

A comparison of acceptance- and control-based strategies for coping with food cravings: An analog study

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Abstract

The present study utilized an analog paradigm to investigate the effectiveness of two strategies for coping with food cravings, which was theorized to be critical to the maintenance of weight loss. Ninety-eight undergraduate students were given transparent boxes of chocolate Hershey's Kisses and instructed to keep the chocolates with them, but not to eat them, for 48 h. Before receiving the Kisses, participants were randomized to receive either (a) no intervention, (b) instruction in control-based coping strategies such as distraction and cognitive restructuring, or (c) instruction in acceptance-based strategies such as experiential acceptance and defusion techniques. Measures included the Power of Food Scale (PFS; a measure of psychological sensitivity to the food environment), self-report ratings of chocolate cravings and surreptitiously recorded chocolate consumption. Results suggested that the effect of the intervention depended on baseline PFS levels, such that acceptance-based strategies were associated with better outcomes (cravings, consumption) among those reporting the highest susceptibility to the presence of food, but greater cravings among those who scored lowest on the PFS. It was observed that craving self-report measures predicted chocolate consumption, and baseline PFS levels predicted both cravings and consumption. Results are discussed in terms of the implications for weight loss maintenance strategies.

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Introduction

According to the World Health Organization (WHO) obesity has become a global epidemic, with numbers reaching more than one billion individuals worldwide (World Health Organization, 2006). Both Europe and the United States have especially high (and rising) levels of obesity; for instance, currently, 64% of the adult population in the United States is either overweight or obese (Hedley et al., 2004; World Health Organization, 2006). Given the significance and prevalence of the problem, considerable resources have been devoted to

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developing effective weight control interventions. Behavioral weight loss programs have shown modest short-term effectiveness (i.e., 5–10% weight loss; Wadden, Steen, Wingate, & Foster, 1996), but poor long-term maintenance; one-third of weight lost is regained within a year, and almost all of it within 3 years (Perri & Corsica, 2002; Wilson & Brownell, 2002).

Food cravings

Food cravings have been defined as an intensely strong desire for a specific food or a type of food (Gendall, Joyce, & Sullivan, 1997). Cravings for food are associated with anxiety, dysphoric mood, and decreased quality of life (especially in those struggling with weight control), as well as increased calorie intake, obesity status and dropout from weight-loss treatments (Gendall et al., 1997; Lafay et al., 2001; Sitton, 1991; Vander Wal, Johnston, & Dhurandhar, 2007; Wurtman & Wurtman, 1986). In fact, the lack of success for many overweight and obese individuals following weight loss programs may be due to difficulties in managing strong cravings that arise from the pervasive presence of and ready access to highly palatable foods (Lowe, 2003; Lowe & Levine, 2005).

Food environment and the power of food

The modern food environment has been labeled as *obesogenic* in part because high-calorie, highly palatable food is so prevalent and easily accessible (Brownell, 2002). In fact, the tremendous growth of overweight and obesity over the past four decades can be attributed largely to the current food environment (Hill & Peters, 1998). For vulnerable individuals, in particular, the motivation to eat in the presence of food may occur even when the person is not in a state of energy depletion (Birch, Fisher, & Davison, 2003; Yeomans, Blundell, & Leshem, 2004). While this response may have been adaptive through much of evolutionary history, it is problematic in the current food environment (Lowe & Levine, 2005). Although awareness of palatable food and/or its availability creates a motivation to eat in people generally, there are large individual differences in the psychological influence of the food environment. A measure of such individual differences, called the Power of Food Scale (PFS), has recently been developed to assess the impact of the food environment on an individual's behavior, thinking, and feelings (Lowe et al., under review).

Coping strategies

A critical challenge to obesity management efforts is the ability to help individuals manage food cravings such that they do not lead to problematic emotional distress or unhealthy food consumption. This study evaluates two strategies to help participants cope with cravings for chocolate, which is the most commonly craved food, according to self-report measures (Rozin, Levine, & Stoess, 1991). Our initial test of these strategies was conducted in a nonclinical, mostly normal-weight population on the assumption that results have the potential to inform efforts to help those with weight problems. In particular, the challenge facing individuals attempting to maintain energy balance following weight loss may be very roughly akin to the normal-weight participants' challenge to abstain from a desired food.

Control-based strategies

Cognitive-behavioral interventions for the treatment of obesity, such as the popular and often-studied Lifestyle, Exercise, Attitudes, Relationships and Nutrition (LEARN) Program for weight management, aim to modify eating, thinking, and activity levels (Brownell, 2000). These interventions teach a number of behaviorally oriented strategies to reduce food cravings and unhealthy consumption including removing highly palatable and unhealthy foods from home and work environments, storing palatable foods out of sight and increasing the structure and regularity of eating. Unfortunately, even if all the recommended changes are made, the pervasive availability of high-energy palatable foods remains in place, and cravings and urges are likely to remain. Weight control programs also incorporate cognitive techniques that aim to reduce the frequency and intensity of cravings and urges. Craving reduction is accomplished primarily by teaching people how to cognitively restructure urge-related thoughts, and to mentally distract themselves from food stimuli.

However, the effectiveness of these strategies has rarely, if ever, been evaluated in isolation. In fact, numerous studies have found that “control” strategies aimed at reducing unwanted thoughts or feelings tend to have the paradoxical effect of increasing their frequency and duration (Borton, Markowitz, & Dieterich, 2005; Wegner, Schneider, Carter, & White, 1987), and the intensity of the distress engendered by these experiences (Marcks & Woods, 2005).

