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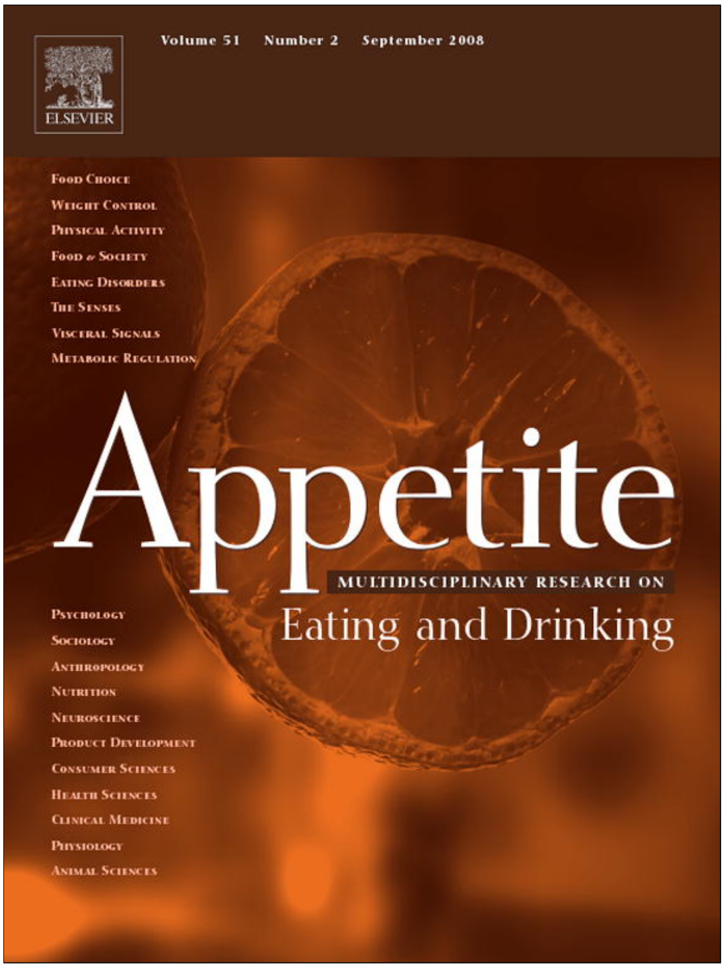

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Short communication

Restraint, disinhibition and food-related processing bias

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ABSTRACT

This study examined associations between restraint, disinhibition and food-related processing bias (FPB, assessed by the emotional Stroop task) in males and females in the UK, Greece and Iran. Results showed high restraint was associated with higher FPB. However, high restrained current dieters showed lower FPB that high restrained non-dieters. There was no significant difference in FPB for those showing high versus low disinhibition. Results are discussed in relation to theories of incentive salience and current concerns.

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Introduction

When a person abuses a substance he or she displays a processing bias for information in the environment relating to this substance (e.g., Cox, Fadardi, & Pothos, 2006). That is, the person will direct his or her attention towards such information and process it more extensively. Processing bias is important since it may contribute to the maintenance and/or escalation of the addictive behaviour (e.g., Cox, Pothos, & Hosier, 2007). Unlike drugs or alcohol, food is not physically addictive. Nevertheless, like addictive substances, food can be a powerful reinforcer. As such, many individuals overeat and have difficulty limiting their food intake.

Previous research on food-related processing bias (FPB) in non-clinical populations is limited. A well-documented result is that higher levels of restraint (i.e. attempts to limit food intake) are associated with greater FPB. However, the compellingness of this finding is reduced by methodological limitations. Most of the studies we identified (e.g., Francis, Stewart, & Hounsell, 1997; Stewart & Samoluk, 1997) have measured restraint using the Restraint Scale; a scale that confounds restraint with disinhibition (i.e. tendency to overeat, Van Strien, 1997). We found only four studies that employed alternative measures of restraint (Braet & Crombez, 2003; Green & Rogers, 1993; Long, Hinton, & Gillespie, 1994; Ogden & Greville, 1993), and of these only one (Green & Rogers, 1993), found a main effect of restraint on FPB. An additional problem with work in this area is that it has been almost exclusively conducted with females from western societies. Given societal pressures on western females to be slim (e.g., Cogan, Bhalla, SefaDedeh, & Rothblum, 1996), it seems likely that women who are more inclined to overeat may also be more likely to attempt to limit their food intake, resulting in correlations between disinhibition and restraint. These limitations raise the question of whether it is restraint that is associated with increased FPB or tendency to overeat.

