Psychological Assessment
2004, Vol. 16, No. 1, 51–59

1040-3590/04/$12.00 DOI: 10.1037/1040-3590.16.1.51

Are Dietary Restraint Scales Valid Measures of Acute Dietary Restriction? Unobtrusive Observational Data Suggest Not

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The finding that dietary restraint scales predict onset of bulimic pathology has been interpreted as suggesting that dieting causes this eating disturbance, despite the dearth of evidence that these scales are valid measures of dietary restriction. The authors conducted 4 studies that tested whether dietary restraint scales were inversely correlated with unobtrusively measured caloric intake. These studies, which varied in foods consumed, settings, and populations, indicated that common dietary restraint scales were largely uncorrelated with acute caloric intake. Results suggest that these scales are not valid measures of short-term dietary restriction and imply that it may be prudent to reinterpret findings from studies that use these scales, including those that suggest dietary restraint is a risk factor for bulimic pathology.

Numerous theorists have posited that dieting increases the risk for onset and maintenance of binge eating and bulimia nervosa (Fairburn, 1997; Hawkins & Clement, 1984; Heatherton & Polivy, 1992; Huon, 1996; Polivy & Herman, 1985). Dieting has been defined as intentional and sustained restriction of caloric intake for the purposes of weight loss or weight maintenance (Herman & Mack, 1975; Laessle, Tuschl, Kotthaus, & Pirke, 1989; Wadden, Brownell, & Foster, 2002; Wilson, 2002). Dietary restriction must result in a negative energy balance for weight loss or a balance between intake and expenditure for weight maintenance (Rosenbaum, Leibel, & Hirsch, 1997). Although dieting has been defined in various ways, the above definition aligns with the lay use of the term to reflect limiting intake for the purpose of weight control.

The dietary restraint model asserts that a reliance on cognitive control over eating, rather than physiological cues, leaves dieters vulnerable to uncontrolled eating when these cognitive processes are disrupted (Polivy & Herman, 1985). Violation of strict dietary rules may also result in an acute abandonment of dietary restraint because of the abstinence violation effect (Marlatt & Gordon, 1985). These binge-eating episodes putatively precipitate redoubled dietary efforts and the use of radical weight control techniques, such as vomiting and laxative use, which cascade into the binge–purge cycle (Fairburn, 1997). Dieting may also result in depletion of tryptophan, a precursor of serotonin, which might increase the likelihood of binge eating high-carbohydrate food in an effort to restore levels of this neurotransmitter (Kaye, Gendall, & Strober, 1998).

The cornerstone piece of evidence supporting these theoretical assertions is that prospective studies have found that elevated scores on dietary restraint scales predicted future onset of binge eating (Stice & Agras, 1998; Stice, Killen, Hayward, & Taylor, 1998; Stice, Presnell, & Spangler, 2002) and bulimic pathology (Killen et al., 1994, 1996), as well as increases in bulimic symptoms (Stice, 2001). Dietary restraint scales also predicted onset of eating pathology (Patton, Johnson-Sabine, Wood, Mann, & Wakeling, 1990) and increases in general eating disorder symptoms (Leon, Fulkerson, Perry, Keel, & Klump, 1999; Santonastaso, Friederici, & Favaro, 1999). Because dietary restraint has emerged as the most potent and consistent risk factor for bulimic pathology, it is now widely accepted by researchers and clinicians that dieting plays a causal role in the onset of this eating disorder (e.g., Hawkins & Clement, 1984; Heatherton & Polivy, 1992; Huon, 1996; Polivy & Herman, 1985). Indeed, certain researchers have called for a moratorium on dieting because of the belief that it causes eating pathology and have evaluated interventions that decrease dietary restriction (Polivy & Herman, 1992).

Although prospective studies provide support for the dietary restraint model, there are experimental findings that are antithetical to this account. Researchers have found that participants in obesity treatment trials who were randomly assigned to a low-calorie weight loss diet (e.g., 1,200 calories a day) showed greater decreases in binge eating than did participants assigned to a wait-list control condition (Goodrick, Poston, Kimball, Reeves, & Foreyt, 1998; Reeves et al., 2001). Assignment to a low-calorie diet in uncontrolled trials has similarly resulted in decreased binge eating for overweight and obese individuals (Telch & Agras, 1993; Wadden, Foster, & Letizia, 1994). Furthermore, assignment to a low-calorie weight loss diet versus a wait-list control condition has been found to result in decreased bulimic symptoms in nonobese individuals (Presnell & Stice, 2003). Similarly, assignment to a lower intensity weight-maintenance diet versus a wait-list control

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This study was supported by Research Grants MH50271 and MH064560 and Career Award MH01708 from the National Institutes of Health. We thank W. Stewart Agras, Katherine Presnell, Gabriela Redwine, Heather Shaw, and Christy Telch for their thoughtful input regarding this article and Sharon Ozer for the clever idea of collecting unobtrusive observational data on caloric intake in restaurants.

