Appetite 79 (2014) 124–133

Contents lists available at ScienceDirect

Appetite

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

Research report

Hunger, inhibitory control and distress-induced emotional eating ☆

Tatjana van Strien [a,b,*], Machteld A. Ouwens [c,1], Carmen Engel [a], Carolina de Weerth [a]

[a] Behavioural Science Institute, Radboud University Nijmegen, PO Box 9102, 6500 HC Nijmegen, The Netherlands
[b] Faculty of Earth and Life Sciences, Free University Amsterdam, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands
[c] Department of Medical and Clinical Psychology, Tilburg University, PO Box 90153, 5000 LE Tilburg, The Netherlands

ARTICLE INFO

Article history:
Received 16 December 2013
Received in revised form 17 April 2014
Accepted 19 April 2014
Available online 23 April 2014

Keywords:
Emotional eating
Hunger
Inhibitory control
Stop Signal Test
Trier Social Stress Test
Food intake

ABSTRACT

Self-reported emotional eating has been found to significantly moderate distress-induced food intake, with low emotional eaters eating less after a stress task than after a control task and high emotional eaters eating more. The aim of the present study was to explore possible underlying mechanisms by assessing possible associations with (1) ability to experience the typical post-stress reduction of hunger and (2) inhibitory control. We studied these effects in 54 female students who were preselected on the basis of extremely high or low scores on an emotional eating questionnaire. Using a within subject design we measured the difference of actual food or snack intake after a control or a stress task (Trier Social Stress Test). As expected, the moderator effect of emotional eating on distress-induced food intake was found to be only present in females with a failure to report the typical reduction of hunger immediately after a stress task (an *a-typical* hunger stress response). Contrary to our expectations, this moderator effect of emotional eating was also found to be only present in females with high ability to stop motor impulses (high inhibitory control). These findings suggest that an a-typical hunger stress response but not poor inhibitory control may underlie the moderator effect of emotional eating on distress-induced food intake. However, inhibitory control may play a role whether or not there is a moderator effect of self-reported emotional eating on distress-induced food intake.

Introduction

Distress is associated with both increased and decreased food intake (Greeno & Wing, 1994), with eating less being the typical and predominant response (Gold & Chrousos, 2002; Stone & Brownell, 1994). Distress is normally associated with physiological responses that are designed to prepare the individual for a fight or flight reaction: inhibition of gastric motility and release of sugar into the bloodstream. As these physiological states are similar to the chief peripheral physiological correlates of satiety, distress generally leads to decreased eating and subsequent weight loss (Gold & Chrousos, 2002; Stone & Brownell, 1994). However, so-called emotional eaters show the atypical response to distress of eating similar or larger amounts of food (Oliver, Wardle, & Gibson, 2000; van Strien et al., 2013a; van Strien, Herman, Anschutz, Engels, & de Weerth, 2012a; van Strien & Ouwens, 2003; Wallis & Hetherington, 2004). Though these effects are robust when participants have sufficiently extreme emotional eating scores[1] and/or ego threat is involved (van Strien et al., 2012a), little is known about the mechanisms underlying these effects.

In an earlier study on possible mechanisms we examined whether this opposite pattern of emotional over-eating is associated with changes in the stress reactivity of the hypothalamic pituitary adrenal (HPA) axis as indicated by changes in the stress hormone cortisol after a distress (ego-threat) versus a control condition (van Strien, Roelofs, & de Weerth, 2013b). Cortisol stress reactivity was indeed found to significantly moderate the relationship between emotional eating and the difference in food intake after distress versus control

☆ *Acknowledgement:* Anita Jansen and Chantal Nederkoorn of Maastricht University are kindly acknowledged for providing us this version of the Stop Signal Task.

* Corresponding author.
E-mail address: t.vanstrien@psych.ru.nl (T. van Strien).
[1] Present address: GGzBreburg Tilburg, PO Box 770, 5000 AT Tilburg, The Netherlands.