Acceptance-based strategies

Acceptance-based strategies are a feature of several novel cognitive-behavioral therapies (Hayes, 2004). Unlike control-based strategies, acceptance-based strategies do not explicitly attempt to reduce the number of cravings or relieve discomfort caused by cravings; rather, the aim is to foster willingness to experience what cannot be controlled while simultaneously promoting behavior that is consistent with desired goals and values. This aim is accomplished through several types of interventions including (a) recognition of the limited ability to control internal experiences such as thoughts and feelings; (b) mindfulness-inspired strategies to increase awareness of internal experiences, while accepting them as they are; and (c) defusion (a psychological stepping back/distance) from thoughts and other internal experiences.

Paradoxically, acceptance-based strategies have been shown to relieve distress and increase tolerance of previously avoided or suppressed internal experiences (Levitt, Brown, Orsillo, & Barlow, 2004; Twohig & Woods, 2004; Zettle, 2003). Small trials of acceptance-based therapies have suggested it is as effective, if not more so, than traditional cognitive-behavioral and control-based strategies for the treatment of social anxiety (Block, 2003), depression (Zettle & Hayes, 1986), emotional distress (Forman, Herbert, Moitra, Yeomans, & Geller, *in press*; Lappalainen et al., *in press*) and chronic pain (Geiser, 1993). In addition, an acceptance-based therapy module for smoking cessation, emphasizing ways to tolerate cravings without acting on them, was shown to be more effective than the nicotine patch in a randomized controlled trial comparing these two approaches (Gifford et al., 2004). Smoking cessation may represent an especially close parallel to weight loss maintenance, given the central feature of abstaining from (for smoking) or limiting the intake of (for foods) a craved substance. Smoking cessation efforts generally fail because of the difficulty of resisting cravings to smoke (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005), just as weight reduction efforts often fail because of a difficulty resisting urges to eat high-energy foods (Alsene, Li, Chaverneff, & de Wit, 2003).

Precursor to the current study

The current study is an expansion of the analog craving paradigm employed by Stirling and Yeomans (2004). Participants in that study were divided into restrained and unrestrained groups, given bags of Hershey's Kisses, told to keep the bags with them for a 24-h period, and instructed not to eat any of the chocolates. Both restrained and unrestrained eaters reported having cravings for the chocolates. Whereas only restrained eaters ate chocolates from the bags (though not many), in the subsequent taste test both restrained and unrestrained eaters ate twice as much chocolate as participants in the control condition, who had not received a bag of chocolates. These results lend support to the theory that the mere presence of food is enough to increase food cravings and subsequent food intake, independent of restraint status.

The current investigation expands upon Stirling and Yeomans' (2004) study in several ways. The primary modification was the inclusion of interventions teaching control-based and acceptance-based strategies for coping with cravings. Other changes included instructing participants not to eat any chocolate at all during the study period (in order to prevent chocolate substitution as a method of coping with cravings), using chocolates with discreetly modified labels (so that any chocolate replacement would be detectable) and extending the study period from 24 to 48 h (in order to provide additional time for participants to practice coping strategies in response to cravings).

Summary and hypotheses

A critical challenge of obesity management efforts is the ability to help individuals manage food cravings such that they do not lead to problematic emotional distress or unhealthy food consumption. The current analog study aimed to compare an acceptance-based strategy to a distraction-based strategy for coping with

food cravings. The selection of chocolate as the target food was made based on previous research that has identified it as the most frequently craved food (Rozin et al., 1991). In this study, participants were randomized to receive either an acceptance-based strategy, control-based strategy, or no strategy for coping with cravings.

We anticipated that the presence of the Kisses would elicit chocolate cravings, especially in light of the prohibition against eating any chocolate, and that these cravings would drive chocolate consumption even in the face of this prohibition. First, we hypothesized that craving ratings would predict consumption. Secondly, we predicted that scores on the PFS scale would predict cravings as well as chocolate consumption.

Third, we predicted that coping strategy group would be associated with differences in consumption and cravings. Based on existing research, we offer three alternative predictions. Given the strong influence of the availability of food on the desire for and consumption of food (Lowe & Levine, 2005; Painter, Wansink, & Hieggelke, 2002; Wansink, Painter, & Lee, 2006), an obvious strategy to reduce the potential of food cues to elicit cravings and eating is to reduce exposure to food. Because it was not possible for participants in this study to literally avoid the chocolates, a strategy for reducing their impact is to use distraction techniques to reduce the psychological impact of the chocolates. Distraction from these cues could be hypothesized to be preferable to the acceptance-based strategies, some of which might increase attention to food perceptions, cognitions, and cravings. Alternatively, acceptance-based strategies may be the most effective. Theories underlying acceptance-based models and preliminary effectiveness data predict that instructions to become more aware of, more “defused” from, and more accepting of one’s cravings will decrease distress associated with them and perhaps even decrease the frequency and intensity of cravings. Because of the paradoxical effects of control efforts directed toward thoughts and feelings, these theories predict that control-based methods utilizing techniques such as distraction are less likely to be effective relative to acceptance-based methods. Yet a third alternative is that the effectiveness of the coping strategies will vary as a function of susceptibility to the influence of food. That is, levels on the PFS scale might be expected to moderate the relationship between intervention and outcome. Control-based strategies may in fact prove superior for individuals whose susceptibility to food is low enough to make distraction and related strategies a viable approach. However, in individuals who tend to experience higher susceptibility to food, we might expect acceptance-based strategies to be superior.

Methods

Participants

Participants ($n = 98$) were undergraduate students who met the study inclusion (ages 18–60; enjoy eating chocolate) and exclusion (current diagnosis of an eating disorder; inability to eat chocolate for health reasons) criteria. These criteria were assessed by means of a simple screening questionnaire with yes–no response options for each criterion, e.g. “Do you enjoy eating chocolate?” Forty-seven (48.0%) participants were female, of whom 5 (10.6%) were perimenstrual. The mean age was 19.60 ($SD = 1.65$), and the mean BMI was 24.89 ($SD = 5.57$). The ethnic makeup of the sample was 68 (69.4%) Caucasian, 18 (18.4%) Asian American, 6 (6.1%) African American and 6 (6.1%) other.

