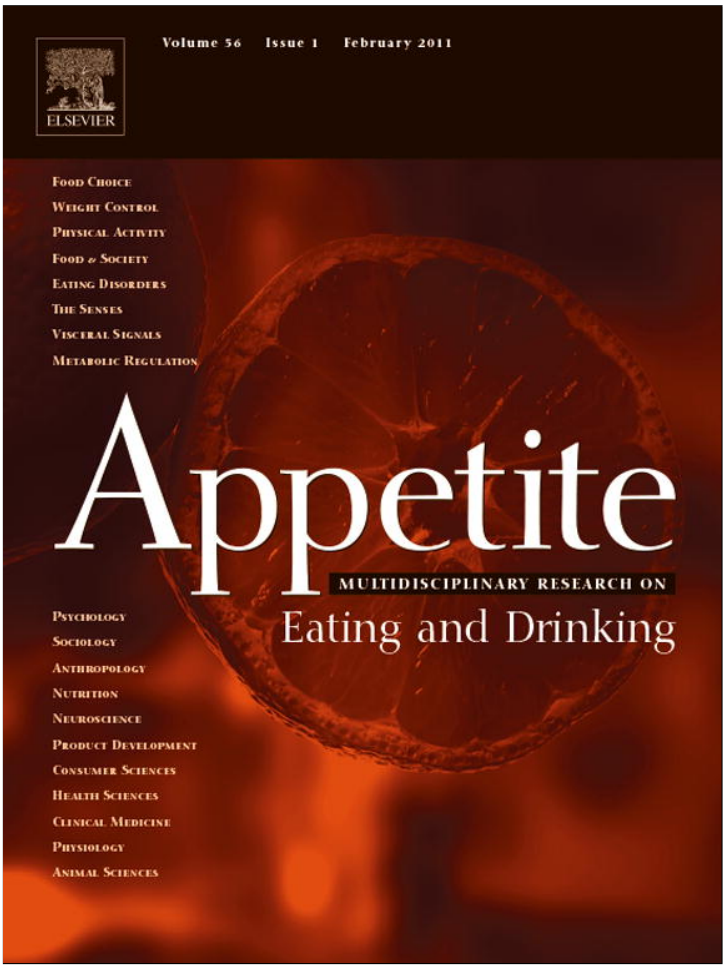

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Appetite 57 (2011) 582–584

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Short Communication

Food cravings mediate the relationship between rigid, but not flexible control of eating behavior and dieting success

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ARTICLE INFO

Article history:
Received 1 June 2011
Received in revised form 17 July 2011
Accepted 21 July 2011

Keywords:
Food cravings
Rigid control
Flexible control
Dieting success
Mediation analysis

ABSTRACT

Both food cravings and rigid dietary control strategies have been implicated in low dieting success while flexible control often is associated with successful weight loss. An online survey was conducted ($N = 616$) to test the mediational role of food cravings between dietary control strategies and self-perceived dieting success. Food cravings fully mediated the inverse relationship between rigid control and dieting success. Contrarily, flexible control predicted dieting success independently of food cravings, which were negatively associated with dieting success. Differential mechanisms underlie the relationship between rigid and flexible control of eating behavior and dieting success.

Introduction

Cravings refer to an intense desire or longing for a particular substance (Weingarten & Elston, 1990). In relation to food, this irresistible urge to eat a specific type of food has been implicated to contribute to a loss of control over eating. For instance, the experience of food cravings is related to higher body-mass-index (BMI) or binge eating behaviors (Abilés, Rodríguez-Ruiz, Abilés, Mellado, García, & Pérez de la Cruz, 2010; Franken & Muris, 2005; Gendall, Sullivan, Joyce, Fear, & Bulik, 1997; Moreno, Warren, Rodríguez, Fernández, & Cepeda-Benito, 2009). Food cravings are distinct from hunger and can even be elicited without food deprivation. For example, Pelchat and Schaefer (2000) have shown that setting people on a monotonous diet triggers food cravings without any nutritional deficit.

Eliminating "forbidden" foods from daily food intake, thereby narrowing the variety of foods, is a rigid strategy many dieters use to control their eating behavior. Westenhoefer (1991) found that such rigid control strategies as opposed to flexible strategies can be assessed by different items of the *Eating Inventory* (EI; formerly known as the Three-Factor Eating Questionnaire; Stunkard & Messick, 1985). Rigid control is marked by an "all-or-nothing" approach to dieting while flexible control reflects a more balanced approach to dietary intake that include eating slowly or taking small helpings. Higher flexible control has been found to be related to lower disinhibition and lower BMI whereas higher rigid control has been found to be related to higher disinhibition and higher BMI (Timko & Perone, 2005; Westenhoefer, 1991; Westenhoefer, Stunkard, & Pudel, 1999). Therefore, flexible control may be an adaptive dietary strategy leading to dieting success while rigid control may be associated with dieting failure.