[1] For two reasons it is important to have sufficient participants with extreme observations on emotional eating. The first reason is statistical: According to McClelland and Judd (1993), pp. 382–383 "jointly extreme observations are crucial for detecting interactions." In comparison with the 'four corners design' in which 25% of cases are allocated to each extreme, "a normal like distribution of the two variables has a relative efficiency of only .06 for detecting an interaction and requires nearly 17 times as many observations to have comparable efficiency" (Whisman & McClelland, 2005, p. 117). Interestingly, most studies with no moderator effect for emotional eating used no extreme values on emotional eating and only had a small number of subjects in their study (van Strien et al., 2012a, 2012b). The second reason is conceptual: Results of a functional magnetic resonance imaging study by Bohon, Stice, and Spoor (2009) suggest that emotional eating may be best described as a categorical rather than a continuous variable. Extreme scores on self-reported emotional eating predicted in this study important individual differences in reward response during negative moods.

http://dx.doi.org/10.1016/j.appet.2014.04.020
0195-6663/

tasks. High emotional eaters with a *blunted* cortisol response ate more food after distress than those with an elevated cortisol stress response (see Tomiyama, Dallman, & Epel, 2011, and Tryon, DeCant, & Laugero, 2013, for similar findings). This finding suggests that emotional over-eating is indeed associated with a lowered HPA-axis functioning, though it is as yet unclear whether this blunted cortisol response is secondary (i.e. the result of an adaptive down regulation) or primary to emotional eating (see van Strien et al., 2013b). In the present study on the same sample plus additional participants[2] we want to pursue our search for possible mechanisms further, this time by addressing the relationship of emotional eating with (1) self-reports of hunger after stress versus control and (2) inhibitory control.

Emotional over-eating may be the result of a failure to experience the typical post-stress reduction of hunger. An earlier study examined the hunger ratings immediately after a distress vs. control condition of low versus high emotional eaters (van Strien et al., 2012a). It was found that high emotional eaters, in contrast to the low emotional eaters, did not report a substantial reduction of hunger immediately after the stress task compared with the control task. This finding suggests that high emotional eaters, in contrast to the low emotional eaters, indeed suffer from an a-typical hunger stress response. Whether this a-typical hunger stress response also predicts distress-induced food intake was, however, not investigated in that study. Furthermore, there are to our best knowledge no published studies that have systematically tested the relationship between hunger stress reactivity and actual stress-induced food intake in high and low emotional eaters. The present study is therefore the first to systematically examine whether the moderator effect of emotional eating on distress-induced food intake is affected by the individual's hunger stress reactivity.

Failure to experience the typical post-stress reduction of hunger of high emotional eaters may be the result of poor interoceptive awareness, that is a confusion of physiological symptoms associated with stress and negative emotions and those associated with hunger and satiety (Bruch, 1964). Poor interoceptive awareness is highly associated with alexithymia (Greek, literally meaning 'no words for emotions'), most notably the alexithymia aspects of difficulty in identifying feelings and describing feelings to other people (Garner, 1991; Taylor, Parker, Bagby, & Bourke, 1996). The association of poor interoceptive awareness and alexithymia with self-reported emotional eating has been widely established (Larsen, van Strien, Eisinga, & Engels, 2006; Pinaquy, Chabrol, Simon, Loevet, & Barber, 2003; van Strien, Engels, van Leeuwe, & Snoek, 2005), with in one study a moderator effect of alexithymia on actual distress-induced food intake (van Strien & Ouwens, 2007). However, whether poor interoceptive awareness and alexithymia are also associated with hunger stress reactivity (typical versus a-typical hunger responses after stress versus control) has not yet been assessed. Similarly, it is as yet unknown whether a possible moderator effect of hunger stress reactivity on the moderator effect of emotional eating on distress-induced food intake is mediated by poor interoceptive awareness and alexithymia.