Measures

Power of food

The PFS (Lowe et al., under review) is an 18-item¹ self-report measure that assesses individual differences in the psychological influence of the food environment, defined as the impact of food’s availability, presence or taste on behavior, thinking, and feelings. Lowe et al. report that the PFS has adequate internal (Cronbach’s $\alpha = .94$) and test–retest reliability (4-month test–retest reliability = .79), and correlates with measures of overeating and binge eating.

¹The current study used an 18-item version of the PFS, though a more recent version of the PFS has 21 items; none of the psychometric properties changed when 3 items were added to the final version.

Craving

The Food Craving Questionnaire-State Version (FCQ-S; Cepeda-Benito, Gleaves, Williams, & Erath, 2000) is a 15-item measure of state-based changes in motivation to consume one or more specific foods; the scale allows investigators to specify the target food. Items (e.g., “I have an intense desire to eat chocolate”) are rated on a five-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). The FCQ-S has excellent internal consistency ($\alpha = .88-.94$; Cepeda-Benito et al., 2000; Vander Wal et al., 2007) and good construct validity (Vander Wal et al., 2007). Craving was also measured using five single-item ratings of craving dimensions that were rated on a five-point scale (1 = *not at all*; 5 = *extremely*). Specifically, items measured craving frequency (“How much did you think about chocolate or the Kisses?”), temptation (“How tempted were you to eat chocolate?”), intensity (“How much did you want the chocolate?”), difficulty resisting (“How difficult did you find resisting the chocolate?”), and distress (“If you had cravings for chocolate, how distressing did you find them?”). Items were analyzed separately, following Stirling and Yeomans (2004), and based on the fact that the items’ relationships to other study variables were not uniform.

Chocolate consumption

The boxes of Kisses were collected and the individual Kisses were counted to provide a measure of chocolate consumption. Kisses without the identifying mark were assumed to have been substituted for an eaten Kiss and were not counted. Because of low consumption rates, this variable was dichotomized to reflect participants’ status as either chocolate abstinent or non-abstinent.

Procedure

Participants were randomized to one of three intervention groups: a control-based coping strategy group (CBC; $n = 36$), an acceptance-based coping strategy group (ABC; $n = 30$) or a no-intervention group ($n = 32$). All participants were informed that the purpose of the study was to measure the intensity of cravings for a highly desirable but “forbidden” food, and how people cope with these cravings. Transparent boxes of chocolate Hershey’s Kisses were provided to all participants who were instructed to keep the Kisses with them at all times for 48 h at which point they were to return them to a predesignated drop-off location. Participants were told to “try their best” not to eat the Kisses or other foods containing chocolate during the study period. As a check, participants were asked to indicate, at the end of the study, if they followed instructions around keeping the chocolates with them at “virtually all times” and around not eating other chocolates; 91.8% and 98.0%, respectively, reported “yes.” The number of kisses in each box (which ranged from 37 to 45) was recorded ahead of time. Additionally, each Kiss had been surreptitiously marked so as to detect substitutions of eaten chocolates.

Participants in the coping strategy groups received 30-min instructions on how to respond to chocolate cravings. Groups were small (between five and nine people), to allow maximum participation and interaction. The groups were conducted by trained graduate student clinicians; the same facilitators conducted both the CBC and ABC groups in order to control for clinician effects. As an adherence check, participants were asked, at the 48-h timepoint, to write the main strategy they utilized to cope with their chocolate cravings. These responses were then subject to blind coding in terms of whether they better fit control-based, acceptance-based, or neither type of strategy. (All responses were coded by two different coders; Kappa = .95.) Control-based participants were much more likely to report a control-based than an acceptance-based strategy (58.8% vs. 0%, respectively), whereas the pattern was reversed for the acceptance-based group (20.0% vs. 36.7%), and less evident in the no-instruction group (28.6% vs. 0%); $\chi^2(4) = 29.91, p < .001$.

Control-based coping strategy group

The CBC protocol was adapted from Brownell’s (2000) *LEARN* manual by identifying those portions of the manual that used cognitive strategies to facilitate dietary adherence. As much as possible, interventions were presented using identical wording drawn from the *LEARN* manual. Participants in the control-based group were taught skills designed to help distract themselves from their food cravings and were told that utilizing the strategies would most likely result in a reduction in the frequency and intensity of their cravings to eat chocolate. Given the premise that attention to thoughts, feelings, sensations, and cravings are within voluntary

control, participants were provided with refocusing strategies designed to turn attention away from food-related stimuli and towards non-food-related stimuli. Examples of such strategies included memory delving, positive imagery, and counting challenges. In addition, participants were taught behavioral redirection (changing or leaving the current situation or environmental context). CBC participants were also instructed to be prepared for “automatic thoughts” suggesting permission to eat the chocolates, and to cognitively “confront” and logically restructure such thoughts. The mnemonic Distract yourself, Imagery, Scene change, Challenge/confront thoughts (DISC) was taught to aid retention.

Acceptance-based coping strategy group

To our knowledge, no manual for an acceptance-based copy strategy for food cravings exists. However, it was possible to adapt a number of existing sources related to one of the predominant acceptance-based models, Acceptance and Commitment Therapy (ACT; Gifford et al., 2004; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Hayes, Strosahl, & Wilson, 1999). Participants in the ABC group were taught that cravings for a desirable but forbidden food are outside of voluntary control. They were told that attempts to suppress or eliminate an uncontrollable internal experience like cravings only serve to make cravings more intense and distressing. Instead of attempting to control cravings, participants were urged simply to notice their internal experiences, and to accept them as they are without trying to change them in any way (i.e., the principle of *acceptance*). Participants were taught to “step back from” the cravings and see themselves having them (i.e., the principle of distancing or *cognitive defusion*). Participants were told that defusion aids in the ability to experience the cravings without taking the usual actions (e.g. eating the desired food) that would immediately reduce the unpleasant experience of wanting something forbidden (i.e., the principle of *willingness*). As above, a mnemonic was created, i.e. Distancing, Acceptance, Willingness, Noticing (DAWN), in order to promote retention of the material.