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condition resulted in decreased bulimic symptoms in nonobese individuals (Stice, Presnell, Groesz, & Shaw, 2003). A randomized trial of a healthy weight intervention promoting moderate caloric restriction and exercise also produced reductions in binge eating (Klem, Wing, Simkin-Silverman, & Kuller, 1997). Participants in these trials showed decreases in body mass in response to the various dietary interventions, verifying that they achieved a lasting negative energy balance. Thus, experiments that have manipulated dietary restriction have consistently produced reductions in binge eating and bulimic pathology.

The pattern of findings wherein dietary restraint scales predict increases in bulimic pathology and experimental assignment to low-calorie diets produces decreases in bulimic pathology is vexing. It is vital to resolve these contradictory findings because of the profound implications for etiologic and maintenance models of bulimic pathology and for the design of prevention and treatment programs. If dieting increases the risk for onset and persistence of bulimic pathology, it would imply that prevention and treatment programs should seek to eradicate dieting. However, if dieting decreases bulimic pathology, it would suggest that prevention and treatment programs should help people diet more effectively. Alternatively, dieting may only contribute to onset and maintenance of bulimic pathology for a subset of individuals with this eating disorder. It is also possible that dieting is simply a confounding variable with no causal relation to bulimic pathology.

One explanation for the conflicting findings is that the dietary restraint scales used in prospective studies may not be valid measures of dietary restriction. The finding that people with high scores on these scales gain more weight over time than people with low scores (French, Jeffery, Forster, et al., 1994; Klesges, Isbell, & Klesges, 1992; Klesges, Klem, & Bene, 1989; Stice, 2001; Stice, Cameron, Killen, Hayward, & Taylor, 1999) provides suggestive evidence that these scales are not valid measures of dietary restriction.

There are three widely used dietary restraint scales that were originally designed to assess intentional dietary restriction for the purposes of weight control. The Restraint subscale of the Three Factor Eating Questionnaire (TFEQ–R; Stunkard & Messick, 1985) reflects "cognitive restraint of eating" (p. 77). The items from this scale assess dietary behaviors designed to produce weight loss or weight maintenance, monitoring of body shape, and importance of thinness. The Dutch Restrained Eating Scale (DRES; van Strien, Frijters, van Staveren, Defares, & Deurenberg, 1986) assesses dietary behaviors that people use to produce weight loss and weight maintenance. These authors noted that a restraint scale is valid only "if it predicts adequately the restriction of food intake" (p. 749). The Restraint Scale (RS; Polivy, Herman, & Warsh, 1978) was originally designed to identify "chronic dieters" who restrict their food intake in order to control their body weight. However, this research group (Heatherton, Herman, Polivy, King, & McGree, 1988) subsequently qualified this claim to suggest that the RS identifies dieters who "exhibit periods of restraint punctuated by episodes of disinhibited overeating" (p. 19). Heatherton et al. (1988) argued that the TFEQ–R and DRES identify dieters who show consistent caloric restriction, whereas the RS identifies dieters whose "caloric restrictions are canceled by bouts of caloric excess" (p. 19). This analysis implies that the RS should show weaker inverse relations to caloric intake than the TFEQ–R and DRES because some of the individuals identified on the RS will exhibit bouts of overeating during their periods of caloric restriction.

The most logical approach to determining whether dietary restraint scales are valid measures of dietary restriction is to test whether they correlate negatively with caloric intake. Indeed, this is the approach used by the authors of the DRES (van Strien et al., 1986). Past validity studies typically tested whether these measures showed inverse correlations with self-reported caloric intake. The DRES and TFEQ–R, but not the RS, have shown significant negative correlations with self-reported caloric intake (de Castro, 1995; French, Jeffery, & Wing, 1994; Hill, Draper, & Stack, 1994; Kirkley, Burge, & Ammerman, 1988; Laessle et al., 1989; Neumark-Sztainer, Jeffery, & French, 1997; van Strien et al., 1986; Wardle, 1980; Wardle & Beales, 1987). On the basis of these findings, investigators have concluded that at least two of these dietary restraint scales are valid measures of dietary restriction (French, Jeffery, & Wing, 1994; Laessle et al., 1989; van Strien et al., 1986).

Unfortunately, there is considerable evidence that self-reported caloric intake itself is not a valid measure of intake. Studies using objective biological measures of caloric intake reveal that people typically underreport intake (Bandini, Schoeller, Dyr, & Dietz, 1990; Lichtman et al., 1992; Livingstone, Prentice, & Strain, 1990; Prentice et al., 1986). One study found an average underreporting rate of 20% in a normative sample (Livingstone et al., 1990). Lichtman et al. (1992) found that "diet-resistant" patients, who claimed they could not lose weight on very low-calorie diets, underestimated their energy intake by almost 50%. Research also indicates that one third of people in a national sample reported a caloric intake that would result in death by starvation (Klesges, Eck, & Ray, 1995). Because the underreporting of caloric intake is most extreme for individuals with elevated body mass (Prentice et al., 1986) and with high scores on restraint scales (Bathalon et al., 2000; Bingham et al., 1995), the effects of this bias distort common statistics (e.g., correlations). This may simply be one example of a broader trend for individuals to underreport socially undesirable behaviors and traits. For instance, research has shown that people tend to underreport weight, psychoactive substance use, and personality disturbances (Baer & Miller, 2002; Cash, Grant, Shovlin, & Lewis, 1992; Latkin, 1998).

