



Review

Assessing the relationship between rumination and cortisol: A review

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ARTICLE INFO

Article history:

Received 7 September 2011
 Received in revised form 11 March 2012
 Accepted 15 March 2012

Keywords:

Cortisol
 HPA axis
 Literature review
 Perseverative cognition
 Rumination
 Stress

ABSTRACT

Objective and methods: For individuals who ruminate, or mentally rehearse past stressful events, the physiological effects of a stressor may be longer lasting. This is well-supported within the cardiovascular domain. In the context of the hypothalamic–pituitary–adrenal (HPA) axis and cortisol, the results are inconsistent. This review summarizes key theoretical and methodological issues that contribute to these mixed findings among the 15 studies to date that have examined the association between rumination and cortisol.
Results: State measures of rumination were consistently linked to increased cortisol concentrations. Stress-related rumination questionnaires were often positively associated with cortisol, whereas depression-related rumination scales predicted lower cortisol concentrations or were unrelated to cortisol. Rumination manipulations in the laboratory (e.g., ruminative self-focused writing tasks compared to distraction writing tasks) influenced cortisol concentrations, but often did not increase cortisol relative to baseline values. Studies that utilized social-evaluative stressor tasks to examine the relationship between rumination and cortisol levels generally showed that rumination predicted greater cortisol reactivity or delayed recovery. Results from studies examining rumination and basal cortisol or the cortisol awakening response were inconsistent.
Conclusion: The ways in which researchers conceptualize and assess rumination and the associated cortisol response influences the association between rumination and cortisol. Suggestions for future studies in this area of research are provided.

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Introduction

Stress can have profound consequences on our bodies, and an abundance of research has documented the wide range of negative effects that stressors can have on health [1]. For individuals who ruminate, or mentally rehearse past stressful events, the physiological effects of a stressor may be longer lasting. This could happen via slower physiological recovery, or longer time to turn off the response. For example, elevated levels of stress hormones may continue to circulate in the body long after an argument has ended for those who dwell on it. In addition, subsequent recall of a stressor could serve to reactivate the stress response later in time. For instance, thinking about yesterday's argument may trigger increases in blood pressure again today. Both of these pathways may lead to persistent activation of stress-related systems as outlined by the Perseverative Cognition Hypothesis [2]. The majority of evidence supporting the hypothesis that perseverative cognition, such as rumination, may prolong the physiological activation originates from the cardiovascular domain [2]. A growing body of research has also examined this model in the context of the hypothalamic–pituitary–adrenal (HPA) axis and its end-product, cortisol [3].

The HPA axis is a major stress response system that is critical for survival and adaptation, and may be particularly relevant in understanding the adverse effects stressors may have on health. Release of cortisol in response to certain stressors may be adaptive in the short term, as it leads to behavioral and physical changes to deal with the acute threat [1]. Prolonged exposure to cortisol from exaggerated, extended, or repeated activation of the HPA axis, however, may be maladaptive. Indeed, a range of disorders, including insulin resistance and cardiovascular disease, have been associated with persistent activation of the HPA axis [4]. Therefore, identifying and targeting factors, such as rumination, that may lead to excessive cortisol exposure could have important health implications.

The studies that have thus far examined the association between rumination and cortisol have produced inconsistent results. Factors contributing to the mixed findings include variability in conceptualization, measurement, and manipulation of rumination, as well as differences in cortisol assessment (e.g., basal cortisol versus cortisol responses to stressors). This review summarizes these key theoretical and methodological issues, discusses these factors in the context of the 15¹ published studies to date that have examined the association between rumination and cortisol, and provides suggestions for future studies in this rapidly-growing area of research. In this review, the study results have been organized by rumination measure and manipulation as well as by cortisol assessment.

Rumination: definition and elicitors

Rumination has been defined in multiple ways and across a variety of contexts and is largely characterized by repetitive, unwanted, past-oriented thoughts about negative content [5,6]. Rumination is generally considered to be maladaptive in nature and it has been implicated in the exacerbation and maintenance of a variety of adverse mental health outcomes, including depression [7], social anxiety [8],

and post-traumatic stress disorder [9]. Rumination is related to another perseverative cognition construct: worry. Worry often refers to a cognitive focus on real or imagined upcoming negative events [10]. Worry is linked to the fear process and is associated with anxiety, apprehension, and general tension [11]. Rumination and worry are similar in that they are both characterized by repetitive negative thought [6]. If these constructs are operationalized as cognitive representations of stressors (either past or future), then we may expect to find similar associations with cortisol outcomes for both rumination and worry. However, substantial heterogeneity among measures and manipulations exist within and between studies of each respective construct. Given the significant variation in construct operationalization among rumination research and worry research, as well as variability in cortisol assessment, the current review is limited to only rumination and cortisol studies.

The determinants of rumination are multifaceted; individual differences as well as situational characteristics may play a role in triggering and maintaining ruminative thought. Theoretical models and empirical research suggest that rumination is a fairly stable coping strategy and that certain individuals are more prone to perseverate than others [5]. For example, trait measures of neuroticism, negative affectivity, and low internal locus of control have been associated with the tendency to ruminate [12,13]. As a result, a great proportion of research has focused on rumination as a trait phenomenon, and multiple questionnaires have been created to assess the predisposition to ruminate [5,6].

Specific situations or circumstances can be potent elicitors of ruminative thought, despite (or in addition to) an individual's general tendency to ruminate. Several theories point to discrepancies between desired and actual states, such as threatened or blocked goals, as likely triggers of rumination. According to goal-fulfillment and discrepancy models, problematic goal progress leads to repetitive negative thought and self-focus as the mind continues to focus on the unresolved goal [12,14,15]. This ruminative thinking is expected to persist until the discrepancy is reduced—typically by goal attainment or disengagement from goal pursuit. Furthermore, these models predict that disruptions of goals that are central to one's well-being are more likely to trigger rumination than those that are trivial or less relevant to the individual.

One such type of situation likely to trigger rumination is social-evaluative threat (SET). In rejecting and evaluative situations, the fundamental needs of social belonging and acceptance are threatened [16]. This threat prevents the satisfaction of the social self-preservation goal and leads to a discrepancy between one's actual self and one's ideal self. As a result, rumination is likely to occur. Consistent with this premise, recent work has demonstrated that laboratory stressors characterized by SET elicit more rumination than those without an evaluative component [17,18]. Therefore, stressful circumstances that disrupt central goals (e.g., SET) may be particularly likely to lead to rumination, and thus prolong the stress response.

SET, rumination, and cortisol

Conditions in which central goals are threatened or blocked are also potent elicitors of cortisol. This is well illustrated with social self-preservation theory [16]. According to this model, SET takes place when an important aspect of the self-identity is or could be negatively judged by others (e.g., rejection). In response to real or perceived negative social evaluation by others, one may engage in negative self-evaluation and consequently experience shame and other self-conscious emotions and cognitions. These emotional responses to SET, in turn, coordinate

¹ An online search of PubMed and PsycInfo was conducted with “cortisol” or “HPA” and the stem “ruminat” as keywords. “Humans” and “English” were set as limitations. This yielded a total of 19 empirical papers (from 18 unique studies) as of September 2011. Three studies were excluded: one did not measure cortisol; one did not assess or manipulate rumination; and one did not report on the association between rumination and cortisol.

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