Participants in the no-intervention group were simply told that they should not eat chocolate and to do their best resisting any cravings that arose.

All participants were instructed to complete the FCQ-S as well as the five individual craving items adapted from Stirling and Yeomans' (2004) original study, at 24 and 48 h after the beginning of the chocolate prohibition period. (The appropriate day and time to complete each measure was written on the participants' packets.) Additionally, participants were reminded to complete the measures by e-mail four hours prior to the target time.

Results

Descriptive statistics

Means and standard deviations for all variables are included in Table 1. Data for chocolate consumption were missing for three participants, yielding an n of 95 for the analysis of abstinence.² Out of the 95 participants included in these analyses, 9 (9.5%) consumed the chocolate (i.e., did not follow abstinence instructions). Of these non-abstinent cases, four returned fewer chocolates than were initially provided, and five returned Kisses that did not contain the distinctive mark (i.e., replacement Kisses). In this sample gender was a significant predictor of neither craving scores nor consumption; it was therefore not considered in subsequent analyses.

Hypothesis 1: Craving ratings predict consumption

A mixed design multivariate general linear model analysis was conducted with abstinence status (2 levels) as the between-subject variable, and time (24-h or 48-h) as the within-subject variable. Dependent variables were FCQ-S, craving frequency, temptation, craving intensity, craving difficulty, and craving distress.

As predicted, mean FCQ-S, craving frequency, intensity, temptation, difficulty, and distress scores were all significantly higher for the non-abstinent participants; omnibus $F(6, 88) = 2.36$, $p = .04$, partial $\eta^2 = .14$.

²Analyses were repeated with missing data coded as non-abstinent; results were essentially identical.

Table 1
Descriptive statistics for study variables assessed at baseline, 24, and 48 h

	<i>N</i>	Minimum	Maximum	Mean	SD
Baseline measures					
PFS (baseline)	98	19.00	65.00	36.42	10.59
24-h measures					
FCQ-S	98	1.00	4.00	2.30	.68
Frequency	98	1.00	5.00	2.28	.74
Intensity	98	1.00	5.00	2.32	.85
Temptation	98	1.00	5.00	2.00	.95
Difficulty	98	1.00	5.00	1.62	.86
Distress	98	1.00	5.00	1.68	.88
48-h measures					
FCQ-S	98	1.00	5.00	2.32	.76
Frequency	98	1.00	5.00	2.23	.77
Intensity	98	1.00	5.00	2.30	.84
Temptation	98	1.00	5.00	2.17	.91
Difficulty	98	1.00	5.00	1.84	.98
Distress	98	1.00	5.00	1.79	.96

Note: PFS = Power of Food Scale; FCQ-S = Food Craving Questionnaire-State.

Table 2
Comparison of craving measure means for participants who were and were not abstinent from chocolate

	Abstinent		Non-abstinent		<i>F</i> (1, 93)	<i>p</i>	Partial η^2
	Mean	SD	Mean	SD			
FCQ-S	2.24	.65	2.89	.81	7.99	.01	.08
Frequency	2.19	.56	2.78	1.46	6.09	.01	.06
Intensity	2.20	.67	3.06	1.26	10.81	.001	.10
Temptation	2.00	.75	2.83	1.46	8.10	.01	.08
Difficulty	1.64	.70	2.39	1.73	6.52	.01	.07
Distress	1.63	.71	2.61	1.50	12.01	.001	.11

Note: FCQ-S = Food Craving Questionnaire-State.

Specific follow-up univariate results are detailed in Table 2. Time ($F = 1.06$, $p = .40$, partial $\eta^2 = .07$) and time by abstinence ($F = 0.83$, $p = .55$, partial $\eta^2 = .05$) effects were not significant.

Hypothesis 2: PFS will predict cravings and consumption

In order to evaluate hypotheses 2 and 3, a mixed design multivariate general linear model analysis was conducted with group (3 levels; contrast coded) and PFS (continuous) as between-subject variables, and time (24-h or 48-h) as the within-subject variable. Dependent variables were FCQ-S, craving frequency, temptation, craving intensity, craving difficulty and craving distress. In support of hypothesis 2, multivariate tests revealed a significant main effect of PFS on craving measures ($F = 2.80$, $p = .02$, $\eta^2 = .16$). Univariate tests revealed that PFS had a significant, positive relationship with FCQ-S ($F_{(1,92)} = 12.61$, $p = .001$, $\eta^2 = .12$), intensity ($F_{(1,92)} = 4.14$, $p = .05$, $\eta^2 = .04$), and distress ($F_{(1,92)} = 4.90$, $p = .03$, $\eta^2 = .05$; see Fig. 1 and top part of Table 3). The effect of PFS on craving frequency approached significance ($F_{(1,92)} = 3.85$, $p = .05$, $\eta^2 = .04$). The effects of PFS on craving temptation ($F_{(1,92)} = .49$, $p = .49$, $\eta^2 = .01$) and craving difficulty ($F_{(1,92)} = 1.42$, $p = .24$, $\eta^2 = .02$) were not significant.

