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Creating a measure of portion control self-efficacy

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ABSTRACT

Objective: Over the last few decades, food portion sizes have steadily increased by as much as 700% (Young & Nestle, 2002). Food portions are often much larger than dietary guidelines recommend, leaving individuals to manage their food consumption on their own and making it necessary to understand individual factors impacting food consumption. In the current paper, we focus on self-efficacy for portion control.
Method: Specifically, across three studies, we developed and validated a new measure of portion control self-efficacy (PCSE).
Result: The PCSE measure yielded good fit statistics and had acceptable test–retest reliability using two cross-sectional surveys (Studies 1(a) and 1(b)). Results from Study 2 demonstrated construct and predictive validity of the PCSE using the Food Amount Rating Scale (FARS; Dohm, & Striegel-Moore, 2002). Study 3 offered additional support for reliability and validity with a sample of overweight and obese adults currently trying to lose weight.
Conclusions: Overall, findings indicate that the new PCSE measure is reliable and valid. Individuals often make inaccurate food portion estimates (Slawson & Eck, 1997; Yuhas, Bolland, & Bolland, 1989) which can lead to overeating and weight-gain. Thus, the discussion centers on the need to incorporate PCSE in future research and intervention work targeting weight loss, health, and food consumption.

1. Introduction

In the past 30 years, obesity levels have increased dramatically from 14% in 1970 to 34% in 2006; by the year 2020, if trends continue, it is estimated that 70% of the population will be overweight or obese (Ruhm, 2007; Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). In the United States, obesity is the secondary cause of premature death after smoking (in some states it is the number one cause), with 110,000–365,000 deaths per year (Corsica & Perri, 2013). Furthermore, obesity increases the risk of coronary heart disease, hypertension, diabetes, and other diseases (Flegal, Graubard, Williamson, & Gail, 2005). It is also estimated that type II diabetes, hypothesized to be largely influenced by eating habits and obesity, now affects nearly 21 million Americans, or about 7% of the U.S. population (Centers for Disease Control, Prevention, 2008). Increasing dramatically from 1995, the total economic costs of obesity (both direct and indirect) reached nearly $130 billion in 2008 (Wang et al., 2008; Wolf & Colditz, 1998), making obesity and food related diseases a major public health concern within the U.S. as well as on a global scale (Cutler, Glaeser, & Shapiro, 2003; Friedrich, 2002).

Although there are a myriad of contributing factors associated with the rapid increase in obesity rates, eating behavior has been cited as an important component to understand (O'Neill et al., 2012). However, considering our obesogenic environment, food consumption is difficult to manage and change (Mattsson & Helmersson, 2007, Stroebe et al., 2013). Despite the widespread availability of nutritional information provided in school curricula, doctors' offices (provider education, pamphlet or newsletters), on the internet, and on food packaging, overeating remains a substantial problem (Centers for Disease Control, Prevention, 2008; O'Neill et al., 2012). Increases in energy intake (but not expenditure) has been implicated in the rise of obesity (Kral & Rolls, 2004), with fast-food consumption and increases in food portion sizes playing a large role (French, Story, & Jeffery, 2001; Kral & Rolls, 2004; Levitsky, Halbmaier, & Mrdjenovic, 2004). Between the years 1977 and 1996, food portion sizes consumed have risen steadily, both inside and outside of the home (Nielsen & Popkin, 2003) by as much as 700% (Young & Nestle, 2002). Currently, restaurants routinely serve portions that contain up to 60% more calories than government-recommended servings (Hellmich, 2002). With the average American eating outside of the home between 4 and 8 times a week (Driskell, Meckna, & Scales,

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2006), a behavior such as portion control is an important behavior to target in the fight against obesity (Logue, Sutton, Jarjoura, & Smucker, 2000).

In targeting health behaviors, such as food consumption, social cognitive theory (SCT; Bandura, 2004) has proved valuable. SCT specifies that possessing knowledge about health risks and benefits serves as a precursor for change; however *self-efficacy* is necessary to translate this knowledge into practice (Bandura, 2004). According to SCT, expectations of self-efficacy determine what activities people will engage in, how much effort they will expend, and how long they will persevere in face of adversity. General self-efficacy (GSE) refers to an individual's belief in his or her ability to perform a behavior (Scherbaum, Cohen-Charash, & Kern, 2006). General self-efficacy is important because it directly affects behavior and it influences other behavioral determinants such as goals and expectations. For example, individuals with greater GSE tend to consume more healthy food such as fruits and vegetables (De Oliveira, Anderson, Auld, & Kendall, 2005). While GSE has been very predictive for a variety of behaviors, numerous researchers have also argued that self-efficacy should be task specific (Bandura, 2006; Pajares, 1996), and that even within many specific domains there may be a wide variety of self-efficacy beliefs. For example, self-efficacy for cooking healthy food may differ from self-efficacy for controlling food portions. Therefore, there is a need to further explore specific self-efficacies such as portion control self-efficacy, as this type of self-efficacy may aid in the understanding of eating and other behaviors related to the development of overweight and obesity.

To date, little research attention has been paid to the role of self-efficacy in portion control behaviors. The primary purpose of the current set of studies is to develop a reliable and valid measure of self-efficacy toward portion control (PCSE; see Graphical abstract). The PCSE measure can be used by researchers and practitioners to examine the impact of self-efficacy for portion control on eating behaviors and subsequent weight-loss and health outcomes. In Study 1(a), we developed a pool of items for the PCSE measure and produced the initial version of the scale.

