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Rigid and flexible control of eating behavior in a college population

C. Alix Timko^{a,*}, Julie Perone^b

^aCenter for Counseling and Student Development, University of Delaware, Newark, Delaware, United States

^bDepartment of Counseling and Psychological Services, West Chester University, United States

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Abstract

The objective of this study was to explore the relationship between rigid control (RC) and flexible control (FC) of eating behavior and their relationship to traditional weight, eating, and affective measurements in a large heterogeneous population. Participants were 639 underweight to obese male and female college students. Multiple regression analyses (MRA) revealed that high RC was associated with high Body Mass Index (BMI) and high Disinhibition (DIS), and high FC was associated with low BMI and low DIS in women. In men, high RC was associated with high BMI and high DIS, whereas FC was not related to BMI or DIS. Multiple regression analyses of BMI on RC and FC in the female subsample revealed that the control variables interact in such a way that the relationship between RC and BMI is stronger when FC is lower. In men, there was no interaction between these variables. This study is the first full replication of Westenhoefer's *Gezügeltes Essen und Störbarkeit des Eßverhaltens: 2. Auflage*. Göttingen: Verlag für Psychologie (Westenhoefer, 1996) findings regarding RC and FC and their relationship to weight (BMI) and Disinhibition (DIS) in women. This is also the only second study to use the expanded, more reliable versions of the RC and FC scales. Overall, high RC in women and men was associated with greater eating and affective pathology.

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* Corresponding author. Tel.: +1 610 348 3361.

E-mail address: alix.timko@verizon.net (C.A. Timko).

1. Introduction

In 1991, Westenhoefer posited that dietary restraint was not a homogeneous construct but could be differentiated into two types of control of eating behavior: Flexible Control (FC) and Rigid Control (RC). Both RC and FC were derived from the Cognitive Restraint (CR) scale of the Eating Inventory (EI; Stunkard & Messick, 1985) and are measured using the RC16 and FC12 scales, respectively. RC is described by Westenhoefer (1991, p. 53) as being “characterized by a dichotomized ‘all or nothing’ approach to eating,” whereas FC is associated with an ability to plan and self-regulate caloric intake, including small amounts of sweets (Westenhoefer, Broekman, Münch, & Pudel, 1994). An individual with higher FC could plan for periods of increased consumption (such as an event later in the day) by eating less beforehand or could respond to a period of increased consumption by eating less afterwards. Westenhoefer (1996) found that when entered into regression analyses, increasing scores on the RC16 were associated with higher Body Mass Index (BMI) and higher scores on the Disinhibition (DIS) subscale of the EI, whereas increasing scores on the FC12 were associated with lower BMI and lower scores on DIS.

The majority of studies published to date investigating RC and FC have used very specific populations and earlier less reliable seven-item RC and FC scales. Results in regard to the constructs’ relationship to BMI have been conflicting (e.g., Masheb & Grilo, 2002; McGuire, Jeffery, French, & Hannan, 2001; Shearin, Russ, Hull, Clarkin, & Smith, 1994; Smith, Williamson, Bray, & Ryan, 1999; Williamson et al., 1995), and none has completely replicated Westenhoefer, Stunkard, and Pudel’s (1999) findings. The relationship between RC, FC, and DIS has also been investigated, and once again, results across studies are often contradictory and in conflict with Westenhoefer’s (e.g., Provencher, Drapeau, Tremblay, Després, & Lemieux, 2003; Smith et al., 1999; Williamson et al., 1995).

Due to these inconsistent findings regarding the relationship and usefulness of RC and FC when using the seven-item scales, Stewart, Williamson, and White (2002) sought to investigate these variables and their relationships to BMI and various affective and weight-related variables using the expanded and more reliable scales. They found that both expanded scales were correlated with each other but, contrary to Westenhoefer et al. (1999) findings, found that both RC16 and FC12 were positively correlated with BMI. Also contrary to Westenhoefer et al., only the RC16 was correlated with DIS (in that the correlation was negative). Although these more recent findings conflict with what Westenhoefer has reported to date (Westenhoefer, 1996; Westenhoefer et al., 1999), the conclusion reached is the same—that both RC and FC are forms of restraint, with FC being more beneficial than RC. Nonetheless, the majority of studies investigating these constructs has been correlational in nature, have used the less reliable scales, and have used fairly homogeneous samples in terms of gender and weight.

