this control process is important to understand goal pursuit and achievement (11).

Increased self-regulation can have positive effects on behaviors such as accuracy of self-monitoring of blood glucose (12), physical activity (13), reduced alcohol and drug use (14, 15), and increased adherence to clinical recommendations for fluid-intake (16). Interventions also show a positive effect of self-regulation on healthy eating (17, 18).

Teixeria et. al. reviewed the literature on mediation mechanisms of successful lifestyle change interventions targeting obesity. They suggested self-regulation to be a promising mediator for medium to long term weight loss (19). Theoretical models support this finding, suggesting self-regulatory skills are important in increasing physical activity and improving healthy eating (20, 21). Despite this, few scales exist to measure self-regulation for exercise or physical activity, and none, to our knowledge, to measure self-regulation for healthy eating.

There is therefore a need for a measure of self-regulation for healthy eating, to better understand the relationship between self-regulation and healthy eating over time. As physical activity and healthy eating are often targeted jointly in interventions for obesity, it will be useful with a measure relating to healthy eating that parallels those developed and used in the context of self-regulation for physical activity. We thus turned to scales for measuring self-

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regulation for physical activity, assessing two dimensions of self-regulation: the Exercise Goal-Setting Scale (EGS) and the Exercise Planning/Scheduling Scale (EPS;(22))- to inform the development of similar scales for measuring self-regulation for healthy eating. The EGS and EPS measure how well an individual sets exercise goals and plans exercise activities, respectively, both central aspects of self-regulation. Since their development in 2002, they have been used in multiple studies, and have been validated for use in adult populations (11).

The purpose of the present study was thus to develop and assess two scales for measuring self-regulation for healthy eating, modeled after and similar to the EGS and EPS. The Healthy Eating Goal-Setting Scale (HEGS) and the Healthy Eating Planning and Scheduling Scale (HEPS) were developed and administered to a cohort of participants with obesity in a workplace weight management program. First, this study establishes the construct validity of the scales by assessing their structural validity via Principal Component Analysis (PCA). Then, we examine their criterion-related validity, or the extent to which the scales are correlated with external criteria(23), through correlation with antecedents and consequences of self-regulation.

## METHODS

### MEASURE DEVELOPMENT

The HEGS and HEPS were modeled after the EGS and EPS, developed by Rovniak et.al. (22). The EGS and EPS were in turn based on a literature review of best-practice recommendations for goal setting, along with pilot study data from college-aged students. The self-regulation for physical activity scales employ 10 questions each, which assess both goal setting and scheduling of exercise activities, such as: I often set exercise goals, If I do not reach an exercise goal, I analyze what went wrong, and I plan my weekly exercise schedule. The participants respond to how well the statement describes them on a 5-point Likert scale (1= does not describe, 2, 3= describes moderately, 4, 5=describes completely).

Our scales employed the same questions and scoring system as the exercise scales, but the questions were rephrased to reflect eating instead of physical activity behaviors. Additionally, since the modified scales were not being used for students, we removed the wording “both classes and work” from question 8 of the planning scale (originally

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Everything is scheduled around my exercise routine—both classes and work).Parallel to the original EPS, three items were negatively worded and therefore were reverse coded in the HEPS, including: healthy eating is generally not a high priority when I plan my schedule, finding time for healthy eating is difficult for me, and when I am very busy, I don't eat healthy foods. Although it was not reverse coded in the original scale,, we opined that another item was also negatively worded: I never seem to have enough time to eat healthy foods, and chose to reverse code it as well.

## Study Design and Participants

Data for validation of the HEGS and HEPS was collected via a randomized controlled trial, the Steps to Health (STH) study, designed to evaluate the effects of two different employee weight management programs (24, 25). The programs aimed to help employees with obesity lose weight and maintain healthy weights. Ethical approval for the STH study was obtained from the Duke Medicine Institutional Review Board and all participants provided informed consent.

Employees at Duke University and Medical Center were with eligible for the STH study if they had obesity (BMI ≥ 30 kg/m2) and were interested in taking part in one of the employee weight management programs. A total of 550 participants were randomized between January 2011 and July 2012.