However, there have been inconsistent findings regarding correlates of rigid and flexible control in intervention studies. In some studies, no association was found between rigid or flexible control and weight loss (Burgmer, Grigutsch, Zipfel, Wolf, de Zwaan, & Husemann, 2005; Timko, Oelrich, & Lowe, 2007). Contrarily, often both rigid and flexible control were increased after weight management interventions and were associated with weight loss (McGuire, Jeffery, French, & Hannan, 2001; Teixeira et al., 2010) or binge eating abstinence (Downe, Goldfein, & Devlin, 2009). While rigid control might lead to short-term successful weight loss, some studies point out that flexible control is especially important for long-term weight maintenance (Teixeira et al., 2010; Westenhoefer, von Falck, Stellfeldt, & Fintelmann, 2004). Besides differences in sample characteristics, inconsistent findings could be explained by different scale versions used. Often the short version of the flexible and rigid control scale is employed despite low reliability (Westenhoefer et al., 1999).

In the present study, we used the long version of the rigid and flexible control scale (Westenhoefer et al., 1999) and tested its

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doi:10.1016/j.appet.2011.07.013

relationship to dieting success in a non-clinical sample. Specifically, we expected rigid control to inversely predict dieting success while flexible control to positively predict dieting success. Moreover, we tested if these relationships were mediated by the experience of food cravings.

Methods

Participants

Data were collected as part of an online survey details of which are reported elsewhere (Meule, Lutz, Vögele, & Kübler, in revision). Student councils of several German universities were contacted via e-mail. Then, the Internet address of the online survey was sent via the student councils' mailing lists. As an incentive five × 50 Euro were raffled among participants who completed the entire set of questions. The study-website was visited 1615 times. The survey was completed by $N = 617$ participants (38.2%). Data from one participant were excluded from further analyses because of implausible statements. The majority of participants were women (75.8%, $n = 467$). Both, men and women were included in all analyses. Almost all participants were students (89.0%) and had German citizenship (95.5%). Only 4.5% reported to have other European (3.4%) or non-European (1.1%) citizenship. Mean body-mass-index (BMI) was $M = 22.3\ kg/m^2$ ($SD \pm 3.3$). BMI of one participant was missing. Participants had a mean age of $M = 24.5$ years ($SD \pm 4.0$).

Measures

Rigid and flexible control of eating behavior

These scales were originally developed by Westenhoefer (1991) who found that the *cognitive restraint* subscale of the EI (Stunkard & Messick, 1985) could be further divided into flexible and rigid control strategies of dietary restraint. Later, additional items were added to increase internal consistencies (Westenhoefer et al., 1999). Flexible control is now assessed with 12 items (FC12), whereas the rigid control scale consists of 16 items (RC16). Internal consistencies in the present sample were $\alpha = .82$ for FC12 and $\alpha = .80$ for RC16. Both scales were correlated in the current study ($r = .55$, $p < .001$).

Food Cravings Questionnaires

Food cravings were assessed with the trait version of the Food Cravings Questionnaires (FCQ-T; Cepeda-Benito, Gleaves, Williams, & Erath, 2000). This 39-item instrument asks participants to indicate on a 6-point scale how frequently they experience food cravings (ranging from *never* to *always*). The FCQ-T consists of nine subscales measuring food cravings in relation to (1) intentions to consume food, (2) anticipation of positive reinforcement, (3) relief from negative states, (4) lack of control over eating, (5) preoccupation with food, (6) hunger, (7) emotions, (8) cues that trigger cravings, and (9) guilt. Only the total score was used in the current study and internal consistency was $\alpha = .96$.

Perceived self-regulatory success in dieting (PSRS)

This three-item scale was developed by Fishbach, Friedman, and Kruglanski (2003). Participants have to rate on 7-point scales how successful they are in watching their weight or losing weight and how difficult it is for them to stay in shape. In our study, participants were able to choose *not applicable* if they were not concerned with their weight. If this option was chosen in at least one question, participants were excluded from analysis ($n = 135$). For the remaining $n = 480$ participants, internal consistency of the PSRS was $\alpha = .74$, which is higher than previously reported ($\alpha = .66$; van Koningsbruggen, Stroebe, & Aarts, 2011).

Statistical analyses

Regression analyses were computed to reveal relationships between rigid/flexible control, food cravings, and dieting success. To test the hypothesized mediational model (i.e. rigid/flexible control → food cravings → dieting success) we followed the guidelines as described by Baron and Kenny (1986). The mediation effect was tested with the Sobel-test. The mediation analysis was also run separately for men and women, but lead to similar results. Therefore, results are only reported for the whole sample. Pearson-correlations were calculated to explore relationships between BMI and questionnaire scores.