These findings imply that it would be prudent to collect unobtrusive data on caloric intake to provide a less biased test of whether dietary restraint scales are valid measures of dietary restriction. Accordingly, we conducted a series of studies that examined the concordance between these scales and unobtrusive measures of actual caloric intake. We sampled broadly in terms of the types of foods, settings, populations, and scales investigated to maximize generalizability. We hoped that these studies would provide information regarding the construct that is assessed by dietary restraint scales. The fact that these scales consistently predict onset of bulimic pathology suggests that these measures reliably assess some construct that is relevant to understanding disordered eating, but the exact nature of this construct has been elusive.

Study 1

We first tested whether dietary restraint scales were valid measures of dietary intake in a controlled laboratory environment.

Specifically, we tested whether three widely used dietary restraint scales were inversely correlated with unobtrusively observed caloric intake in a standard taste-test paradigm (Polivy, Herman, & McFarlane, 1994).

Method

Participants and Procedure

Sixty-four female undergraduates volunteered for this study in exchange for course credit (M age = 19.1 years, SD = 3.2). The sample was composed of 10% Asians, 5% Blacks, 69% Whites, 12% Hispanics, and 4% who specified mixed racial heritage. The average body mass index (BMI = kg/m^2, based on direct measures of height and weight) of participants was 24.6 (SD = 6.0).

Participants, who were tested individually, were told that this was a study of the relation between mood and taste perception. Following standard procedures for this paradigm (Polivy et al., 1994), we presented participants with three types of cookies (chocolate chip, peanut butter, and sugar) and asked them to rate each along various dimensions (e.g., sweetness, saltiness). They were given rating forms and a glass of water and were instructed to have as many cookies as necessary to achieve accurate ratings. They were told that they had 10 min to complete this task but that they should have as many cookies as they wanted after the ratings were complete because we had to bake fresh ones for each participant. However, they were asked not to change any of the initial ratings. Each oversized plate was covered with a mound of bite-sized cookies to make participants less self-conscious about the number of cookies eaten. Hidden cameras were used to ensure that the cookies were actually eaten. (One participant put an entire plate of cookies in her backpack and was excluded from the study because we could not calculate how many grams of cookies she consumed.) Fresh cookies were prepared for each participant to maximize appeal. After the taste test, participants completed a packet of surveys, which included the dietary restraint scales described below and distracter scales (e.g., mood measures). Each of the three plates was weighed before participants arrived and after they departed to provide an unobtrusive measure of total caloric intake.

Measures

RS. The RS (Polivy et al., 1978) assesses dieting behaviors, preoccupation with eating, and past weight fluctuations (sample item: "How often do you diet?"). Items were averaged for analyses (and for all scales described below). Researchers (French et al., 1994; Klesges et al., 1992) have found this scale to be internally consistent (αs range from .79 to .86) and temporally reliable (2-year test–retest = .74).[1]

TFEQ–R. The TFEQ–R (Stunkard & Messick, 1985) assesses dietary behaviors designed to produce weight loss or maintenance, monitoring of body shape, and importance of thinness (sample item: "I count calories as a conscious means of controlling my weight"). This scale has been found to be internally consistent (αs range from .85 to .93) and temporally reliable (1-month test–retest = .98) in past research (French et al., 1994; Laessle et al., 1989; Stunkard & Messick, 1985).

DRES. The DRES (van Strien et al., 1986) assesses dietary behaviors designed to produce weight loss and maintenance (sample item: "Do you deliberately eat less in order not to become too heavy?"). Researchers (Stice, 2001; Stice & Agras, 1998; van Strien et al., 1986) have found this scale to be internally consistent (αs range from .93 to .95) and temporally reliable (2-week test–retest reliability = .82).

Caloric intake. Using a digital scale accurate up to ± 0.1 g, we unobtrusively weighed the three plates of cookies twice before and twice after the taste test. The total average weight of the three plates after the taste test was subtracted from the total average weight of the three plates before the taste test to provide an unobtrusive measure of total grams of cookies consumed (M = 98, SD = 92, range = 513). The hidden cameras allowed us to confirm that the cookies were eaten. Research assistants responsible for weighing the plates and calculating caloric intake were completely blind to the participants' scores on the dietary restraint scales.

Body mass. The BMI was used as a measure of adiposity. Using a portable direct reading stadiometer, we measured height to the nearest millimeter. Digital scales were used to assess weight to the nearest 0.1 kg; participants wore light clothing, without shoes or coats. Two measures of height and weight were obtained and were averaged. The validity of the BMI is supported by the fact that it shows correlations between .80 and .90 with direct measures of total body fat such as dual energy X-ray absorptiometry (Goran, Driscoll, Johnson, Nagy, & Hunter, 1996; Pietrobelli et al., 1998), and correlates with health measures, including blood pressure, adverse lipoprotein profiles, atherosclerotic lesions, serum insulin levels, and diabetes mellitus (Dietz & Robinson, 1998; Pietrobelli et al., 1998).