## Data Collection

The STH study employed a study specific questionnaire and health risk assessment questionnaires to collect participant data. The HEGS and HEPS were administered as part of the study specific questionnaire at both entry to the study ("baseline") and at the end of the intervention (about 12-14 months post-baseline, "follow-up").

## Other Measures

Demographic Factors: Demographic factors (age, gender, and race) were assessed at baseline through the HRA questionnaire.

Self-efficacy: Self-efficacy for Healthy Eating was assessed using the Eating Habits Confidence Survey (EHCS), a measure of self-efficacy for diets in adult populations (26).We used three sub-scales of the EHCS including: "sticking to it" (5 items, Cronbach's α = 0.88), "reducing calories" (5 items, Cronbach's α =0.78), and "reducing fat" (5 items, Cronbach's α = 0.80). Note that Cronbach's α calculations are based on baseline data.

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Social support: We developed a measure of social support for healthy eating for the STH study. Nine items were included to assess how much participants felt they could count on those close to them to provide support. Response options ranged from 1 ("Not at all") to 3 ("A lot"). The measure had three sub-scales including: emotional support (e.g., How much could you count on people close to you to encourage you to eat health foods? [3 items, Cronbach's α = 0.74]), informational support (e.g., How much can you count on people close to you to tell you about ways to increase your physical activity? [3 items, Cronbach's α = 0.92]), and instrumental support (e.g., How much can you count on people close to you to help you stick with weight management goals? [3 items, Cronbach's α = 0.63])."

Diet Habits: We measured three aspects of diet including vegetable intake, percent of energy derived from fat, and number of sugar sweetened beverages per day. Vegetable intake was measured using the National Cancer Institute (NCI) fruit and vegetable screener, a measure of intake in the last month (27). Questions ask the participant to recall frequency and quantity food intake, and responses are scored to calculate servings of vegetables per day. Studies show that daily estimates are well correlated with true intake (28).

The Percentage of Energy from Fat Screener was used to estimate the percentage of energy intake derived from fat (29). The scale is comprised of three questions used to assess eating habits over the last 12-months. The scale has been validated for use, and is widely used in adult populations (30, 31).

Additional questions were asked to estimate number and quantity of sodas and other sugar sweetened beverages consumed per day; total ounces of sugar sweetened beverages were calculated from these estimates.

## Analysis

Participant characteristics were summarized. Means and standard deviations of each item of the HEPS and HEGS scales were calculated separately at baseline and at follow-up. The factor structure of the two scales together was determined using PCA with prom ax rotation. PCA was run separately on the baseline and follow-up datasets, to determine if the same factor structure was observed in each set of data. As in the validation of the EGS and EPS, all the items of HEGS and HEPS were considered together in the PCA in order to determine if the two-scale structures were maintained. The number of factors retained

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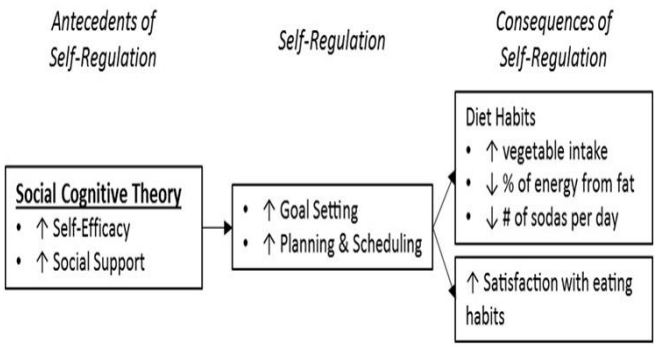
was determined using the Scree test (32). Cronbach's alpha was calculated for each identified factor, and individual factor scores were output for use in further analysis.