2. Study 1(a) method

2.1. Participants

One-hundred-eight undergraduate students volunteered to complete the questionnaire for course credit. Participants who indicated having a medical concern that would impact food consumption (e.g., diabetic, $n = 22$) were excluded from this first stage of survey development. Therefore, the initial development of the measure was tested on a total of 86 participants (56 females, 25 men, and 5 who did not indicate gender).

2.2. Procedure and measures

The survey was administered using a paper-pencil questionnaire that consisted of three sections assessing (1) portion control self-efficacy (PCSE), (2) GSE, and (3) basic demographic questions assessing gender and medical concern. All participants were debriefed after completing the survey.

2.2.1. Portion control self-efficacy (PCSE)

The original PCSE scale contained 20 items (see Table 1), answered using a five-point Likert scale such that 1 = *strongly disagree* and 5 = *strongly agree*. These twenty items were created by modifying all ten items from the GSE scale created by Schwarzer and Jerusalem (1995) in order to specifically target an individual's overall level of ability to control food portions. For example, the PCSE items "I can handle eating the right food portions no matter what comes my way" and "I am certain that I can consider smaller portion sizes when eating" were derived out of the GSE item "I can always manage to solve difficult problems if I try hard enough." Reliability and other information regarding the development and reduction to a final twelve-item scale (see Table 1) are presented in the Study 1(a)'s results section.

2.2.2. General self-efficacy (GSE)

A 10-item measure of GSE (Schwarzer & Jerusalem, 1995) was used to assess an individual's overall level of general ability/control. The items were answered using a five-point Likert scale such that 1 = *strongly disagree* and 5 = *strongly agree*. Overall reliability was considered good at $\alpha = .90$.

3. Study 1(a) results

3.1. Tests of assumptions

Because there are certain assumptions of the data that must be met prior to running confirmatory factor analyses and structural equation models (e.g., normality, linearity; Kline, 1998), all variables were analyzed to test them. Prior to model estimation, normality of the variables

Table 1
Items dropped and retained in the development of the 12-item portion control self-efficacy scale.

Item description		Dropped (D) or retained (R) (item reliability coefficient avg)
1.	I believe I can eat standard food portions when served portions that are too large.	R (0.98)
2.	I feel insecure about my ability to eat the right food portion.	D
3.	I am certain that I can consider smaller portion sizes when eating.	R (0.99)
4.	When I establish food portion goals from myself, I rarely achieve them.	R (0.94)
5.	I can handle eating the right food portions no matter what comes my way	R (0.98)
6.	I avoid difficult situations such as, eating out where food portions are abnormally large.	D
7.	When I prepare food for myself, I am able to estimate portion sizes easily	D
8.	It would be easy for me to control the size of the portions that I eat at social events.	R (0.97)
9.	I feel confident that I can leave food on my plate if I think a serving size is too large.	R (98)
10.	I often feel uncomfortably full after a meal.	D
11.	I don't know if I can control the size of the portions that I eat at social events.	R (0.86)
12.	I am confident that I know how much food I should eat to follow nutritional guidelines	D
13.	When eating at home, I am able to avoid overeating	D
14.	I am confident that I can control the size of the portions that I eat when out with friends.	R (0.91)
15.	I am confident I can judge whether a restaurant serving is appropriate when out with others.	R (0.92)
16.	When ordering meals with others, I am certain that I can consider smaller portion sizes.	R (0.94)
17.	Whether I control the amount I eat at social events is up to me.	R (0.96)
18.	When eating out with friends, they influence how much I eat.	R (0.96)
19.	When I am upset, I am more likely to lose control over how much I eat	D
20.	I believe I can eat out at restaurants less often.	D

used for the analyses were assessed by the absolute values of kurtosis and skewness, and the data were within normal ranges.

3.2. Scale development

An examination of the original 20 PCSE item revealed incongruent negative correlations; the majority of these problematic items were ambiguously worded, and so could therefore have been measuring multiple constructs. For example, one item described avoiding a difficult situation such as eating out, but some participants may not be able to afford eating out frequently, if at all. The five problematic items were deleted from the scale (see Table 1). A confirmatory factor analysis (CFA) in the structural equation modeling software package Mx (Neale, 2002) was then conducted to test for a one-factor solution for the 15-item scale. The single factor model did not yield a good fit to the data ($\chi^2_{90} = 228.21$, $p < .001$; RMSEA = 0.14). McDonald's fit index was 0.44 revealing an extremely poor fit; McDonald and Ho (2002) has suggested that models are considered to show good fit when this index is at least 0.90. Examination of the residual matrix showed that 14 (12%) of the 120 residual correlations had an absolute value greater than or equal to .10, and 20 (17%) were greater than .15. This information suggests a considerable amount of misfit in the original single factor model, therefore an alternate specification of the model was considered.

After careful review of the remaining items' uniqueness and factor loadings, three more items were dropped due to large residuals and high uniqueness, resulting in a final twelve-item model (see Table 1 for final twelve items). Testing the new twelve-item model with a CFA in Mx revealed an improvement in the model ($\chi^2 = 20.5$, $p < 0.01$.; RMSEA = 0.04). The PCSE revealed an omega reliability coefficient of 0.87 and Cronbach's alpha of 0.76, indicating that the final scale has acceptable reliability. McDonald's fit index revealed a good fit at .98; Spearman–Brown Prophecy formula indicated that a dramatic increase in reliability would not be attained by adding further items to the final twelve-item scale.