Table 3
Univariate analyses of the effects of intervention group and Power of Food Scale on craving variables

Craving variable	<i>F</i> (1, 92)	<i>p</i>	Partial η^2
Main effects of PFS			
FCQ-S	12.61	<.01	.12
Frequency	3.85	.05	.04
Intensity	4.14	.05	.04
Temptation	.49	.49	.01
Difficulty	1.42	.24	.02
Distress	4.90	.03	.05
Main effects of group			
FCQ-S	2.16	.12	.05
Frequency	2.73	.07	.06
Intensity	4.28	.02	.09
Temptation	5.27	.01	.10
Difficulty	3.12	.05	.06
Distress	4.88	.01	.10
Interaction effects of group by PFS			
FCQ-S	2.68	.07	.06
Frequency	2.88	.06	.06
Intensity	4.14	.02	.08
Temptation	5.12	.01	.10
Difficulty	2.82	.07	.06
Distress	5.09	.01	.10

Note: PFS = Power of Food Scale, FCQ-S = Food Craving Questionnaire-State.

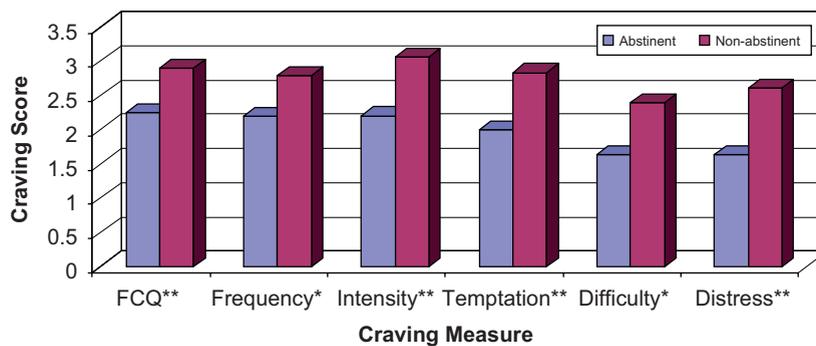


Fig. 1. Craving measures for participants who were and were not abstinent from chocolate. Note: Because the effect of time and time by abstinent were not significant, craving measure means are collapsed across time; **p* < .05, ***p* < .01; FCQ = Food Craving Questionnaire.

Abstinence from chocolate was analyzed using a logistic regression with PFS as the independent variable. The main effect of PFS on consumption was significant (Odds ratio = 1.12, Ward’s $\chi^2 = 3.84, p < .05$), such that the greater the susceptibility to power of food, the less likely the participant would be abstinent.

Hypothesis 3: Experimental intervention will differentially impact craving and consumption

At the multivariate level, no significant effects were detected for Time ($F(6, 87) = .80, p = .57, \eta^2 = .05$), Time by PFS ($F(6, 87) = .56, p = .76, \eta^2 = .04$), Time by Group ($F(12, 176) = 1.17, p = .31, \eta^2 = .07$) nor Time by Group by PFS ($F(12, 176) = 1.19, p = .29, \eta^2 = .08$); therefore no follow-up univariate analyses were examined. PFS (already described above), Group ($F(12, 176) = 2.28, p = .01, \text{partial } \eta^2 = .14$), and PFS by Group ($F(12, 176) = 2.35, p = .01, \text{partial } \eta^2 = .14$), on the other hand, were all significant in the omnibus

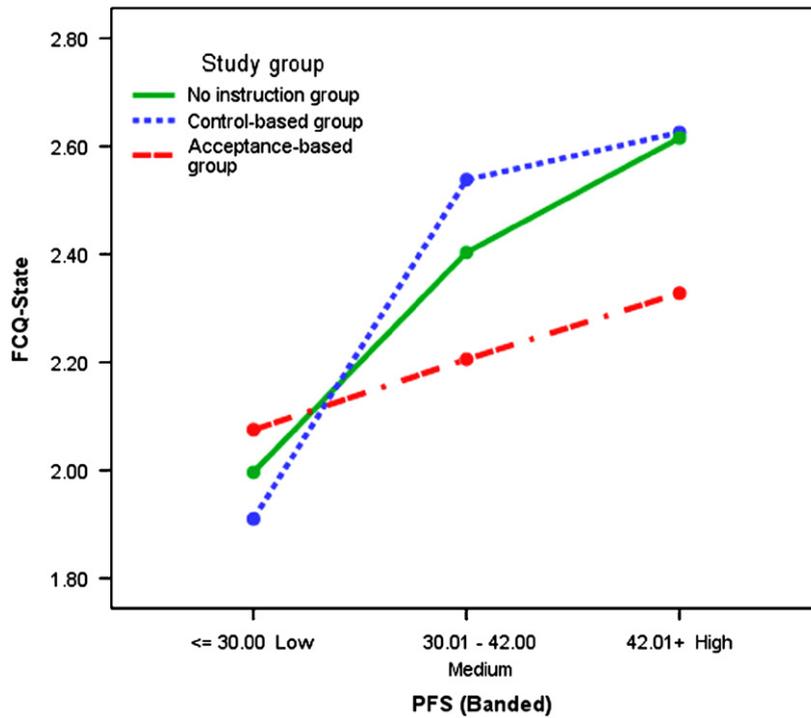


Fig. 2. Effect of group intervention on overall chocolate cravings separated by PFS level. *Note:* Values pooled across time. $FCQ \times Group$ effect: $F(2, 92) = 2.68, p = .07, \eta^2 = .06$; FCQ-State = Food craving questionnaire-State, PFS = Power of Food Scale.