Bandura's Social Cognitive Theory of Self-Regulation suggests that multiple factors influence self-regulation, including self-efficacy and social support (33). Furthermore, self-regulation should be related to better outcomes in the self-regulated behavior. Therefore, we assessed criterion-related validity by examining correlations between the self-regulation factors identified and antecedents and consequences of self-regulation, based on a previous model developed by Elavskyet. al, as shown in Figure 1(11). The antecedent factors in this study were self-efficacy and social support, and the consequences measured were self-reported eating behaviors (vegetable intake, percentage of daily energy from fat, and number of sodas per day) and satisfaction with eating habits. Correlations were assessed using the baseline data.

**Figure 1: Conceptual Framework for analysis**




## RESULTS

Demographic characteristics of the subjects are shown in Table 1, at baseline and follow-up. At baseline, 31 participants did not complete all items in the two scales and were excluded from the analysis. 126 participants included at baseline were also excluded at follow-up for this reason. Most participants were female. Mean age at baseline was 45.2 (standard deviation= 10.0) years, with a range of 22 to 69 years. Approximately half of participants were obese class I (BMI of 30–34.9), the rest nearly equally distributed in obese class II (BMI of 35–39.9) and III (BMI of 40+).

Descriptive statistics for each item in the HEPS and HEGS are presented in Table 2, at both baseline and follow-up. The mean scores were significantly higher at follow-up for many questions, conceivably due to the intervention or selective non-response.

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**Table 1: Sample characteristics at baseline and follow-up**

| Variable | Baseline (n=519) n | % | Follow-up (n= 393) n | % |
|---|---|---|---|---|
| Gender | | | | |
| Male | 90 | 17.34 | 61 | 15.52 |
| Female | 429 | 82.66 | 332 | 84.48 |
| Age | | | | |
| < 35 | 91 | 17.53 | 63 | 16.03 |
| 35-50 | 262 | 50.48 | 194 | 49.36 |
| > 50 | 166 | 31.98 | 136 | 34.61 |
| Race | | | | |
| White | 226 | 43.55 | 171 | 43.51 |
| Black | 265 | 51.06 | 204 | 51.91 |
| Other races | 28 | 5.39 | 18 | 4.58 |
| Baseline BMI ($kg/m^2$) | | | | |
| Obese class I (30–34.9) | 243 | 46.82 | 180 | 45.8 |
| Obese class II (35–39.9) | 133 | 25.63 | 109 | 27.74 |
| Obese class III (40+) | 143 | 27.55 | 104 | 26.46 |

## Factor Analysis

Factor loadings for the final factors are also presented in Table 2. Factors were determined based on the highest factor loading for the item. Three factors were present: factor 1 containing all HEGS questions, and factors 2 and 3 both containing a subset of HEPS questions. Factors 2 and 3 were consistent with factors found in a previous analysis of EGS and EPS and were named accordingly: factor 2 was deemed Planning and Scheduling, while factor 3 was Deprioritization of Healthy Eating.

No items loaded heavily (factor loading >0.40) on more than one factor in either model. However, HEPS question 10 loaded more heavily on Factor 1 at follow-up (factor loading 0.34) than factor 2. It was included in factor 2 due to its loading in the baseline model and its relation to planning and scheduling.

## Criterion validity

Criterion validity was assessed using correlations. Antecedents and consequences of self-regulation were compared with self-regulation for healthy eating factor scores at baseline. All three factors were significantly correlated ($p<0.01$) with all of the antecedents and consequences at baseline, as shown in **Table 3**.

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**Table 2: Distribution and factor loadings of HEGS and HEPS**