Inability to inhibit motor impulses (pressing a button) – a measure for inhibitory control, which has been considered an indirect measure for impulsivity (Jansen et al., 2009) – would also be a good candidate for affecting the moderator effect of emotional eating on distress-induced food intake. In a series of studies summarized by Jansen et al., (2009), inability to inhibit motor impulses, as measured with the stop signal task (by Logan, Schachar, & Tannock, 1997), predicted higher food intake, a higher body weight and less weight loss after a weight reduction treatment. However, in more recent studies inability to stop motor impulses only predicted overeating and weight gain in combination with other factors, such as a high implicit preference for the test food, high dietary restraint or strong feelings of hunger (Jansen et al., 2009; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010). Emotional eating could also be such a factor, given the association of emotional eating with various self-report measures of reduced inhibitory control or negative urgency (the tendency to act impulsively in the face of negative affect) (Bekker, van de Meerendonk, & Mollerus, 2004; Ebneter, Latner, Rosewall, & Chisholm, 2012; Elfhag & Morey, 2008; Lattimore, Fisher, & Malinowski, 2011; Ouwens, van Strien, & van Leeuwe, 2009; Racine et al., 2013) and the number of false alarms in a Go/NoGo task, a measure of efficiency of inhibitory control in the presence of food cues (Jasinska et al., 2012). We know of no published study that tested the relationship between inability to stop motor impulses and actual stress-induced food intake in high and low emotional eaters. Hence, to the best of our knowledge this would be the first study to assess the effect of this implicit measure of impulsivity on the moderator effect of emotional eating on distress-induced food intake.

This study aims at exploring the relationships of (1) hunger stress reactivity and (2) inhibitory control with actual distress-induced food intake in high versus low emotional eaters. As in most previous studies on emotional eating the focus is on females and on eating in response to *negative* emotions[3] (see also Gibson, 2012). Earlier, we found that emotional eating significantly moderated the distress-food intake association, with low emotional eaters eating less after the stress than after the control task and high emotional eaters eating more. For the present study we hypothesized that this moderator effect of emotional eating would be more likely to hold true for participants with an a-typical hunger stress response (failure to show the typical reduction of hunger after stress), and for participants with high inability to stop motor impulses (poor inhibitory control). Specifically, participants who combined an a-typical hunger stress response or poor inhibitory control with high emotional eating were expected to eat more after the stressor than those with the typical hunger stress response and adequate inhibitory control. We left it an open empirical question whether this possible moderator effect of hunger stress reactivity on the moderator effect of emotional eating on distress-induced food intake would be mediated by poor interoceptive awareness or alexithymia.

Methods

Design

We used a within-subjects design in which females who were preselected on the basis of extremely high or low scores on an emotional eating questionnaire were subjected to a control task and a stress task (Trier Social Stress Task – TSST) on 2 consecutive days. The TSST involves speaking in front of a jury coupled with an arithmetic challenge. Because the stress condition is perceived by some subjects as quite stressful, we deliberately chose to always start with

[2] Results of a sub-sample of 47 participants, the data of which had been collected in spring and autumn of 2010, have been reported in two previous publications (van Strien et al., 2012a, Study 2; van Strien et al., 2013b). They address, respectively, the moderation of distress-induced eating by emotional eating scores, and cortisol reactivity and distress-induced emotional eating. The data of the additional participants for the present study were collected in spring 2012.

[3] While recognizing that eating in response to positive emotions may occur as frequently as eating in response to negative emotions, there is increasing evidence that eating in response to negative and to positive emotions may refer to different constructs (Nolan, Halperin, & Geliebter, 2010; van Strien et al., 2013a). One reason may be that we tend to celebrate happy events with food. Eating in response to positive emotions, unlike eating in response to negative emotions, can therefore not be considered an 'inapt' or 'inappropriate' response. Accordingly, it can be expected that self-assessed emotional eating in response to positive emotions has a main effect on food intake, whereas self-assessed emotional eating in response to negative emotions only shows an effect on food intake in interaction with distress.