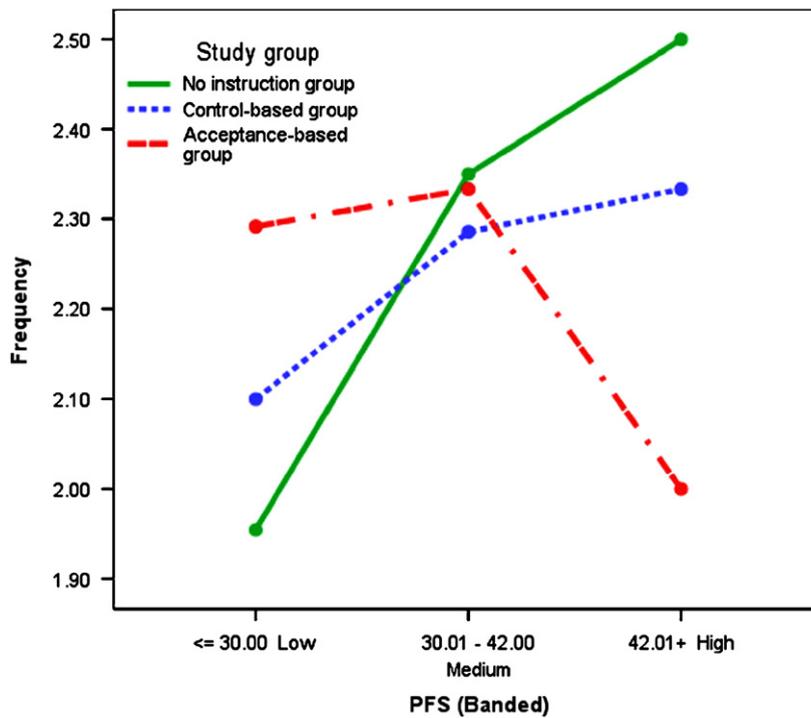


Fig. 3. The effect of group intervention on craving intensity separated by PFS level. *Note:* Values pooled across time. $Intensity \times Group$ effect: $F(2, 92) = 4.14, p = .02, \eta^2 = .08$; PFS = Power of Food Scale.

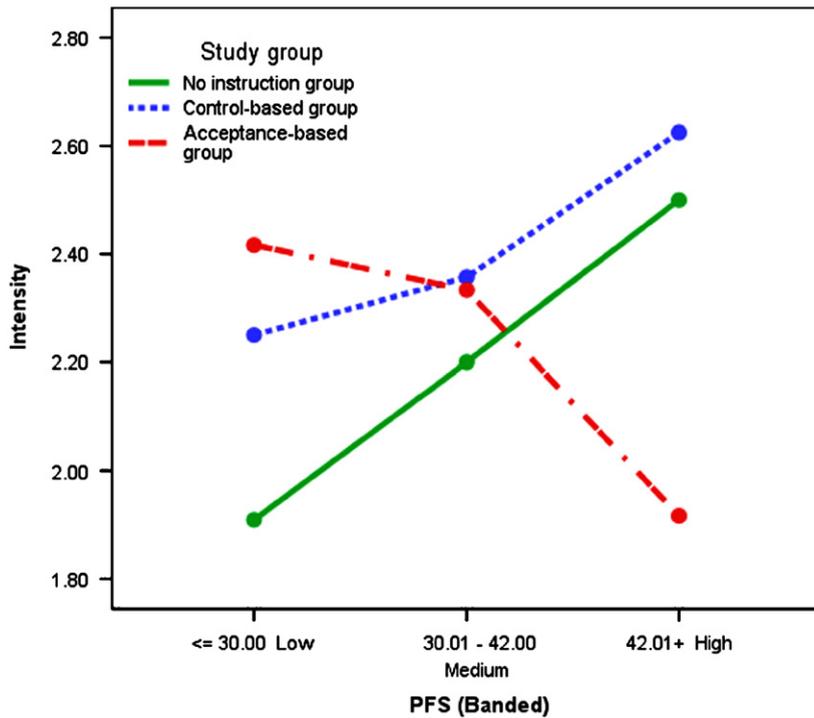


Fig. 4. The effect of group intervention on craving temptation separated by PFS level. *Note:* Values pooled across time. Temptation \times Group effect: $F(2, 92) = 5.12, p = .01, \eta^2 = .10$; PFS = Power of Food Scale.

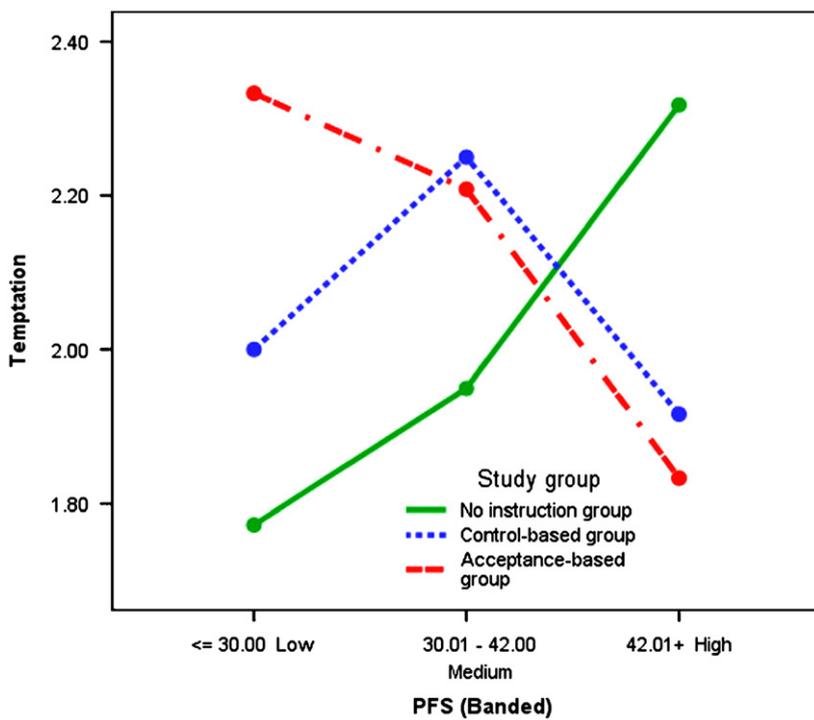


Fig. 5. The effect of group intervention on craving frequency separated by PFS level. *Note:* Values pooled across time. Frequency \times Group effect: $F(2, 92) = 2.88, p = .06, \eta^2 = .06$; PFS = Power of Food Scale.