The contents of the 12 final items for the PCSE scale were reviewed to confirm if the items reflected self-efficacy as it relates to controlling one's portions. Content validity was confirmed by five researchers and five additional research assistants in the field of psychology familiar with both self-efficacy and eating behaviors. To ensure that the order of presentation of the 12-items did not influence ratings, five different orders of presentation were used. Some variability in ratings was expected, and in order for an item to be retained it had to receive at least 80% rating agreement. Raters were told "It is important to think about how the average man or woman feels about his or her ability to control the portion of food he or she consumes." Raters were then shown the general self-efficacy scale and were asked to rate each item as to the degree they assessed self-efficacy for portion control. The raters confirmed that the 12 final items on the PCSE represent an individual's personal ability to control food portion sizes while alone, and while in the presence of others (social situations). The association between PCSE scores for the raters ranged from 0.86 to 0.98, and the intraclass correlation was 0.99 (95% confidence interval), indicating substantial association and agreement among the scores of raters. In developing the PCSE measure, by representing both the individual and social aspect of PCSE, content validity was maximized.

A correlational analysis revealed a moderate correlation between the GSE scale and the PCSE scale ($r = 0.26$, $p < .05$), indicating that our PCSE is discriminant with GSE. As the PCSE items were derived from the GSE scale, it is expected that there will be a slight correlation between the two scales, however a result of less than 0.85 tells us that discriminant validity presumably exists between the two scales (John & Benet-Martinez, 2000). As GSE and PCSE are theoretically different concepts, showing discriminant validity indicates that PCSE is indeed measuring something unique; this measure is applying self-efficacy to a specific behavior, portion control, rather than applying self-efficacy in its general form across multiple domains.

4. Study 1(b) test–retest reliability assessments

The second part of Study 1 was designed to administer the PCSE scale to another sample of participants to determine whether the same single-factor solution exists, and to examine the test–retest reliability of the measure over three time points.

5. Study 1(b) methods

5.1. Participants

Volunteer participants were undergraduate students enrolled in an introductory psychology course at a large Western University. They completed paper-pencil questionnaires for extra-credit in a classroom setting across three different time points (Time 1 $N = 355$; Time 2 $N = 143$; and Time 3 $N = 151$).

5.2. Procedure and measures

The same measures used in Study 1 were administered in the Study 1(b). Participants completed the measures at Time 1, then 4 weeks later (Time 2), and finally at eight-weeks after Time 1 (Time 3). Each survey session took approximately 5 min to complete. At Times 1, 2, and 3, the GSE scale (Schwarzer & Jerusalem, 1995) had good reliability $\alpha = 0.77$, 0.76, and 0.79, respectively; information regarding the PCSE scale is discussed in the Results section below.

5.3. Procedure and measures

In order to examine whether the same one-factor model was the best fit for the data when tested again with this new sample of participants, the EQS 6.1 structural equation modeling (SEM) program was used. As the process validates a measurement model and fits the structural model (Byrne, 2006; Fan, Thompson, & Wang, 1999), SEM integrates path analysis and factor analysis. Following normal standards, a reasonably good model fit is indicated by a nonsignificant χ^2, and a Comparative Fit Index (CFI) of at least 0.95 (Byrne, 2006; Joreskog & Sorbom, 2002).

5.4. Time 1 (baseline)

First, the omnibus measurement model examined the degree to which each latent variable was measuring the intended underlying constructs, and revealed a CFI of 0.89, indicating a fair fit (although the chi-square was significant $\chi^2_{(52)} = 474.69$, $p < .0001$). Next, the measurement model was designed to test the 12-item factor, and although the chi-square statistic was significant ($\chi^2_{(26)} = 551.54$ $p < .001$), several other fit indices revealed a moderately acceptable fit, (CFI = 0.98, Bentler–Bonett NFI = 0.97, RMSEA = 0.05), and so the final twelve items measuring portion control self-efficacy measurement model were determined to fit the data adequately. As was the case in Study 1(a), a correlational analysis indicated that the GSE scale was moderately correlated with the PCSE scale at Time 1 ($r = 0.20$, $p < .05$), therefore, it was demonstrated again that PCSE is unique but related to GSE.

5.5. Time 2 (4 weeks retest)

A measurement model was constructed for Time 2 data collected four weeks post-baseline testing, consisting of the twelve items designed to measure self-efficacy toward portion control. The chi-square statistic was significant ($\chi^2_{(88)} = 728.93$ $p < .001$), but other fit indices reveal a good fit (CFI = 0.99, Bentler–Bonett NFI = 0.98, RMSEA = 0.05). The measurement model fit the data adequately and confirms the reliabilities found in the baseline and Study 1(a) test results. The PCSE scale demonstrated discriminant validity, as it moderately correlated with the GSE

scale from Time 2 ($r = 0.26$, $p < .05$), and demonstrated again that PCSE is similar yet unique from GSE.