Results

Rigid control

Rigid control was a significant predictor of food cravings ($F_{(1,478)} = 87.3$, $p < .001$, adj. $R^2 = .15$) and dieting success ($F_{(1,478)} = 24.8$, $p < .001$, adj. $R^2 = .05$). Beta-weights are depicted in Fig. 1. Food cravings also predicted dieting success ($F_{(1,478)} = 111.3$, $p < .001$, adj. $R^2 = .19$, $\beta = -.44$). The overall model including both rigid control and food cravings as predictors was also significant ($F_{(2,477)} = 56.7$, $p < .001$, adj. $R^2 = .19$). While food cravings were still a significant predictor of dieting success, the influence of rigid control was no longer significant (Fig. 1). Food cravings mediated the relationship between rigid control and dieting success (Sobel $z = -6.42$, $p < .001$).

Flexible control

Flexible control predicted dieting success ($F_{(1,478)} = 34.5$, $p < .001$, adj. $R^2 = .07$, $\beta = .26$). However, flexible control did not predict food cravings ($F_{(1,478)} = .58$, *ns*, adj. $R^2 = .00$, $\beta = -.04$).

Correlations with BMI

BMI correlations were weakly positive with rigid control ($r = .14$, $p < .01$) and food cravings ($r = .11$, $p < .05$), weakly negative with flexible control ($r = -.15$, $p < .01$), and moderately negative with dieting success ($r = -.38$, $p < .001$).

Discussion

In the current study, we found that rigid dietary control strategies were inversely related to dieting success while flexible control strategies were positively associated with dieting success.

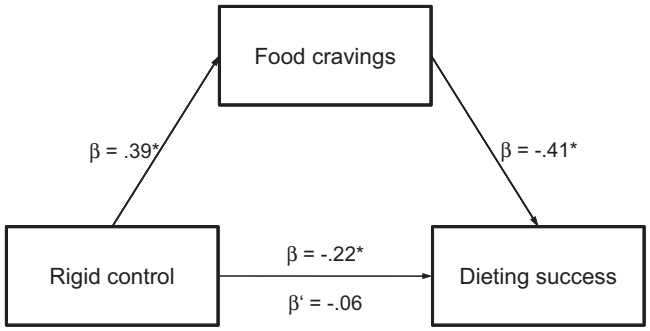

Fig. 1. Mediation model showing the mediating influence of food cravings on the relationship between rigid control of eating behavior and dieting success. Standardized β-coefficients are shown for the relation between rigid control and food cravings, food cravings and dieting success (adjusted for rigid control), and rigid control and dieting success (β' indicates the relation which is adjusted for the mediator). Asterisks indicate a p-value $< .001$.

We could also demonstrate that the experience of food cravings fully mediated the relationship between rigid control and dieting success. Contrarily, flexible control was not related to food cravings and predicted dieting success independent of food cravings.

Our results corroborate and extend previous findings indicating that rigid control is associated with self-regulatory failure in eating behavior (Timko & Perone, 2005; Westenhoefer, 1991; Westenhoefer et al., 1999). The mediating role of food cravings in this relationship is in line with rigid dietary strategies, such as a monotonous diet, eliciting such cravings (Pelchat & Schaefer, 2000). However, these results also contrast positive associations between rigid control and weight loss in overweight and obese women (McGuire et al., 2001; Teixeira et al., 2010). It has to be noted that we only cautiously compare our results with such studies because our cross-sectional data were based on a predominantly normal-weight sample. However, we speculate that obese patients might have low – both rigid and flexible – dietary control and therefore benefit from increases in rigid control which leads to initial weight loss. On the long run, however, rigid eating behaviors lead to food cravings thereby hampering long-term weight maintenance. Indeed, people with flexible control strategies have been found to be more successful in long-term weight maintenance (Teixeira et al., 2010; Westenhoefer et al., 2004). While flexible control was associated with dieting success in our study, this relationship was not attenuated by food cravings. Accordingly, flexible control was not related to food cravings. Dieters with flexible control strategies may also experience food cravings because they are common and experienced by most people (Hill, 2007). It is possible that even after giving in to such cravings, food intake is properly adjusted afterwards leading to successful weight loss or maintenance. Finally, flexible control in combination with less food cravings fosters dieting success even more.

A limitation of the current study is that our sample predominantly consisted of female students. Therefore, translation of results to the general population is limited. However, female participants are an appropriate target sample to investigate dieting because women are particularly concerned with their weight (Dinkel, Berth, Exner, Rief, & Balck, 2005). A second limitation is that results are based on self-report questionnaires only. Objective criteria, e.g. measuring BMI, are recommended to corroborate such findings. However, construct validity of the PSRS can be seen in negative correlations with self-reported BMI, which has also been found previously (Papies, Stroebe, & Aarts, 2008; van Koningsbruggen et al., 2011). Moreover, we excluded participants who indicated that at least one question of the PSRS was not applicable, i.e. participants who were not concerned with their weight or did not try to stay in shape. This procedure resulted in an increase in reliability and therefore improved the quality of the scale. Finally, our study was cross-sectional. Longitudinal studies investigating the predictive value of dietary control strategies and food cravings on dieting success are warranted.

Role of funding sources

Funding for this study was provided by a grant of the research training group 1253/1 which is supported by the German Research Foundation (DFG) by federal and Länder funds. DFG had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

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