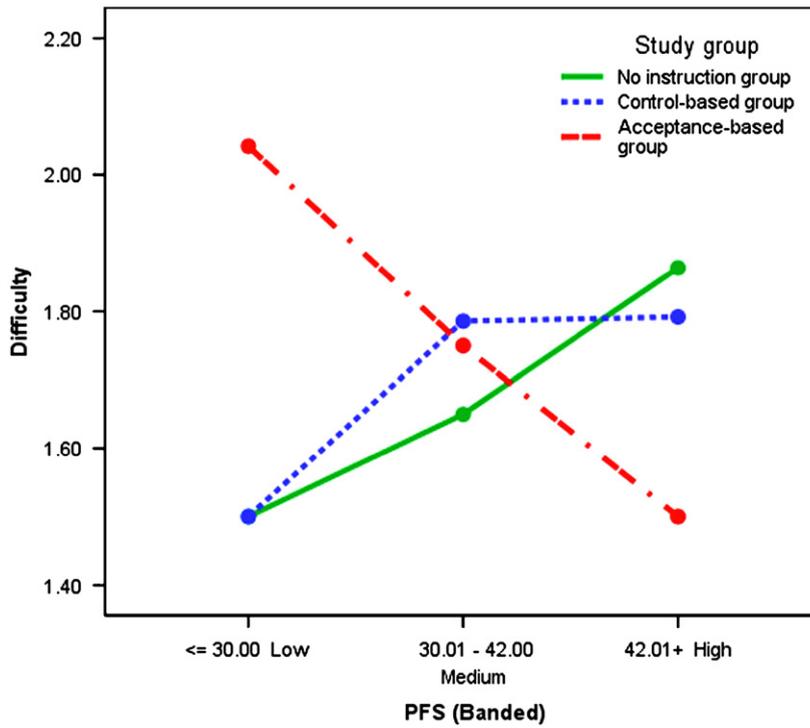


Fig. 6. The effect of group intervention on difficulty resisting craving separated by PFS level. *Note:* Values pooled across time. Difficulty \times Group effect: $F(2, 92) = 2.82, p = .01, \eta^2 = .10$; PFS = Power of Food Scale.

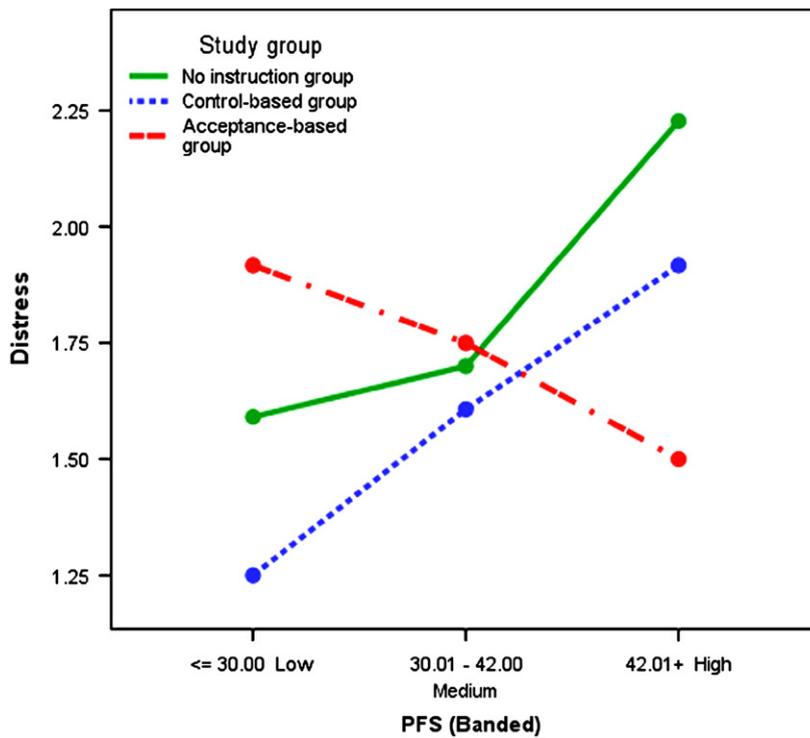


Fig. 7. The effect of group intervention on distress from craving separated by PFS level. *Note:* Values pooled across time. Distress \times Group effect: $F(2, 92) = 5.09, p = .01, \eta^2 = .10$; PFS = Power of Food Scale.

Table 4
Proportion of sample who consumed chocolate by intervention group and PFS level (trichotomized)

Group	PFS		
	0–30.00	30.01–42.00	42.01 +
NI	8.33%	0.00%	30.00%
CBC	0.00%	6.67%	9.09%
ABC	8.33%	16.67%	0.00%

Note: PFS = Power of Food Scale, NI = no intervention group, CBC = control-based coping, ABC = acceptance-based coping.

analysis, and so each of these effects were followed up with a series of univariate analyses (Table 3). Given that the interaction qualifies the main effect of group, we focus our description of results on the PFS by group effects on craving (pooled across the two time points). The interaction effect was significant on four of the six craving measures (see Table 3). The interpretation of the interaction effects is aided by trichotomizing PFS into low, medium and high scores and graphing the group by craving relationship for each band of PFS (see Figs. 2–7). The figures reveal a pattern whereby the ABC group evidences lower craving scores relative to the other two groups at the higher levels of PFS, but equivalent or higher craving scores at the lower PFS levels. An alternate way to describe the results is that the positive relationship of PFS on craving was not present (or even reversed) for those who received the ABC intervention.