5.6. Time 3 (8 weeks retest)

A final measurement model for PCSE was constructed for Time 3 data collected eight weeks post-baseline testing. The chi-square statistic was significant ($\chi^2_{(88)} = 715.02$, $p < .001$), several other fit indices reveal a good fit (CFI = 0.99, Bentler–Bonett NFI = 0.98, RMSEA = 0.05), indicating that the measurement models from Time 3 data fit adequately and confirm the reliabilities found during Time 1 and Time 2 test results. Similar to Time 1, Time 2, and Study 1(a) results, correlational analyses indicate that the PCSE moderately correlated with the GSE Scale at Time 3 ($r = 0.24$, $p < .05$).

5.7. Test–retest reliability

At the item level, test–retest correlations ranged from 0.86 to 0.99. For the 143 participants who completed the PCSE scale at Time 1 and Time 2, the correlation between the PCSE total score for Time 1 and the total PCSE score for Time 2 was 0.88; for the 151 participants who completed the PCSE scale at Time 1 and Time 3, the correlation was 0.91. These correlations indicate sufficient test–retest reliability (Rosenthal, & Rosnow, 1991).

6. Study 1 discussion

In Study 1(a), the measure of PCSE had overall good reliability and validity as tested against the GSE scale. As with the development of any survey instrument, selecting the final items required identifying and deleting items that have problematic wording and did not load well on the final factor that emerged in the CFA. The PCSE scale also correlated significantly with GSE, but there was no evidence of multicolinearity. Therefore, the scale appears to be related to GSE, but is measuring a unique construct, specifically related to food portion control behaviors. The results of Study 1(b) demonstrate good fit for the PCSE single factor solution across multiple time periods and confirmed reliability of the twelve-item scale. Over the course of three different administrations of the survey, good test–retest reliability for the measure was found. In addition, the PCSE scale revealed discriminant validity, showing that PCSE is similar to GSE but distinct.

7. Study 2

Study 2 sought to demonstrate several forms of validity (predictive, convergent, and discriminant) for the PCSE scale. Predictive validity was examined using the Food Amount Rating Scale (FARS; Dohm, & Striegel-Moore, 2002). Discriminant validity was incorporated by using the measure of GSE (Schwarzer & Jerusalem, 1995) again that was used in Study 1. Another related and relevant measure used in health research, weight locus-of-control (WLOC, Saltzer, 2010), was used to examine convergent validity. Weight locus of control captures an individual's belief that weight loss is within one's personal control; in other words it measures an individual's perception of self-control over his or her own weight, and it has been associated with confidence in weight loss, behavioral intention to lose weight, and other eating behaviors (Bryan & Tiggemann, 2001; Holt, Clark, & Kreuter, 2001; Saltzer, 2010). As WLOC is highly associated with other food related behaviors, it was expected to also be related to the PCSE measure, such that as WLOC increases, PCSE would also increase.

8. Study 2 methods

8.1. Participants

The Study 2 sample consisted of 205 undergraduate students recruited from introductory psychology courses at a large Western university during the 2011–2012 academic year, and received course credit for participating in the project. Participants were 18 to 26 years old, with a mean age of 19.6. Fifty-two percent of the participants reported being male ($N = 106$).

8.2. Procedure & measures

Participants signed up for the study via a secure website that allowed them to read a description of the study and its requirements: 1) the study would be conducted in a controlled lab setting, 2) would include a questionnaire measuring various individual variables and 3) would involve measuring the participant's height and weight. After signing up, participants were directed to arrive at a designated location on the University's campus at least 3 h before or after eating to ensure that the participants were not full when completing the study. As hunger is shown to be related to eating and other food related behaviors (e.g., individuals with higher mean hunger tend to spend more time shopping for food, more time prepping food, and consume less energy from foods; Mattes, 2002), hunger was an important factor to control for when examining food portion control.

8.2.1. Hunger satiety

To measure an individual's level of hunger, participants were asked *How hungry do you feel at the moment?* Response choices were on a ten-point scale ranging from 1 (*Stuffed to the point of being full*) to 10 (*Starving hungry, feel irritable and dizzy*). The average level of hunger for this sample was $M = 7.34$, $SD = 2.88$, indicating that participants were not starving but were relatively hungry.

8.2.2. General self-efficacy (GSE)

The same items comprising the GSE scale (Schwarzer & Jerusalem, 1995) from Study 1 were used again in Study 2, and reliability analyses indicated acceptable reliability ($\alpha = 0.79$).

8.2.3. Portion control self-efficacy (PCSE)

In this study, the final twelve items selected from Study 1 comprised the PCSE scale. Reliability analyses for the measure in the second study revealed that the scale was reliable ($\alpha = 0.87$).

8.2.4. Weight locus of control (WLOC)

Four items made up the weight locus of control scale (Saltzer, 2010). Items were designed to measure an individual's perception of self-control over his or her own weight (e.g., "Whether I gain or lose weight is entirely up to me"). Scored on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), reliability analyses indicated the scale had acceptable reliability ($\alpha = 0.72$).

8.2.5. Food Amount Rating Scale (FARS)

Two versions (male and female) of the FARS (Dohm & Striegel-Moore, 2002) were used to assess participants' subjective judgments of food amounts. The FARS was designed to assess whether judgments of food amounts vary as a function of personal characteristics (e.g., PCSE). Twenty-four items comprise the FARS, and although the measure is limited in that the descriptive foods do not adequately represent the multi-cultural or multi-ethnic topography of the United States, the foods are some of the most commonly represented food within the U.S. (Dohm & Striegel-Moore, 2002). Participants were asked to rate the amount of food described (e.g., 3 pancakes, 1/4 cup syrup, 2 strips bacon, 1 cup fresh fruit) in each item as either 1 (small amount) to 5 (beyond enormous).