Results and Discussion

Correlations between the RS, TFEQ–R, DRES, and caloric intake are reported in Table 1. Although the dietary restraint scales correlated positively, none was significantly correlated with caloric intake. Given the sample size of 64, we had a power of .79 to detect a medium effect size (r = .30), which suggests that the lack of effects is not a result of low statistical power. We considered a medium effect size the minimum necessary to establish the validity of a scale.

Post hoc multiple regression models tested whether the findings were similar when BMI was used as a covariate because there is some evidence that BMI is positively correlated with dietary restraint scales and caloric intake (e.g., Heatherton et al., 1988), which suggests that it might operate as a confounding variable. However, BMI did not show significant correlations with any of the measures of dietary restraint or with caloric intake in this sample (all p values $> .10$). More important, the correlations of the three dietary restraint scales to caloric intake in Study 1 remained nonsignificant when BMI scores were entered as a covariate. Parallel analyses with data from Studies 2, 3, and 4 revealed that all 17 of the relations between dietary restraint scales and caloric intake across the four studies remained the same when BMI was used as a covariate (e.g., nonsignificant effects remained nonsignificant). These results suggest that BMI scores were not acting as a confounding variable that biased the results.

Post hoc analyses also tested whether BMI moderated the relations of the dietary restraint scales to caloric intake because there has been concern that these scales are not valid for obese individuals (Ruderman, 1986). We estimated a series of multiple regression models, wherein the main effects for BMI and each dietary restraint scale (in mean deviation form), as well as the cross-

[1] Preliminary analyses investigated the factor structure of the RS because research had suggested that the items assess two latent factors rather than one (Heatherton et al., 1988; Ruderman, 1986). Exploratory factor analysis (principal-axis extraction) was used to test whether the RS items loaded on one factor or more in the sample from Study 1. Only one eigenvalue over 1.0 was extracted (eigenvalue = 4.29, 43% variance explained). The scree test similarly suggested that there was only one latent factor (eigenvalues = 4.29, 0.98, and 0.86). Parallel analyses of the RS items from Studies 3 and 4 revealed similar results (i.e., only one eigenvalue over 1.0 in all data sets). Accordingly, for analyses in the studies reported in this article, the RS was coded to reflect a single unidimensional scale.

Table 1
Correlations Between the Dietary Restraint Scales and Unobtrusively Observed Caloric Intake in Study 1

Measure	1	2	3	4
1. RS	—	.73***	.29*	−.02
2. TFEQ–R		—	.46***	−.01
3. DRES			—	−.14
4. Caloric intake				—

Note. RS = Restraint Scale; TFEQ–R = Three Factor Eating Questionnaire—Restraint; DRES = Dutch Restrained Eating Scale.
* $p < .05$. *** $p < .001$.

product of these two variables, were used to predict caloric intake. We estimated separate models for each restraint scale to avoid multicollinearity. However, none of the interactions between BMI and restraint scales reached significance in the prediction of caloric intake in Study 1. Parallel analyses with data from Studies 2, 3, and 4 indicated that none of the interactions between BMI and restraint scales reached significance in the prediction of caloric intake. These results suggest that the nature of the relations between dietary restraint scales and caloric intake was invariant across the range of BMI scores (i.e., that BMI did not moderate the relations).[2]

The findings from Study 1 suggest that these three dietary restraint scales are not valid measures of short-term caloric restriction among normal-weight women. However, it may be that it is particularly difficult to exercise effective dieting when confronted with tempting food, such as cookies. Therefore, in Study 2 we tested whether dieting scales correlated with caloric intake when participants were offered a healthy meal in a controlled laboratory environment. The data were drawn from two previously published experiments on the effects of negative affect (Telch & Agras, 1996a) and food deprivation (Telch & Agras, 1996b) on caloric intake in women with and without eating disorders. All data reported here were from the baseline phase of these two experiments, before the negative affect and food deprivation manipulations.

Study 2

Method

Participants and Procedure

Participants were 151 women (M age = 41.2 years, SD = 10.9) who responded to advertisements for a laboratory study of the determinants of eating (and a $150 payment). The sample was composed of 2% Asians, 7% Blacks, 73% Whites, 15% Hispanics, and 3% Native Americans. The average BMI of participants (based on direct measures of height and weight) was 31.3 (SD = 7.3). Thirty-two women met the criteria of the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–IV*; American Psychiatric Association, 1994) for bulimia nervosa, 60 met *DSM–IV* criteria for binge-eating disorder, and 59 did not have an eating disorder.

During the first visit to the laboratory, participants were screened to confirm their eating disorder status. This was accomplished by administering the Questionnaire on Eating and Weight Patterns (Spitzer et al., 1992) and a structured diagnostic interview created for these studies that assessed diagnostic criteria for bulimia nervosa and binge-eating disorder. At this point they also completed several other self-report measures, including the two dietary restraint scales described below. Participants meeting criteria for either eating disorder or showing no clinically significant eating pathology returned to the lab a second time to complete the experiments.