We sought to address these shortcomings by including in our sample individuals displaying high disinhibition/low restraint and vice versa. This was achieved by recruiting males and females in the UK, Greece and Iran, since there is evidence to indicate that men and non-western women are less subject to pressures to be slim (e.g., Cogan et al., 1996; Wardle et al., 1992). Additionally, we employed the Dutch Eating Behaviour Questionnaire (DEBQ; Van Strien, Frijters, Bergers, & Defares, 1986), which assesses restraint and disinhibition separately. If, as suggested by previous research

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(e.g., Francis et al., 1997; Green & Rogers, 1993; Stewart & Samoluk, 1997), restraint is associated with increased FPB, we would also expect to see such an association in the present sample of men and women from diverse cultures. However, if previous findings of an association between restraint and FPB are simply a result of underlying associations with tendency to overeat, then we would expect to see an association between FPB and disinhibition.

Method

Participants were 224 native undergraduates at the universities of Swansea, UK (36 females, 30 males), Ioannina, Greece (30 females, 30 males) and Ferdowsi of Mashhad, Iran (60 females, 38 males). Mean age was 21.7 years (S.D. = 3.91; range = 17–47) and mean BMI was 22 kg/m^2 (S.D. = 3.57; range = 16–36).

To test for FPB we employed a food version of the emotional Stroop task. This consisted of one card containing 20 different neutral travel-related words and one card containing 20 different food words (e.g., chocolate, salad, potato). For Greek and Persian translations, where possible we used words that were identical in meaning to the British lists. However, in some instances different words were used in order to ensure a match in terms of cultural use/significance (e.g., burger in English was translated to souvlaki in Greek). In each of the three languages the two word lists were matched in terms of the average number of characters (Cox et al., 2006). Each word was presented four times (80 words per card) and printed in blue, green, red or orange. Word order was randomly determined.

Participants were tested in their native language between 10.00–12.00 and 14.00–16.00 h. In order to familiarize them with the task they were first provided with 20 neutral words printed in the four colours and were asked to name the colour of each word. Subsequently, they received either the food or neutral card (the order was counterbalanced across participants) and were asked to name the colour of each word on the card out loud, as quickly and as accurately as possible. The experimenter recorded the time it took the participant to complete the card by starting a stopwatch when the participant started naming the colour of the first word and stopping it as soon as they named the colour of the last word. The experimenter also made a note of any errors. This procedure was then repeated for the other card, after which participants completed the DEBQ and the Grand (1968) Hunger Scale and recorded whether or not they were currently dieting to lose weight ('yes' or 'no').

Results

For each participant we computed: a FPB score, by subtracting the time it took them to read through the card of neutral words from the time it took them to read through the card of food words; BMI; DEBQ scores (ranging from 1 to 5) for restraint and disinhibition (Van Strien et al., 1986; the latter was computed by taking the mean of the emotional and external eating subscales) and hunger (according to guidelines provided by Grand, 1968).

Of the 224 participants 31 indicated that they were currently dieting to lose weight (Britain = 6 females, 4 males; Greece = 7 females, 2 males; Iran = 9 females, 3 males). Our analyses consider (a) those who were not currently dieting and (b) the whole sample. Of the 193 participants who were not currently dieting one participant (British, female) scored greater than 3.5 S.Ds. from the mean on the FPB score and was excluded leaving 192 participants. Of the 31 participants who were currently dieting one participant (Greek, female) scored greater than 3.5 S.Ds. from the mean on the FPB score and was also excluded. A further six participants (1 British female, 2 British males, 1 Iranian female, 2 Iranian males), despite currently dieting, scored under three on the Restraint Scale. These were taken to be spurious responses and were also eliminated, thus leaving a total of 24 participants in the dieting group, 216 across the whole sample.