8.2.6. Body mass index (BMI)

Body mass index was calculated based on the National Institutes of Health's measure of height by weight, the Imperial BMI Formula (BMI = weight in lbs * 703 / height in inches squared; as in Study 2). Based on the National Institutes of Health cutoff points for weight categories (18.5 or lower = underweight, 18.5–24.99 = average weight, 25–29.99 = overweight, and 30 or higher = obese), BMIs for this sample ranged from 16.01 to 34.21 with a mean of 23.15, indicating that the majority of participants in this sample are considered normal weight or healthy.

8.3. Study 2 results

In Study 2, the portion control self-efficacy scale demonstrated good reliability ($\alpha = 0.87$). Discriminant and convergent validity were also evident, as the PCSE scale was moderately correlated with the GSE scale and the WLOC scale as expected ($r = .24$, $p < .01$; $r = 19$, $p < .01$, respectively).

A MANOVA was performed to examine whether differences exist in the FARS and PCSE scale between gender, age, BMI, and hunger satiety levels. Of all the variables examined, significant differences were found only between males and females in both the FARS ($F = 7.51$, $p < .05$) and PCSE ($F = 3.47$, $p < .05$) scales; males reported lower ratings for food amounts ($M = 57.06$, $SD = 6.64$) and higher levels of PCSE ($M = 4.00$, $SD = 0.41$) than females ($M = 66.31$, $SD = 7.28$; $M = 3.89$, $SD = 0.34$).

Regression analyses indicate that the PCSE is a good predictor of estimations of food portions as measured by the FARS ($F = 7.29$, $p < .01$); PCSE predicts roughly 19% of the variance for estimated food ratings ($r = .19$; $p < 0.01$). As the MANOVA analyses revealed significant differences in the FARS based on gender, a stepwise regression analysis was performed to determine whether PCSE would eliminate the gender effects. Gender was entered in the first step in the regression, followed by the PCSE score. Together, gender ($t = 8.89$, $p < .01$) and PCSE ($t = -1.98$, $p < .05$) explained a significant amount of the total variance ($R = 0.56$, $F = 44.73$, $p < .001$). The increase in variance indicates both gender and PCSE contribute uniquely to the explanation of judgments of food amounts.

Additionally, regression analyses were run to determine whether GSE is a predictor of FARS, ($F = 1.89$, $p = 0.14$), and we found that GSE did not significantly predict the FARS.

8.4. Study 2 discussion

The results of Study 2 indicate that our PCSE scale has good predictive validity when using the FARS (FARS; Dohm, & Striegel-Moore, 2002), and importantly the PCSE rather than the GSE is a significant predictor of FARS scores. By measuring self-efficacy that is more specific to the behavior in question, there was greater predictive validity. Furthermore, the results suggest that judgments of food amounts may vary depending on whether the rater is male or female. Although it may seem to make sense that men would rate the portion in the FARS as being smaller, the FARS is already adjusted for differences in portions for men and women, therefore this gender difference is notable. When examining the effects of both gender and PCSE on judgments of food amounts, both variables explained a significant amount of variance in food amount judgments. This predictive validity gives our PCSE measure both basic and applied research applicability, however it may be just as important to consider gender effects when studying food amount estimations. Consistent with results which show that compared to men, women have more concern regarding their weight and eating, and have lower self-esteem (Arens & Hasselhorn, 2014), our results indicate women may have less belief in their ability to control portions and judge food portion sizes to be bigger than men do. As weight concern often translates into other issues, including anxiety, this anxiety or concern may actually affect portion control self-efficacy and food portion judgments as seen within our female sample for Study 2.

Although hunger and BMI are two variables often related to weight control (Leahey, LaRose, Fava, & Wing, 2011), Study 2 results show that for our sample, hunger satiety level had no effect on judgments of food amounts as measured by the FARS. These findings support the notion that humans often appear to be more responsive to the environment (e.g., food portion size), rather than internal biological cues (e.g., stomach feeling full or being over-weight). It is not entirely surprising that BMI scores did not affect food judgment amounts, as research on the relationship between food estimation amounts and BMI is inconsistent (Speakman, Walker, Walker, & Jackson, 2005). Speakman et al. (2005) showed that estimates of food energy contents were only significantly related to BMI when examining certain foods; for example, foods high in fat were perceived as lower in energy content by individuals with higher BMI scores, however no significant differences were found in food energy estimates when examining foods high in carbohydrates.

Additionally, the PCSE scale demonstrated again construct and discriminative validity when correlated with GSE and WLOC. The moderate correlation between PCSE and GSE indicates our measure is similar to (convergent) but different (discriminant) from GSE; therefore PCSE appears to be measuring something unique. Additionally, the moderate correlation between PCSE and WLOC demonstrates excellent convergent and discriminant validity, as Saltzer's (2010) weight locus of control scale is designed to measure an individual's expectancies for locus of control with respect to personal weight. Although the WLOC is similar to portion control self-efficacy, weight locus of control and belief in the ability to handle portions are unique constructs.