In order to test the hypothesis that coping strategy group predicts chocolate consumption, a logistic regression was conducted, with PFS and group (contrast coded) entered as independent variables, and abstinence versus non-abstinence as the dependent variable. The main effect of group was not significant for any of the contrasts. The group by PFS interaction effects also did not reach significance, but the ABC-group-versus-no-intervention-group contrast showed a weak trend ($OR = .88$, $Wald = 2.36$, $p = .12$) such that, for those in the highest band of PFS only, the ABC intervention demonstrated lower consumption rates (0%) than the no intervention group (30%; see Table 4).

Discussion

The primary purpose of the present study was to investigate the comparative effectiveness of a control-based relative to an acceptance-based strategy for coping with food cravings, and whether effectiveness varied as a function of psychological sensitivity to the presence of food. Participants were given transparent boxes of chocolate Hershey's Kisses and were instructed to keep the chocolates with them, but not to eat them, over a period of 48 h. The high abstinence rate obtained, i.e. 91%, is not unexpected given the explicit instructions, participants' desire to create a positive impression on the experimenter, the short-term and circumscribed nature of the task, and the low consumption (high-restraint group mean = 1.3 g, low-restraint mean = 0 g) reported by Stirling and Yeomans (2004).

Relationship between cravings and consumption

Previous research (e.g., Lowe & Levine, 2005) has recognized the importance of hedonic motivation in food consumption. Yet, the current study is one of few to investigate empirically the relationship between food cravings and consumption. As predicted, non-abstinent participants scored higher across all measures of craving across the two time points. Because the exact times that participants experienced cravings and ate the chocolate were not recorded, causality cannot be definitively established. However, results are consistent with speculation that cravings are implicated in dietary nonadherence, and thus inability to control weight (Basdevant et al., 1995), and highlight the possibility

that weight control programs specifically targeting food cravings will maximize participants' likelihood of success.

Power of food as a predictor of craving and consumption

As hypothesized, higher scores on the PFS were found to be predictive of greater cravings and food consumption. These results support the validity of the PFS and the idea that the omnipresence of highly palatable food in the environment gives rise to more frequent food cravings and food intake, particularly in those who are most sensitive to the constant availability of food (Hill & Peters, 1998; Lowe, 2003; Lowe et al., under review).

Effectiveness of control-based and acceptance-based strategies

Both strategies appeared somewhat effective in helping people cope with cravings and maintain their abstinence from chocolate. However, the effectiveness of the treatment conditions on cravings and eating appeared to depend on susceptibility to food. Among those presumably less challenged by cravings, i.e. those scoring low on PFS, the control-based group appeared to offer an advantage. Among those most susceptible to food, and thus most challenged by cravings, the acceptance-based intervention was found to be most effective in contending with cravings and promoting abstinence. In fact, 30% of the high-power-of-food participants receiving no intervention were non-abstinent, while none of high-power-of-food participants receiving the acceptance-based intervention were non-abstinent. However, this result showed only a trend towards significance, and thus must be interpreted with caution. Moreover, because only about 10% of participants ate the chocolate, this was a less-than-optimal test of effect of the interventions on eating, per se. Even so, results offer qualified support for the acceptance-based theory (Hayes et al., 1999) that guided the development of the ABC intervention.

One explanation for this interaction is that control- and distraction-based strategies are more viable, though less necessary, in those whose susceptibility to food is low; for those with greater susceptibility to food, distraction-based strategies “backfire” and acceptance-based strategies offer superior efficacy. A potential implication of this result is that those who are likely to be highly susceptible to food, such as overweight and obese individuals, might particularly benefit from acceptance-based interventions.

Thus, it is possible that existing behavioral weight loss and maintenance interventions would be enhanced by incorporating acceptance-based strategies and perhaps even by de-emphasizing control-based strategies. To the extent that overweight individuals are continually bombarded by food stimuli, and to the extent that these stimuli provoke internal experiences that such individuals are unable to control through other means, they may benefit from strategies that assist them in becoming more willing to experience urges to eat without the necessity of behaving in undesirable ways that reduce these experiences (e.g., consumption of desired foods). Conversely, interventions aimed at restructuring thoughts about food, distracting oneself from food and “confronting” food urges are conceivably ineffective or even iatrogenic, at least when aimed at those most susceptible to the food environment.

Due to the analog nature of the design, it is not possible to determine whether participants would respond similarly in real-world situations, in which dieting proscriptions may be less explicit, forbidden foods more numerous, and cravings more intense. To the extent that the trait-based moderation effects detected in the current study (i.e. that the acceptance-based strategies were most helpful for those reporting the highest susceptibility to the power of food) can be extended to a state-based prediction (i.e. that the acceptance-based strategies will be particularly helpful when faced with intense and difficult to control urges to eat), it could be predicted that the acceptance-based strategies would emerge as even more effective under real-world dieting conditions. More generally, caution must be used in interpreting these results, as the sample was restricted to undergraduate students and inclusive of participants of all weights. Additionally, the interventions were very short, and different results may be obtained in more extended interventions designed for true diet change and weight loss or maintenance. Future research is needed to test the comparative efficacy of control-based and acceptance-based interventions in analog situations requiring greater challenge (e.g. a broader class of dietary

restrictions such as all sweets, or a longer abstinence period), as well as in bona fide behavioral weight loss and maintenance programs.

In summary, the current study established significant associations between levels of susceptibility to food, chocolate cravings, and chocolate consumption in an analog study of dietary compliance. Moreover, the results indicated that the relative effectiveness of coping strategies depends on an individual's susceptibility to food. Acceptance-based strategies were found to be superior to traditional control-based strategies in those individuals highly susceptible to food. These results raise the possibility that acceptance-based strategies would be of utility in obesity management programs.

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