Across the whole sample (n = 216), the mean length of time it took to read the food words was 64.07 s (S.D. = 12.74) whilst the mean length of time it took to read the neutral words was 61.19 s (S.D. = 11.57). Mean error rates were 0.77% for the food card (S.D. = 0.95) and 0.56% for the neutral card (S.D. = 0.98) and no participant's error rate exceeded 5%. Mean FPB score was 2.88 (S.D. = 7.39). Mean FPB scores were 4.35 for British participants (S.D. = 6.94, n = 62), 2.22 for Greek participants (S.D. = 7.64, n = 59), 2.32 for Iranian participants (S.D. = 7.45, n = 95), 2.62 for females (S.D. = 6.59, n = 122) and 3.20 for males (S.D. = 8.34, n = 94). For the DEBQ mean levels of restraint were 2.38 (S.D. = 0.95) whilst mean disinhibition was 2.73 (S.D. = 0.61). There were significant correlations between restraint and disinhibition for British (r = .33, $p < .05$) and Greek (r = .28, $p < .05$) participants, but not for Iranians (r = .03, NS). For females the correlation was .20 ($p < .05$) and for males .19 (NS). Across the whole sample the correlation was .21 ($p < .005$).

Considering that (a) preliminary correlational analyses revealed considerable noise in the DEBQ continuous measures and (b) an important analytical objective concerned an examination of interactions, where restraint and disinhibition were employed as independent variables we adopted a dichotomization approach, taking care not to introduce spurious variance (MacCallum, Zhang, Preacher, & Rucker, 2002). As such, restraint and disinhibition scales were dichotomized above and below a score of 3 (which represented the midpoint of the 5-point scales).

To test for hunger biases across the whole sample (n = 216) a four-way ANOVA was employed with country, gender, restraint (high/low) and disinhibition (high/low) as independent variables and hunger as the dependent variable. Results showed no significant main or interaction effects, (F(2,202) = 0.35 for country, F(1,202) = 0.21 for gender, F(1,202) = 0.35 for restraint, F(1,202) = 0.97 for disinhibition). This analysis was then repeated for non-dieters only (n = 192). Again, no significant main or interaction effects were observed. Finally, three independent t-tests were employed to examine possible hunger differences between low restrained non-dieters (M = 5.44, S.D. = 2.96, n = 164), high restrained non-dieters (M = 4.51, S.D. = 2.08, n = 28), and high restrained current dieters (M = 5.46, S.D. = 2.80, n = 24) (see below). Results showed no significant hunger difference between low and high restrained non-dieters, t(190) = 1.59, no significant difference between low restrained non-dieters and high restrained current dieters t(186) = 0.04, and no significant difference between high restrained non-dieters and high restrained current dieters, t(50) = 1.40.

Across the whole sample (n = 216), a two-way MANOVA was employed to examine country and gender effects on restraint and disinhibition. As predicted, there was a main effect of country on restraint with lower restraint in Iran than in Britain and Greece (F(2,210) = 3.97, $p < .05$; Britain: M = 2.50, S.D. = 0.93; Greece: M = 2.52, S.D. = 1.06; Iran: M = 2.21, S.D. = 0.87). Also as predicted, there was a main effect of gender on restraint, with males showing lower restraint than females, (F(1,210) = 22.38, $p < .001$; females: M = 2.62, S.D. = 0.99; males: M = 2.07, S.D. = 0.79). There was no interaction between country and gender on restraint. There was also a main effect of country on disinhibition, with higher levels in Britain than in Greece and Iran, (F(2,210) = 5.42, $p < .01$; Britain: M = 2.93, S.D. = 0.68; Greece: M = 2.58, S.D. = 0.66; Iran = 2.68, S.D. = 0.47). There was no main effect of gender on disinhibition, (F(1,210) = 3.28, NS; females: M = 2.78, S.D. = 0.58; males: M = 2.66, S.D. = 0.64) but there was an interaction between country and gender, (F(2,210) = 3.54, $p < .05$). Means revealed that there were higher levels of disinhibition among females compared to

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males in both Britain ($M = 3.01$, S.D. = 0.68 and $M = 2.84$, S.D. = 0.69, respectively) and Greece ($M = 2.78$, S.D. = 0.70 and $M = 2.38$, S.D. = 0.56, respectively), but that the reverse was true in Iran, with higher levels of disinhibition among males ($M = 2.76$, S.D. = 0.58) compared to females ($M = 2.64$, S.D. = 0.39). Given that a mixed gender and cross-cultural sample was employed primarily to unconfound restraint and disinhibition, gender and country were not included in further analyses.