8.5. Study 3

Seeking to replicate and extend the first two studies, Study 3 incorporated a sample of primarily obese and overweight adults, the majority of whom were currently trying to lose weight (87%). Our primary goal in this last study is to replicate the strong test–re-test reliability findings from Study 1(b) and to offer additional information regarding relations with efficacy related to healthy eating behavior (i.e., nutrition self-efficacy), rather than using the GSE measure used in each of the previous studies, or the WLOC measure used in Study 2. Nutrition self-efficacy has been shown to be an important predictor of eating behaviors (e.g., Schwarzer & Renner, 2000). Furthermore, research highlights the importance of task specificity when examining self-efficacy (e.g., Bandura, 2006; Pajares, 1996). Thus, we sought to demonstrate that although self-efficacy for portion control would be related to nutrition self-efficacy, it would also be distinct.

Furthermore, this study explored whether PCSE could predict perceived self-regulatory dieting success even after controlling for nutrition self-efficacy. If one is efficacious at controlling what he/she eats, then dieting success should follow. In a recent review, Stroebe and colleagues (2013) outlined the importance of understanding what contributes to dieting success. After considering that the majority of individuals fail to reach their dieting goals (e.g., Powell, Calvin, & Calvin, 2007), a goal conflict model explaining how the goal or desire for pleasurable food often undermines the goal for weight control was outlined. Their model focused on the anticipated pleasure of eating as a primary contributor of weight problems in our obesogenic environment (Stroebe et al., 2013). Building on the idea that eating pleasure is related to dieting success, this study explored if greater self-efficacy for portion control might predict greater perception of self-regulatory dieting success. That is, if individuals perceive that they control their desire to overeat (especially likely for palatable foods), then they should be more likely to perceive that they are succeeding at managing their weight, adding another component of predictive validity for our newly developed PCSE measure.

8.6. Study 3 methods

8.6.1. Participants and recruitment

As part of a larger dieting resolutions study examining partner support, we recruited participants from the Southeastern U.S. ($N = 100$; couples = 50) through radio advertisements, online resources (e.g., Craigslist) and various listservs (e.g., graduate student forums). Eligibility criteria required that (a) each participant currently be involved in a romantic relationship of three months or more (b) at least one partner must be considering setting a new year's resolution to lose weight and (c) both partners be interested in participating in an experiment spanning three months. Participants earned $15 for in-lab sessions (Time 1 and Time 3) and $5–$10 for online sessions (prescreen and Time 2). If both partners completed all components of the study, each individual partner received a $50 bonus. Participant retention was excellent: 97 of the 101 participants completed all three of the assessment periods.

At Time 1, participants were on average 30 years old ($M = 30.99$, $SD = 8.66$; range 20–55), and 87% set a new year's resolution to lose weight. Most participants were involved in serious relationships (54% married, 39% dating seriously and 7% other; most common engaged) and had been involved with their partners for an average of 5.5 years ($SD = 66.28$ for months; range = 4 months to 28 years). The ethnicity breakdown was 76% White, 11% Asian, 6% Black or African American, and 7% multiracial/other. BMI was calculated using the Imperial BMI Formula (BMI = weight in lbs $*$ 703 / height in inches squared; as in Study 2), with 34% of participants categorized as average weight, 43% as overweight, and 23% as obese at Time 1.

8.6.2. Procedure and measures

Study 3 consisted of four parts: (a) an initial, 30 min screening questionnaire conducted online in early December to prescreen for requirements and gauge interest in the study and participants' intentions to set a new year's resolution to lose weight, (b) a 60-minute lab-based session involving questionnaires and weight assessments in the beginning of January (Time 1), (c) a 10-to-15-minute online questionnaire (approximately six weeks later; Time 2), and (d) a 60-minute lab-based session at the end of the three-month period (Time 3). We report no data from the prescreen as this was used as a recruitment tool not to assess key variables. At Time 1, participants completed a battery of questionnaires in the lab, most of them as part of another larger study on couples (e.g., relationship satisfaction, partner support). For the purpose of the current work, from Time 1, we used demographic information and self-reported weight and height to compute BMI. In the current work, we also focus on the PCSE assessment at Time 1 for the factor analyses. For construct and predictive validity purposes, we draw on two measures included at Time 2—we conducted these assessments online and the primary goal of this short 10-minute survey was to assess how well participants felt they were doing in terms of reaching the weight-loss goal they set at Time 1. We also included the PCSE at Time 2 to examine test–re-test reliability. Thus, no measures in the current work come from Time 3.

8.6.2.1. Portion control self-efficacy (PCSE). Because this was part of a larger project that was already assessing a multitude of constructs, we used a slightly shorter version of the PCSE, deleting two of the social items that did not load as strongly in the above reported studies. Specifically, we deleted the following two items: "*when ordering meals with others, I am certain that I can consider smaller portion sizes*" and "*whether I control the amount I eat at social events is up to me.*" An exploratory-factor-analysis (EFA) on the 10 items used in this study was run. Due to the shortened nature of this measure and because an adult sample of dieters was tested, we wanted to place as few restrictions on the patterns of relations between the common factors and the measured variables as possible. Furthermore, EFA was chosen because the primary goal was to identify the latent construct underlying the measured variables. Maximum likelihood was used based on recommendations for when data are normally distributed and a promax rotation because factors could be correlated (Fabrigar et al., 1999). Specifically, an EFA was performed with maximum likelihood factoring and promax rotation on the Time 1 assessment. The break in our scree plot, extracted eigenvalues, and percentage of variance explained by the factors revealed one clear factor for Study 3 as it did in Study 1 and Study 2 (see Table 2). Only items that loaded at a level of .40 or greater were kept, resulting in an eight-item scale ($\alpha = .91$ at Time 1 and $\alpha = .91$ at $\alpha =$ Time 2).