The original population studied by Westenhoefer using the expanded scales was very large ($N=1338$, Westenhoefer, 1996; Westenhoefer et al., 1999) and diverse in terms of geographic location, weight, and gender. Therefore, a primary goal of the current study was to replicate Westenhoefer et al.’s findings regarding the relationships between FC, RC, and a variety of weight, eating, and affective variables in a large heterogeneous sample (e.g., BMI, depression, anxiety, body image). It was hypothesized that high FC would be associated with both low BMI and DIS as well as lower scores on measures of body dissatisfaction, eating disorder symptomatology, and affective disturbance (i.e., depression and anxiety). It was further hypothesized that high RC would be associated with higher BMI and DIS scores as well as higher levels of body dissatisfaction, more eating disorder symptomatology, and more affective disturbance.

In addition to the traditional weight, eating, and affective measurements, the current study included a measure of impulsivity. This was added because impulsivity may be a risk factor for eating disorders (Lowe & Eldredge, 1993), and impulsivity and rigid control (RC) show similar patterns with regard to eating behavior and eating disorder symptomology (Pudel & Westenhofer, 1998). In regard to RC and FC, it was hypothesized that high levels of impulsivity would be correlated with higher levels of RC, as individuals with higher levels of RC are the ones believed to be more prone to engage in disinhibited eating. Furthermore, impulsivity is partially defined as the lack of ability to plan (Barratt, 1993), hence, lower levels of impulsivity were hypothesized to be associated with higher levels of FC, as individuals high in FC tend to plan for periods of increased consumption and self-regulate better than those individuals high in RC (Westenhofer et al., 1994).

2. Method

2.1. Participants

Data were collected from male and female university students who were between the ages of 18 and 65, the same age range used by Stewart et al. (2002). A total of 694 participants were assessed at three different universities. Fifty-five questionnaires (or 7.9%) were excluded from the study due to incomplete data, leaving a total sample size of 639. A Human Subjects Review Board or Institutional Review Board at each institution approved the study and participation for its students.

Because heterogeneity of the population was desired, both men and women of different ethnic backgrounds and various body types were included. Of the total number of those assessed, 472 (or 74%) were female and 167 (or 26%) were male. Ethnically, the majority of subjects was Caucasian (538, or 84%), with those identifying themselves as “Black/African American” comprising 9% of the total population. The remaining minority pool consisted of 3% Asian, 2% Hispanic, and 2% identified as “Other.” Based on the Body Mass Index (BMI), 6% of the entire sample was underweight, 68% was normal weight, 21% was overweight, and 5% was obese.

2.2. Measures

The questionnaire packet included an information sheet that apprised participants of the study and explained their rights as a voluntary participant, a cover sheet for demographic data, seven standardized measures, and an item on weight loss. The demographic information requested included age, gender, ethnicity, marital status, height, weight, year in school, academic major, and questions pertaining to whether or not one was currently on a diet to lose or to maintain weight.

The standardized measures used in this study have all been shown to have good reliability and validity. The measures and the order in which they were presented to the participants are as follows: The Beck Depression Inventory—Second Edition (BDI-II; Beck, Brown, & Steer, 1996), Eating Inventory (EI; Stunkard & Messick, 1985), Flexible and Rigid Control Scales (FC12, RC16; Westenhofer et al., 1999), Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987), State-Trait Anxiety Inventory (STAI, Spielberger, 1983), Eating Attitudes Test-26 (EAT-26, Garner, Olmsted, Bohr, & Garfinkel, 1982), and the Barratt Impulsiveness Scale (BIS-11; Barratt, 1959). Weight cycling history

was assessed by asking how many times the subject had lost a certain amount of weight and if the subject felt like a “yo-yo” dieter. The subject was directed to indicate how many times over the subject’s lifetime a given range of weight had been lost.

3. Results

Traditionally, the relationships between FC, RC, and several other variables (such as BMI and DIS) have been presented as correlational. It can be argued that regression analysis is a more appropriate analysis to use than bivariate correlation, as a regression analysis can account for the collinearity of RC and FC when entered as covariates. It was decided to investigate the relationships between RC, FC, and other variables using a multiple regression with both RC and FC entered as covariates and the other variables of interest entered as dependent variables. This method replicates that used by Westenhoefer (personal communication, June 18, 2002) to determine the relationship between RC, FC, BMI, and DIS. It should account for the simultaneous effects of RC and FC that could be lost in a bivariate correlation. Furthermore, in order to avoid the creation of falsely dichotomous variables, regression analysis with an interaction was chosen over ANOVA to investigate the differential effects of RC and FC on BMI. Results are presented for men and women separately, as men generally have lower scores on both the RC16 and FC12 (Provencher et al., 2003; Westenhoefer, 1996). Demographic data is available from the authors upon request.