During the second visit, participants arrived at the laboratory at 7:45 a.m. (participants were tested individually). Research assistants verified food records to ensure that participants had not eaten since midnight. A standard breakfast was served at 8:00 a.m. to all women to generally equate participants in terms of caloric intake before the experiments. This breakfast consisted of cereal, fruit, a bread roll, and decaffeinated tea or coffee. Food items were unobtrusively weighed before and after the participants ate breakfast, which allowed us to calculate the number of calories each participant consumed. We examined the correlation between the two dietary restraint scales and calories consumed during the breakfast.

Measures

TFEQ–R. The TFEQ–R (Stunkard & Messick, 1985) was the first dieting scale used in Study 2 (see Study 1 for psychometric details).

Eating Disorder Examination Questionnaire—Restraint subscale. The second dieting scale, the Restraint subscale of the Eating Disorder Examination Questionnaire (EDEQ–R; Fairburn & Beglin, 1994), assesses attempts to restrict food intake, abstain from eating, avoid high-fat foods, and follow strict dietary rules (sample item: "Have you been consciously trying to restrict the amount of food you eat to influence your shape or weight?"). This scale was internally consistent (α = .84) and temporally reliable (2-week test–retest = .81) in past research (Luce & Crowther, 1997).

Caloric intake. Using a digital scale accurate up to ± 0.1 g, we unobtrusively weighed each serving dish before and after the test meal. The weight of each serving dish after the meal was subtracted from the weight of each serving dish before the meal. This information, in conjunction with data on the caloric density of each food, allowed us to generate an unobtrusive measure of total caloric intake for each participant (M = 423, SD = 58, range = 388). Research assistants responsible for weighing the serving dishes and calculating caloric intake were blind to the participants' scores on the dietary restraint scales.

Results and Discussion

Correlations between the TFEQ–R, EDEQ–R, and total caloric intake for the full sample are reported in Table 2. The dietary restraint scales were significantly correlated but did not correlate significantly with caloric intake. Given the sample size of 151, we had a power of greater than .99 to detect a medium effect size (r = .30). Additional analyses confirmed that the TFEQ–R and EDEQ–R did not show significant correlations with caloric intake among the participants with bulimia nervosa (r = −.07 and −.23, respectively), binge-eating disorder (r = .13 and −.04, respectively), or no eating disorder (r = .02 and −.18, respectively). Thus, there was no evidence that eating disorder status qualified the relations between the dietary restraint scales and caloric intake.

Findings suggest that these dietary restraint scales are not valid measures of short-term caloric restriction among women with

[2] Post hoc multiple regression models also tested whether ethnicity (0 = *White*, 1 = *minority*) moderated the relations between the dietary restraint scales and caloric intake in Study 1. Results indicated that none of the interactions between dietary restraint scales and ethnicity were significantly related to caloric intake. Parallel analyses from Studies 2, 3, and 4 also failed to find any evidence that ethnicity moderated the relations between dietary restraint scales and intake variables.

Table 2
Correlations Between the Dietary Restraint Scales and Unobtrusively Observed Caloric Intake in Study 2

Measure	1	2	3
1. TFEQ–R	—	.60***	.05
2. EDEQ–R		—	−.09
3. Caloric intake			—

Note. TFEQ–R = Three Factor Eating Questionnaire—Restraint; EDEQ–R = Eating Disorder Examination Questionnaire—Restraint.
*** $p < .001$.

bulimia nervosa or binge-eating disorder or among overweight women. Although the first two studies suggest that dietary restraint scales are not valid measures of dietary restriction, it may be that the artificial nature of the laboratory distorted the findings. That is, participants may not exhibit normal eating behavior in the laboratory. Thus, the aim of Study 3 was to test whether dietary restraint scales correlated with unobtrusively measured caloric intake in a real-world setting to provide a more ecologically valid test of these relations.

Study 3

This study tested whether three dietary restraint scales correlated with unobtrusively observed caloric intake in a fast food restaurant chain. We collected validity data at a popular fast food restaurant because the average American consumes two meals a week at such establishments (Jeffery & French, 1998). There were a variety of food types available at the restaurants from which we collected data, ranging from low-fat salads and blended fruit drinks to fries and double cheeseburgers, implying that it was possible for participants to consume a low-calorie meal if they wanted to exercise dietary restriction.

Method

Participants and Procedure

Female patrons (M age = 25.4 years, SD = 9.9) of fast food restaurants in California and Texas (N = 69) volunteered for this study. The sample was composed of 9% Asians, 4% Blacks, 73% Whites, 11% Hispanics, and 3% Native Americans. The average BMI (based on self-reported height and weight) of participants was 21.1 (SD = 3.0).