8.6.2.2. Nutrition self-efficacy. At Time 2, nutrition self-efficacy was assessed with an established five-item scale (Schwarzer & Renner, 2000). The scale consists of five items that start with the prompt, "*how certain are you that you could overcome the following barriers.*" An example item is, "*I can manage t stick to healthful foods even if I have to make a detailed plan* ($\alpha = .91$).

8.6.2.3. Self-regulatory dieting success. At Time 2, approximately six weeks after setting a new year's resolution to lose weight, perceived success thus far was assessed; specifically, the three-item scale developed by Fishbach et al. (2003) was incorporated. Participants responded on a 7-point scale to questions assessing success of dieting (e.g., "how successful are you in losing weight" with anchors of *not very successful* to *very successful*). The scale exhibited adequate reliability ($\alpha = .76$).

8.7. Study 3 results

Because participants were recruited with their romantic partners, nonindependence of participants' responses within the couples was assessed by computing the intraclass correlation coefficient (ICC) for all assessments included in correlation or regression analyses. The ICC is calculated by using mean squares from a fixed effect ANOVA in which group or couple is nested within the independent variable (see Kenny, Kashy, & Bolger, 1998). The ICCs for the self-efficacy portion control measure at Time 1 ($r = .15$, $p = .14$), the nutrition self-efficacy at Time 2 ($r = .11$, $p = .23$), and the dieting self-regulatory success measure at Time 2 ($r = .03$, $p = .42$) were non-significant. Even considering the recommendation by Kenny and colleagues that a liberal alpha of at least .10 should be used to avoid erroneously rejecting the existence of nonindependence, the ICC calculations for these assessments indicate that the assumption of independence was met and the data could be analyzed at the individual level (Kenny, Mannetti, Pierro, Livi, & Kashy, 2002).

In Study 3, the portion control self-efficacy scale demonstrated strong inter-item reliability and test–re-test reliability (see Table 3). Discriminant and convergent validity were evident, as the PCSE at Time 1 and at Time 2 was moderately correlated with the nutrition self-efficacy scale ($r = .42$, $p < .001$; $r = .46$, $p < 0.001$, respectively). Regression analyses, $F(2,96) = 9.18$, $p < 0.001$, indicate the PCSE at Time 1 is a marginally significant predictor of dieting self-regulatory success at Time 2 (6 weeks after setting a resolution to lose weight) even after controlling for nutrition self-efficacy at Time 2, $B = .29$, $t = 1.82$, $p = .07$.

8.8. Study 3 discussion

The results of Study 3 indicate that our PCSE scale demonstrated good test–re-test reliability in a sample of overweight and obese adults, most of whom were currently trying to lose weight. Furthermore, the PCSE correlated in expected ways with the nutrition self-efficacy scale but also predicted unique variance (although only marginally significant) in participants' perceived dieting success.

8.9. Overall discussion

Our goal was to develop a tool that measures an individual's self-efficacy for portion control. The inter-item and test–retest reliability,

Table 2
Study 3: Factor loadings and commonalities based on an exploratory factor analysis with Promax rotation for 10 items from the portion control self-efficacy (PCSE) scale.

Item	Factor 1	Factor 2	Factor 3
I believe I can eat standard food portions when served portions that are too large.	**1.03**		
I am certain that I can consider smaller portion sizes when eating.*	**.58**	−.24	.26
I can handle eating the right food portions no matter what comes my way.	**.52**		.21
I feel confident that I can leave food on my plate if I think a serving size is too large.	**.88**		
When eating with friends, they influence how much I eat.	.22	**−.41**	
It would be easy for me to control the size of the portions that I eat at social events.		**.72**	
I don't know if I can control the size of the portions that I eat at social events.		**−.93**	
I am confident that I can control the size of the portions that I eat when out with friends.		**.53**	.22
I am confident I can judge whether a restaurant serving is appropriate when out with others.			**.75**
When I establish food portion goals from myself, I rarely achieve them.*			**−.65**

Note. Factor loadings < .2 are suppressed. Boldface values indicate significant factor loadings.
* Items dropped from scale in analyses.

convergent and discriminant validity, and the predictive validity of the PCSE scale support that the scale is a psychometrically sound tool for measuring an individual's portion control self-efficacy. Portion control is a health behavior that has serious ramifications for the management of weight and prevention of weight related diseases. In the current study, PCSE predicted evaluations of servings in a range of foods and perceived dieting success in a sample of primarily overweight and obese individuals, indicating this measure may be important to include in future studies, programs, and interventions focusing on healthy eating, weight-management, weight-loss, and obesity.

Most food portions served in the United States are larger than dietary guidelines recommend. As food portion sizes continue to increase in the U.S. (Nielsen & Popkin, 2003), particularly in restaurants (Young & Nestle, 2002), accounting for individual differences in self-efficacy toward food portion control could help researchers better understand eating behaviors. Furthermore, Stroebe et al. (2013) have suggested that the desire for palatable foods might override the desire for successful weight management. However, until changes are made in the environment, an individual must rely on his or her own ability to eat the correct portion, making it important to understand how self-efficacy toward portion control affects an individual's eating habits. Because the increases in obesity can be correlated with the trend of increases in portion sizes (Ledikwe, Ello-Martin, & Rolls, 2005; Young & Nestle, 2002), an individual's belief in their ability to control portion sizes may prove to be a valuable construct to understand in designing interventions to help individuals reach their weight management goals.