| | Mean (SD) | | Factor Loading | | Cronbach's α |
|---|---|---|---|---|---|
| **Healthy Eating Goal Setting Scale** | Baseline | Follow-up | Baseline | Follow-up | Reliability |
| *Factor 1: Healthy eating goals* | | | | | |
| 1. I often set healthy eating goals | 2.93 (1.21) | 3.14 (1.14) | 0.72 | 0.67 | 0.92 |
| 2. I usually have more than one major healthy eating goal | 2.57 (1.22) | 2.88 (1.2) | 0.78 | 0.7 | |
| 3. I usually set dates for achieving my healthy eating goals | 2.03 (1.19) | 2.3 (1.16) | 0.83 | 0.74 | |
| 4. My goals help to increase my motivation for eating healthy | 2.35 (1.20) | 2.71 (1.17) | 0.81 | 0.86 | |
| 5. I tend to break more difficult healthy eating goals down into a series of smaller goals | 2.09 (1.19) | 2.4 (1.13) | 0.72 | 0.71 | |
| 6. I usually keep track of my progress in meeting my goals | 1.97 (1.15) | 2.33 (1.18) | 0.62 | 0.87 | |
| 7. I have developed a series of steps for reaching my healthy eating goals | 2.00 (1.14) | 2.35 (1.18) | 0.66 | 0.85 | |
| 8. I usually achieve the healthy eating goals I set for myself | 2.13 (1.15) | 2.47 (1.14) | 0.66 | 0.75 | |
| 9. If I do not reach a healthy eating goal, I analyze what went wrong | 2.09 (1.21) | 2.41 (1.2) | 0.64 | 0.84 | |
| 10. I make my healthy eating goals public by telling other people about them | 2.16 (1.27) | 2.34 (1.28) | 0.72 | 0.79 | |
| **Healthy Eating Planning and Scheduling Scale** | | | | | |
| *Factor 2: Planning and Scheduling* | | | | | |
| 4. I schedule all events in my life around healthy eating | 1.82 (1.09) | 1.92 (1.05) | 0.59 | 0.71 | 0.84 |
| 5. I plan my meals ahead of time. | 2.28 (1.25) | 2.54 (1.23) | 0.8 | 0.77 | |
| 6. I plan my weekly grocery shopping schedule | 2.29 (1.32) | 2.52 (1.32) | 0.82 | 0.81 | |
| 8. Everything is scheduled around my healthy eating routine | 1.65 (0.97) | 1.84 (1.04) | 0.68 | 0.73 | |
| 9. I plan my weekly menu on the same day each week to keep a routine going | 1.63 (1.02) | 1.76 (1.07) | 0.84 | 0.79 | |
| 10. I keep a food journal and write down everything I eat and drink throughout the day. | 1.62 (1.13) | 1.93 (1.22) | 0.43 | 0.17 | |
| *Factor 3: Deprioritization of Healthy Eating* | | | | | |
| 1. I never seem to have enough time to eat healthy foods (reversed) | 2.34 (1.21) | 2.16 (1.13) | 0.81 | 0.85 | 0.77 |
| 2. Healthy eating is generally not a high priority when I plan my schedule (reversed) | 3.59 (1.25) | 3.74 (1.15) | 0.71 | 0.78 | |
| 3. Finding time for healthy eating is difficult for me (reversed) | 3.56 (1.26) | 3.69 (1.24) | 0.87 | 0.88 | |
| 7. When I am very busy, I don't eat healthy foods (reversed) | 2.86 (1.44) | 3.05 (1.34) | 0.67 | 0.7 | |

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**Table 3: Correlations of the three self-regulation factors for healthy eating factors with antecedents and consequences of self regulation**

| | *HEPS factor: Healthy Eating Goals* | *HEGS factor 1: Planning and Scheduling* | *HEGS factor 2: Deprioritization of Healthy Eating (reversed)* |
|---|---|---|---|
| ***Antecedents of self-regulation*** | | | |
| **Self-Efficacy** | | | |
| Self-efficacy to stick with eating healthy | 0.31 | 0.22 | 0.23 |
| Self-efficacy to reduce calories | 0.16 | 0.12 | 0.10 |
| Self-efficacy to reduce fat | 0.13 | 0.11 | 0.10 |
| **Social Support** | | | |
| Emotional Support | 0.25 | 0.22 | 0.14 |
| Informational Support | 0.25 | 0.19 | 0.12 |
| Instrumental Support | 0.21 | 0.22 | 0.16 |
| ***Consequences of self-regulation*** | | | |
| **Diet Habits** | | | |
| Vegetable Intake | 0.25 | 0.20 | 0.25 |
| % of energy from fat | -0.17 | -0.21 | -0.14 |
| # sodas per day | -0.17 | -0.17 | -0.18 |
| **Satisfaction** | | | |
| Satisfaction with eating habits | 0.50 | 0.46 | 0.36 |