3.1. Female results

The women in this sample had an average BMI of 22.67 (S.D.=3.69) with a range of 15.15–45.72. The average score on the RC16 was 6.5 (S.D.=4.2); the average score on the FC12 was 5.4 (S.D.=3.2). The two control scales were highly correlated at $r(472)=0.77$, $p=0.01$.

In line with hypotheses, high RC was associated with high BMI ($B=0.27$, $t=4.41$, $p<0.001$, $\eta^2=0.04$) and high DIS scores ($B=0.62$, $t=10.91$, $p<0.001$, $\eta^2=0.20$), whereas high FC was associated with low BMI ($B=-0.26$, $t=-31.17$, $p=0.002$, $\eta^2=0.02$) and low DIS ($B=-0.34$, $t=-4.60$, $p<0.001$, $\eta^2=0.04$) scores. This is a full replication of Westenhoefer’s findings regarding the relationships among these four variables.

As expected, high RC was also associated with high scores on the BDI-II ($B=0.37$, $t=2.48$, $p=0.01$, $\eta^2=0.01$), EAT-26 ($B=1.63$, $t=11.59$, $p<0.001$, $\eta^2=0.22$), EAT-Diet ($B=1.21$, $t=12.87$, $p<0.001$, $\eta^2=0.26$), EAT-Bulimia ($B=0.37$, $t=8.72$, $p<0.001$, $\eta^2=0.14$), BSQ ($B=6.51$, $t=13.42$, $p<0.001$, $\eta^2=0.28$), nonplanning impulsiveness ($B=0.14$, $t=2.56$, $p=0.01$, $\eta^2=0.01$), STAI ($B=0.50$, $t=2.91$, $p=0.004$, $\eta^2=0.02$), EI-Cognitive Restraint ($B=0.63$, $t=20.09$, $p<0.001$, $\eta^2=0.46$), and EI-Hunger ($B=0.31$, $t=5.50$, $p<0.001$, $\eta^2=0.06$). RC was also associated more frequent weight loss ($B=0.36$, $t=2.62$, $p=0.009$, $\eta^2=0.01$) and greater amounts of overall weight lost ($B=2.48$, $t=3.61$, $p<0.001$, $\eta^2=0.03$). There was no relationship between RC and the measures of Cognitive or Motor Impulsivity, EAT Oral, nor STAI-State. Contrary to expectations, FC was found to have no association with the majority of variables. It was predicted that FC would be associated with greater affective stability or health and less pathology in eating behavior/attitudes and body image; yet, FC only had additional associations with EI-Cognitive Restraint ($B=0.98$, $t=24.16$, $p<0.001$, $\eta^2=0.56$) and EI-Hunger ($B=-0.31$, $t=-4.22$, $p<0.001$, $\eta^2=0.04$).

3.1.1. Exploratory analyses

Of interest in the area of control over eating is whether or not individuals who score differentially on each of the scales (high on one and low on the other) or those who score high or low on both differ according to BMI. In the past, this has been done using a median split on participants' scores on the RC and FC scales (e.g., Stewart et al., 2002). Using a median split on a continuous variable transforms a continuous scale into a dichotomous scale (high or low), thereby increasing the likelihood of losing information and decreasing power (Aiken & West, 1991). It was deemed more appropriate to investigate the combined relationship of RC and FC on BMI by using a regression with an interaction analysis. This was calculated by centering the variables of interest and then entering the main effect terms for RC and FC in Step I and the interaction term in Step II of the regression. Results were significant for an interaction ($B=-0.06$, $t=-4.49$, $p<0.001$, $R^2=0.08$), indicating that the level of one type of control differentially affects the level of the other and, consequently, BMI.

As per Aiken and West's (1991) recommendation, the regression equation was plotted twice: once with BMI regressed on FC at RC and once with BMI regressed on RC at FC. Both ways of plotting generated ordinal interactions. In order to probe the interaction, simple regressions were used. It was found that the relationship between RC and BMI was stronger at one standard deviation below the mean ($B=0.91$, $t=6.18$, $p\leq 0.001$) than one standard deviation above the mean ($B=0.48$, $t=6.21$, $p\leq 0.001$) for FC. That is, the relationship between RC and BMI is stronger when FC is lower.