An effective method for the promotion of healthy eating behaviors requires an understanding of factors that influence eating behaviors. We suggest here that one such factor is self-efficacy toward portion control. Consistent with current arguments that self-efficacy should be task specific (Bandura, 2006; Pajares, 1996), our PCSE measure is task specific and has more predictive power than a general measure of self-efficacy. As research continues to demonstrate that behavioral modification is a viable and effective approach to safe weight loss (Dansinger & Schaefer, 2006; Wardle, 2005), one of the largest challenges is to identify which behavioral aspects to target. Individuals often make inaccurate food portion estimates and underestimate calorie intake (Slawson & Eck, 1997; Yuhas, Bolland, & Bolland, 1989), so portion control is one promising behavior to address. Our PCSE scale is designed to be used in both basic (e.g., do PCSE levels differ if the individual is described as eating alone versus dining out with friends) and applied (e.g., whether the PCSE level for individuals with eating disorders relates to the success of treatment interventions) research settings. Future studies could not only include the measure of self-efficacy toward portion control, but could also design interventions aimed at increasing portion control. These analyses may provide helpful insight into the nature of self-efficacy for portion control, eating behaviors, and ultimately weight-loss.

Table 3
Study 3: Reliabilities and test–re-test correlations for portion control self-efficacy (PCSE) across 3 time points.

Measurement Occasion	Time 1	Time 2	Time 3	α
Time 1	1	.75*	.66*	.87
Time 2		1	.80*	.89
Time 3			1	.91
M (*SD*)	26.24 (5.97)	26.40 (6.24)	26.11 (6.96)	

Note. PCSE is a shortened scale with 8 items (see Table 2).
* $p < .001$.

8.10. Conclusions and limitations

This study focused solely on developing a measure for use in future studies to assess PCSE. Our findings suggest that our PCSE construct is reliable and valid measure. As with most measures of self-efficacy, our PCSE is a measure of perceived self-efficacy, not actual self-efficacy, and future studies could be conducted to determine whether the perceived measure correlates with actual ability. Before interventions are put into practice, more work is needed, especially additional research addressing some of the limitations of the current work.

First, this study relied on self-report data. Although this is a first step in scale development, future work should consider using multiple types of assessments including some form of objective measurement (e.g., laboratory-based food intake), and matching reports from others with self-reports of efficacy portion control. Sample characteristics represent another limitation of the current set of studies. The participants used in Study 1 and Study 2 were recruited from a university population and are perhaps not representative of the general population. However, Study 3 utilized a more representative sample of adults in another part of the U.S., most of whom were currently trying to lose weight. However, the scale in this study was slightly shorter and did not include the two social-items. Future work may want to address whether these two items are critical to the scale. And, despite the geographic diversity and sampling from different populations (student and community), the samples still consisted largely of White/European Americans. Thus, the results may not be generalizable beyond individuals belonging to different racial or ethnic groups. Replication with these samples will be necessary for future scale validation and use with these populations.

Additionally, a number of methodological differences exist between the three studies discussed herein. Specifically, it should be acknowledged that participants in Study 1 and Study 2 completed paper-pencil questionnaires, whereas participants in Study 3 completed an online version of the questionnaire. Regardless of administration type, scale reliabilities and validities (e.g., with the GSE) were consistent across studies. Additionally, a shortened 8-item version of the PCSE scale had a better fit in Study 3 (community sample) than the longer 12 item version administered to the student samples (see Tables 1 and 2). Although overall use of the 12-item scale is recommended (the reliability is slightly increased), if survey length is of concern, using the reduced 8-item scale is considered a viable option as the

reduced version is still reliable, valid, and predictive. Additionally, within Study 2, gender effects were found when examining the PCSE and the FARS. Consistent with prior studies indicating gender differences exist when studying weight and eating related concerns (Arens & Hasselhorn, 2014), our Study 2 results indicate women have on average lower PCSE and judge food portion estimates to be larger than they actually are, therefore gender should be controlled for when examining PCSE. These results indicate gender specific aspects of PCSE may exist and should be considered a variable of importance by future researchers using the measure.

Despite these limitations, the current work offers a reliable and valid scale for portion control self-efficacy. As it becomes clearer the importance of assessing domain specific-efficacy (Bandura, 2006; Pajares, 1996), we hope that this measure can contribute to a better understanding of the role of portion control efficacy during the obesity epidemic. If portion control efficacy can have a direct effect on eating related behaviors this particular variable could be targeted during intervention strategies and an individual initially reporting low levels of PCSE could potentially improve their efficacy and in turn their eating behaviors.

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This research was conducted with no financial support or funding from any sources.

Statement 2: contributors

Authors Lindsey Fast and Julie Maertens completed the initial scale development in Study 1(a) and 1(b). Authors Lindsey Fast, Jennifer Harman, and Francesca Dreith conducted Study 2. Authors Jeni Burnette and Jennifer Harman conducted Study 3. Authors Lindsey Fast and Jennifer Harman wrote the first draft of the total manuscript and all authors contributed to and have approved the final manuscript.

Statement 3: conflict of interest

All authors declare that they have no conflicts of interest.

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