*Note: all correlations significant p<0.01*

## DISCUSSION

We developed and validated two novel scales of self-regulation for healthy eating: the HEGS and HEPS. To the best of our knowledge, these scales are the first to be developed and validated to measure self-regulation specifically for healthy eating. Our results supported a model with three factors including: one HEGS factor: Healthy eating goals, and two HEPS factors: Planning and Scheduling, and Deprioritization of Healthy Eating. All three factors were strongly correlated with the antecedents and consequences of self-regulation developed from our conceptual model, which support the criterion validity of the two scales.

The HEGS and HEPS, when evaluated as one measure via factor analysis, yielded meaningful factors. Both scales, or dimensions, were maintained in the factor analysis (albeit, the HEPS was shown to include two factors), suggesting that Goal Setting and Planning are distinctly represented. The identified factors coincide with factors present in the EGSS and EPSS evaluation study (11), and likewise, we decided to retain the two dimension model despite the HEPS including two factors. Future research could further investigate

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the two HEPS factors, and determine whether both are necessary for the measurement. Internal consistency for all factors was good, suggesting constructs were measured reliably. Factor structure was in agreement between baseline and follow-up datasets, with only one exception: question 10 of the HEPS, I keep a food journal and write down everything I eat and drink throughout the day, did not load significantly on any factor in the follow-up dataset. This could be partially due to the effect of the intervention; participants were asked to keep a food journal as part of their intervention participation. Conceivably, this could have affected the resulting structure. The merit of this question could be assessed in future work.

Theory suggests self-regulation is strongly influenced by self-efficacy and social support (33). Therefore, the strong correlations between self-efficacy for healthy eating, social support for healthy eating, and self-regulation factors provide evidence of criterion validity of HEGS and HEPS, in addition to lending support to Bandura's Social Cognitive Theory of Self-Regulation. Furthermore, these data also confirmed several hypotheses regarding the consequences of self-regulation for healthy eating.

## STRENGTHS AND LIMITATIONS

The study population comprised obese employees of an academic medical center, limiting the generalizability of results. However, the exclusion of non-obese individuals lends strength to HEPS and HEGS as scales for measuring self-regulation in obese populations, and for use in weight management studies. Further research is needed to validate the scales in other populations. Furthermore, criterion validity was evaluated at one time point. This cross-sectional evaluation could be appropriate, as ones' self-regulation at one time can affect one's behavior at that specific time, however it could also be useful to investigate the predictive ability of the scales to allow us to make better inferences about cause and effect. Lastly, test-retest reliability was not measured. While we did assess the scales at two time-points for most participants, these time-points were 14 months apart and likely heavily affected by the intervention, invalidating a test-retest analysis.

Our scales were based on two widely used, validated scales for measurement of self-regulation for physical activity-the EGS and EPS. The frequent use of the EGS and EPS in research studies suggests that question wording and the Likert scale are readily

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understood and accepted in English speaking populations. This will allow researchers who are targeting both physical activity and dietary behavior change to more easily implement and compare results from these parallel measures.

## CONCLUSION

The need for tools to measure self-regulation tailored to healthy eating is evident- theory and research alike confirm that self-regulation is an important component of dietary behavior change. A 20-item questionnaire was developed to measure self-regulation for healthy eating. This measure assessed two dimensions of health eating: the single factor HEGS and the 2 factor HEPS. Both show good internal consistency and a meaningful factor structure. Significant correlations between antecedents and consequences of self-regulation and the factors suggest that the measure has good construct validity. Further research is needed to better characterize its test–retest reliability and predictive validity. Regardless, the HEGS/HEPS is the first attempt at measuring self-regulation for healthy eating, and its two scales may be useful both in behavior change and obesity research to understand and promote healthy eating.

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