3.2. Male results

The men in the sample had a mean BMI of 24.61 (S.D.=3.84) with a range of 16.73–44.07. The mean RC16 score was 3.58 (S.D.=3.0); the mean FC12 score was 3.05 (S.D.=2.57). As expected, these scores were significantly lower than the women's scores on these measures (RC: $F(1, 637)=68.14$, $p=0.001$; FC: $F(1, 637)=72.91$, $p=0.001$). The correlation of RC and FC for men was $r(167)=0.76$, $p=0.01$.

Multiple regression analyses (MRA) were used to determine the relationship between RC, FC, and the other variables measured. As with the women, high RC was associated with higher BMI ($B=0.40$, $t=2.77$, $p=0.006$, $\eta^2=0.05$) and higher DIS ($B=0.387$, $t=4.51$, $p<0.001$, $\eta^2=0.11$). There was no relationship between FC, BMI, and DIS for the men in this sample.

High RC was significantly related to higher scores on the EAT-26 ($B=0.62$, $t=3.66$, $p<0.001$, $\eta^2=0.28$), EAT-Diet ($B=0.46$, $t=4.30$, $p<0.001$, $\eta^2=0.10$), EAT-Bulimia ($B=0.18$, $t=3.00$, $p=0.003$, $\eta^2=0.05$), and EI-Cognitive Restraint ($B=0.70$, $t=10.93$, $p<0.001$, $\eta^2=0.42$). There was no relationship found between RC and BDI, MI, IC, INP, EAT-Oral, STAI-State and Trait, EI-Hunger, and measures of weight cycling. As with the women in the sample, FC was not found to be associated with most of the other variables. High FC was associated with high scores on the EAT-Diet ($B=0.39$, $t=3.14$, $p=0.002$, $\eta^2=0.06$) and high EI-Cognitive Restraint scores ($B=0.70$, $t=10.93$, $p<0.001$, $\eta^2=0.42$).

A regression with an interaction analysis was performed to determine whether or not the type and level of control over eating had an influence on BMI in the male subsample. No interaction was found ($t=-1.49$, $p=0.10$). The unstandardized regression coefficient was -0.053 , and the standardized coefficient was -0.13 . However, there was a main effect for RC ($t=2.96$, $p=0.004$, $B=0.43$, $\beta=0.34$) such that high RC was associated with high BMI. The R^2 for this model was 0.12, and the adjusted R^2 was 0.11.

4. Discussion

This study is the first to fully replicate Westenhoefer's (1996) findings in a female population. Other studies investigating RC and FC have cited lack of complete replication as a problem with these measures (e.g., Stewart et al., 2002). The findings of this study indicate that the relationships between FC, RC, and other variables are present; therefore, further investigation of RC and FC and their relationship to consummatory behaviors may prove valuable. This is also the first study to investigate the relationship of the expanded measures of FC and RC to each other, BMI, and other variables in a heterogeneous population. It is also the first to use the same statistical methodology that Westenhoefer employed in his studies; i.e., multiple regression analysis (MRA).

As expected, RC was found to be associated with greater eating and emotional pathology than FC. However, contrary to expectations, FC was not found to be associated with "greater health" (i.e., less eating and emotional pathology) but rather to have no relationship to the numerous variables in this study. This merits further investigation, as no known study to date has been able to show a relationship between FC and positive attitudes towards self and eating. It has been argued (Westenhoefer et al., 1999) that weight reduction programs should endeavor to increase FC during treatment in order to enhance outcome. However, the lack of a relationship between FC and positive attitudes or healthy behaviors calls into question the possibility of increasing FC as a way to promote healthier eating and body image. On the other hand, the relationship between high nonplanning impulsiveness and RC may be a viable area for further investigation in the areas of weight reduction. For example, if individuals were able to reduce their nonplanning impulsiveness (conversely, to increase their ability to plan), they may be better able to maintain weight loss. It is also possible that RC may mediate any relationship between nonplanning impulsiveness and weight maintenance.

The only relationship not replicated was the relationship between DIS, BMI, and FC in men. As knowledge about men's eating behavior, particularly restraint, is not as comprehensive as that regarding women, the role RC and FC plays in men's consummatory behavior needs to be explored further. Overall, men in this sample were less restrained than women and tended towards a more rigid type of restraint.

A limitation of this study is the correlational nature of the results. As regression analyses were used, there is no way to determine causal relationships between RC, FC, and BMI. The presence of an interaction in the data indicates that FC and RC act in relation to each other to predict BMI. It cannot be determined if a causal relationship exists or what the direction of causality may be.

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