Undergraduate research assistants approached patrons as they finished their meal and asked if they would be willing to complete a one-page survey. Each research assistant told patrons she was a student conducting a study on eating behaviors for a college course. As the patrons completed the surveys, the research assistant surreptitiously recorded the types of wrappers that were left on each patron's tray. On the basis of data provided by the restaurant chain, we were able to use this information to estimate the number of calories and fat grams that each patron consumed. We collected data during breakfast, lunch, and dinner hours. All data were collected on an anonymous basis.

Measures

The RS (Polivy et al., 1978) was the first dieting scale used in Study 3; the DRES (van Strien et al., 1986) was the second (see Study 1 for psychometric details).

Dietary Intent Scale. The third dieting scale, the Dietary Intent Scale (DIS; Stice, 1998), assesses behaviors used for weight-loss or weight-maintenance purposes (sample item: "I eat diet foods in an effort to control my weight"). This scale was internally consistent (αs range from .93 to .94) and temporally reliable (1-month test–retest = .92) in past research (Stice, 1998).

Caloric intake. As noted above, the research assistant unobtrusively recorded the types of wrappers that were left on patrons' trays after they completed their meals. This information, in conjunction with the calorie content data provided by the restaurant chain, allowed us to calculate total caloric intake (M = 664, SD = 346, range = 1,390) and number of fat grams (M = 30, SD = 17, range = 68) consumed by each patron during her meal. This approach appeared to provide an accurate, unobtrusive measure of intake because the vast majority of patrons (approximately 98%) consumed everything they ordered. The research assistants made ratings of the food items consumed before the participants completed the dietary restraint scales, thereby ensuring a blinded rating of caloric intake.

Results and Discussion

Correlations between the RS, DRES, DIS, total caloric intake, and fat-gram intake are reported in Table 3. The three measures of dieting were significantly correlated. It was reassuring that the measures of total caloric intake and fat-gram consumption were highly correlated because this indicates that our intake measures possessed validity and that a restriction in range did not preclude the ability to detect significant effects. Again, the RS did not evidence significant correlations with caloric intake or fat-gram intake. The DRES showed a significant correlation with fat-gram intake but not with caloric intake. The DIS showed significant correlations with both of the intake measures. Given the sample size of 69, we had a power of .81 to detect a medium effect (r = .30).

It was encouraging that the DRES showed a significant inverse relation with fat-gram intake, but the effect size was meager, and the correlation with total caloric intake did not reach significance. Furthermore, the RS again did not show significant correlations with either criterion measure of intake. Collectively, these findings suggest that these two widely used measures of dietary restraint are not valid measures of acute caloric restriction among largely normal-weight women. The DIS did show significant inverse correlations with total caloric intake and fat-gram intake. Although these effects were also rather meager, these results suggest that the DIS is a more valid measure of dietary restriction than the other dietary restraint measures but that there is still much room for improvement.

Table 3
Correlations Between the Dietary Restraint Scales and the Unobtrusively Observed Caloric Intake in Study 3

Measure	1	2	3	4	5
1. RS	—	.76***	.66***	−.06	−.17
2. DRES		—	.80***	−.21	−.26*
3. DIS			—	−.24*	−.34**
4. Total caloric intake				—	.71***
5. Fat-gram intake					—

Note. RS = Restraint Scale; DRES = Dutch Restrained Eating Scale; DIS = Dietary Intent Scale.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Again, it may be particularly difficult to exercise effective dietary restraint when confronted with tempting food, such as hamburgers. Although there was a range of food types, dieters might find it challenging to abstain from the high-fat foods. It is also possible that the most extreme dieters do not frequent fast food restaurants. Accordingly, in Study 4 we tested whether dietary restraint scales correlated with unobtrusively observed caloric intake in a more "usual" eating environment that contained more low-fat food options. We focused on caloric intake in the university dormitory for several reasons. First, the local university provides data on the caloric content of all foods served, which facilitated the calculation of calories and fat grams consumed per meal. Second, because the dormitory fees include breakfast, lunch, and dinner, students consume the vast majority of their meals in this setting. Third, a large portion of the studies conducted with the dietary restraint scales focused on undergraduates. Thus, the results can be more easily generalized to the population that has been studied most extensively with these measures.

Study 4

Method

Participants and Procedure

Sixty female university students volunteered to participate in this study (M age = 18.2 years, SD = 1.8). Most were undergraduate students, but 7% were high school students attending summer sports camps at the university. The sample was composed of 20% Asians, 12% Blacks, 49% Whites, 14% Hispanics, and 5% Native American. The average BMI (based on self-reported height and weight) was 21.5 (SD = 2.6).

An undergraduate research assistant surreptitiously recorded how many servings of each food type each student placed on her tray. On the basis of data provided by the university, we used this information to estimate the number of calories and fat grams that were consumed by patrons. The research assistant then approached students as they finished their meal and asked if they would complete a one-page survey. The research assistant told students that she was conducting a study on eating behaviors for a class. All students who volunteered to complete the survey (approximately 83%) were included in this study. We collected data during breakfast, lunch, and dinner because it is unlikely that the most ardent dieters would skip all three meals (our clinical impression is that they often skip breakfast). Data were collected on an anonymous basis.