Our main analyses first considered those who were not currently dieting ($n = 192$). A two-way ANOVA showed no main effect of disinhibition on FPB ($F(1,188) = 2.23$, $p = 0.14$; the means, however, were in the predicted direction; $M = 2.78$, S.D. = 7.24, $n = 146$ and M = 3.92, S.D. = 7.73, $n = 46$, for low and high disinhibition, respectively), a main effect of restraint on FPB ($F(1,188) = 6.15$, $p < .05$; $M = 2.57$, S.D. = 7.21, $n = 164$ and $M = 5.91$, S.D. = 7.72, $n = 28$ for low and high restraint, respectively), but no interaction. (NB. When emotional and external eating were included separately in the above model there were no significant main effects or interactions though all means were in the predicted directions with higher levels of each behaviour being associated with greater FPB.) For these non-dieters, the correlation between BMI and FPB was non-significant ($r = .11$).

We next extended our analyses to the whole sample (i.e. both non-dieters and current dieters, $n = 216$). These participants were divided into three groups according to dieting and restraint status (high and low restraint were defined as above): low restrained non-dieters ($n = 164$), high restrained non-dieters ($n = 28$), high restrained current dieters ($n = 24$). A one-way ANOVA with the three restraint and dieting groups as the independent variable and FPB as the dependent variable revealed a near significant effect ($F(2,213) = 3.02$, $p = .051$; low restrained non-dieters: $M = 2.57$, S.D. = 7.21; high restrained non-dieters: $M = 5.91$, S.D. = 7.72; high restrained current dieters: $M = 1.44$, S.D. = 7.60). Follow-up t-tests showed that dieters displayed *lower* FPB compared to high restrained non-dieters, $t(50) = 2.10$, $p < .05$, but not compared to low restrained non-dieters, $t(186) = 0.71$, NS.

Discussion

Results showed that high restraint was associated with greater FPB. Given the potential role of processing bias in the maintenance of addictive behaviours (e.g., Cox et al., 2007), this result is intriguing: if restraint *causes* FPB (e.g., via increased preoccupation with food, see Klinger & Cox, 2004) then attempting to limit food intake in this way may actually be counterproductive. However, given the correlational nature of the data in the present study, further research would be needed to confirm such a causal link.

The results also suggested that dieters may have lower FPB than high restrained non-dieters. Thus, it is possible that successful dieters tend to use strategies that result in lower FPB, which in turn should make it easier to lose weight. For example, by deciding to keep to a particular diet plan they may actually be less preoccupied with food, which could in turn reduce FPB (Klinger & Cox, 2004). Again, further research would be needed to explore this possibility.

Additionally, the results showed a trend towards an effect of disinhibition on FPB, but one that did not reach significance. It is possible that this would have reached significance in a sample where participants had a wider range of BMIs. In the present study most of the participants were university students with fairly uniform BMIs. Moreover, all three samples comprised persons who would be of higher socioeconomic status, compared to the average in their respective societies.

It is important to consider the limitations of the present study. In particular, the food Stroop employed a range of different 'types' of food words (e.g., those that would generally be considered low calorie, such as salad, high calorie, such as chocolate or somewhere in between, such as potato) and thus may have varied in their affective valence for restrained and disinhibited eaters. Had the words all referred to high calorie foods it is possible that participants who were high on restraint and/or disinhibition would have displayed larger biases.

Finally, we can consider the origins of FPB. There are two areas that have been the focus of much research in recent years. First, it is possible that FPB reflects the incentive salience of stimuli, i.e. their relevance for reinforcement (Robinson & Berridge, 1993). According to this viewpoint, we preferentially attend to food information because of a history of dopaminergic reward as a result of consuming food. Individual differences in taste perception (Drayna, 2005), sensitivity to food reinforcement (e.g., Beaver et al., 2006; Blundell & Finlayson, 2004), or the ease with which food cues acquire incentive properties (Robinson & Berridge, 1993) are all factors that could contribute to individual differences in the incentive salience of food cues and thus account for differences in FPB. Second, it is possible that FPB is a consequence of preoccupation with food. Klinger and Cox (2004) suggested that our lives are organized around the pursuit of goals. The motivational state that exists when pursuing a goal is called a *current concern* and it induces processing bias for information relating to this goal. Although the present study did not directly compare these two accounts it is possible that restraint reflects an individual's level of preoccupation with food whilst disinhibition (particularly external eating) reflects individual differences in the incentive salience of food cues. If this is the case, the present results provide greater support for the preoccupation account. However, this conclusion is bound to be dependent on sample characteristics (e.g., high versus average BMI). Future research will hopefully clarify this issue.

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