Measures

Dietary restraint scales. The RS (Polivy et al., 1978) was the first dieting scale used in Study 4, the TFEQ–R (Stunkard & Messick, 1985) was the second, and the DRES (van Strien et al., 1986) was the third (see Study 1 for psychometric details).

Caloric intake. Again, the research assistant unobtrusively recorded the number of servings of each food type that each student placed on her tray. This data, in conjunction with the calorie-content data provided by the university, allowed us to calculate the caloric (M = 718, SD = 286, range = 1,510) and fat-gram (M = 26, SD = 16, range = 75) intake of each student during her meal. This approach appeared to provide an accurate, unobtrusive measure of caloric intake because patrons almost always consumed everything on their food tray (approximately 86%). The research assistants made ratings of foods consumed before the participants completed the dietary restraint scales, ensuring a blinded rating of caloric intake.

Results and Discussion

Correlations between the RS, TFEQ–R, DRES, total caloric intake, and fat-gram intake are reported in Table 4. Again, the dietary restraint scales were highly correlated. It was also reassuring that the caloric and fat-gram intake measures were highly correlated. However, the RS, TFEQ–R, and DRES did not show significant correlations with caloric or fat-gram intake. Given the sample size of 60, we had a power of .76 to detect a medium effect size (r = .30). That none of the three widely used dietary restraint scales showed significant inverse correlations with either caloric intake or fat-gram consumption suggests that these scales are not valid measures of acute caloric restriction among normal-weight young women.

General Discussion

Results from the four studies collectively suggest that widely used dietary restraint scales are not valid measures of short-term dietary restriction. With few exceptions, scores on these scales did not show the expected inverse correlations with caloric intake for normal weight or overweight individuals, individuals with or without eating disorders, tempting food or healthy food, and real-world or laboratory-based eating. The average correlation between dietary restraint scales and actual caloric intake across the four studies was −.07. These appear to be the first studies to test whether dietary restraint scales correlate with unobtrusive measures of caloric intake.

Because each study had adequate power to detect a medium effect size, the null findings cannot be easily attributed to a lack of power. In addition, the wide range in caloric intake in each study (388–1,510 calories) renders it unlikely that a restriction in range constrained our ability to detect effects. The fact that we consistently observed correlations between caloric intake and fat-gram intake further substantiates this perspective (as well as the fact that these were valid measures of intake). Likewise, the wide range in scores on the restraint scales renders it unlikely that a restriction in range on these measures contributed to the nonsignificant findings (e.g., the RS ranged from 11 to 39 in Study 4, out of a possible range of 10 to 50). The fact that the various dietary restraint scales were significantly correlated provides corroboration of this point.

Our findings stand in stark contrast to those from past validation studies that reported negative correlations between dietary restraint scales and self-reported caloric intake (e.g., French, Jeffery, & Wing, 1994; Kirkley et al., 1988; Laessle et al., 1989; Wardle &

Table 4
Correlations Between the Dietary Restraint Scales and the Unobtrusively Observed Caloric Intake in Study 4

Measure	1	2	3	4	5
1. RS	—	.68***	.65***	.20	.10
2. TFEQ–R		—	.70***	.14	.03
3. DRES			—	−.06	−.22
4. Total caloric intake				—	.82***
5. Fat-gram intake					—

Note. RS = Restraint Scale; TFEQ–R = Three Factor Eating Questionnaire—Restraint; DRES = Dutch Restrained Eating Scale.
*** $p < .001$.

Beales, 1987). The most likely explanation for the discrepant findings is that self-reported caloric intake is inaccurate. Studies that used biological measures of actual caloric intake have revealed that people often underreport caloric intake (Bandini et al., 1990; Lichtman et al., 1992; Livingstone et al., 1990; Prentice et al., 1986) and that this effect is more pronounced for individuals who score high on dietary restraint scales (Bathalon et al., 2000). Such inaccuracies in reporting are likely to be at least partially rooted in social desirability biases, as this underreporting is greatest for overweight individuals (Prentice et al., 1986). Numerous studies have shown that people underreport behaviors and traits that are considered socially undesirable, such as weight, psychoactive substances use, and personality disturbances (e.g., Baer & Miller, 2002; Cash et al., 1992).

Nonetheless, the evidence that dietary restraint scales are not valid measures of short-term dietary restriction dovetails with the finding that these measures are not valid measures of long-term caloric restriction. In one study (Bathalon et al., 2000), the TFEQ–R did not show a significant correlation with an objective biological measure of caloric intake over an 18-day period in a natural environment. In addition, several studies have found that elevated scores on dietary restraint scales predicted an elevated weight-gain trajectory (French, Jeffery, Forster, et al., 1994; Klesges et al., 1989, 1992; Stice, 2001; Stice et al., 1999). These latter findings are particularly noteworthy because this type of design provides an unobtrusive index of long-term intake; participants do not know whether they are going to gain weight over the follow-up period when they complete the dietary restraint scales at baseline.

The current findings represent a novel contribution to researchers' understanding of the construct validity of dietary restraint scales. Although it has been argued that the RS measures unsuccessful dieting, whereas the TFEQ–R and DRES measure successful dieting (Heatherton et al., 1988), our results largely suggest that none of these widely used scales reflects successful dietary restriction. Although the DRES did show a significant relation to fat-gram intake in one study, this measure did not correlate significantly with total caloric intake in that study or with caloric or fat-gram intake in the other two validation studies that included this measure. That the DRES was only significantly related to intake in one of the five tests across these four studies suggests that this scale might be a slightly more valid indicator of acute caloric intake relative to the RS and the TFEQ–R but that it is still suboptimal in this regard.

An important implication of these results is that it may be prudent to reinterpret the findings from studies that used these dietary restraint scales, including those that have suggested that dietary restraint is a risk factor for subsequent onset of bulimic pathology. If dietary restraint scales do not measure dietary restriction, then this implies that it may not be dietary restriction that increases the risk for bulimic pathology, as has been concluded on the basis of prospective studies indicating that dietary restraint scales predict onset of bulimic pathology (Huon, 1996; Polivy & Herman, 1992). It is vital to elucidate the construct that is measured with dietary restraint scales for a clear understanding of the implications of studies that use these scales for theories of etiology and maintenance and for the design of preventive and treatment interventions.

Another contribution of our findings is that they appear to explain why the experiments that directly manipulated caloric restriction (e.g., Goodrick et al., 1998; Stice et al., 1998) produced findings contradictory to those from prospective studies using dietary restraint scales. Our results suggest that these seemingly incompatible findings may have emerged because the dietary restraint scales are not valid measures of caloric restriction. If the imposition of a documented energy-deficit diet reduces bulimic symptoms, and if dietary restraint scales predict future increases in bulimic symptoms, then it is illogical to suggest that the later findings occur because individuals identified by restraint scales are engaging in dietary restriction.

One unexpected finding was that the DIS evidenced significant inverse correlations with caloric intake and fat-gram intake in the one study that included this scale. Although these correlations were only moderate, these results suggest that this measure is a more valid indicator of dietary restriction than the widely used measures of dietary restraint. This scale may show greater concordance with dietary restriction because the items describe concrete behaviors that individuals use to reduce caloric intake (e.g., "I take small helpings in an effort to control my weight"), whereas the items from the widely used restraint scales tend to contain more global descriptions of dietary efforts (e.g., "How often are you dieting?" and "How conscious are you of what you're eating?"). This suggestion echoes the more general finding that items that describe specific behaviors have greater predictive validity than items that describe more general tendencies (Klesges, 1984; Schwarz, 1999). The global items may be more ambiguous to participants, which results in greater measurement error that attenuates the correlations these scales show with criterion variables.

Limitations

Although we examined various food types, settings, populations, and dietary restraint scales, it would have been useful to have studied the eating behavior in the home because that is where most people consume the majority of calories and may be where they exhibit the most natural eating behavior. We were unable to devise an ethically acceptable way to collect unobtrusive data on caloric intake in the home. In addition, the fact that we only observed a single episode of caloric intake for each participant, rather than their eating behavior over a longer period of time, limits the generalization of the findings to other eating episodes. However, given that we sampled the eating behavior of individuals in restaurants, dormitories, and the laboratory during breakfast, lunch, and dinner and sampled for the consumption of healthy and high-fat foods, it is unlikely that individuals who score high on these scales show very frequent displays of dietary restriction. Furthermore, the fact that Bathalon and associates (2000) found that the TFEQ–R did not correlate with an objective biological measure of caloric intake over an 18-day period suggests that our limited sampling frame did not produce misleading findings.

Future Directions

Because it appears that dietary restraint scales are not valid measures of short- or long-term dietary restriction, an important priority for future research will be to determine the mystery construct that is assessed by these scales. The fact that these scales consistently predict eating pathology onset suggests that a resolution of this question would have important implications for etio-

logic and maintenance theories of bulimic pathology and for the design of prevention and treatment interventions. Future research should also explore the possibility that there are qualitatively different types of dieting and that some forms increase and others decrease the risk for bulimic symptoms (e.g., skipping meals vs. replacing high-fat foods with fruits and vegetables).

Finally, it would be useful to develop a dieting scale that is a valid measure of dietary restriction. Lowe (1993) has suggested that simply asking participants whether they are currently on a weight-loss diet with a single test item may be a more valid measure of dietary restriction. In support of this assertion, self-labeled dieters showed significantly less unobtrusively observed caloric intake than did self-labeled nondieters in the control condition of one study (Baucom & Aiken, 1981). Furthermore, whereas individuals with high scores on dietary restraint scales gained weight over time, self-labeled dieters lost weight (Stice, 1998). Another research alternative is to take an empirical-keying approach that identifies items that prospectively predict weight loss but lack face validity (to circumvent reporter biases). Biological measures, such as the doubly labeled water technique, represent another research alternative, but the costs are currently prohibitive. Ultimately, it will be necessary to produce a valid measure of dietary restriction to fully understand the consequences of this behavior.

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Received March 19, 2003
Revision received September 5, 2003
Accepted October 8, 2003 ■