Mindfulness is Associated with Lower PM Cortisol, Less Day-to-Day Variability of the Cortisol Awakening Response, and Reduced Reactivity to Separation-related Sadness

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Presentation No. 1040

Introduction

Overall Question: Is mindfulness related to cortisol?

PM Cortisol: If stress-related cortisol release is sustained, it can contribute to pre-disease pathways.1 The human capacity to sustain psychological stress by ruminating over past or future stressors can escalate cortisol.2 It follows that maintaining a mindful focus (e.g., directing attention toward immediate experience and away from stressors that are not immediately present) may reduce cortisol.

Prediction 1. Mindfulness will be related to lower PM Cortisol.

The Cortisol Awakening Response: Cortisol sharply increases after waking. This increase is dependent on retrograde or prospective memories that become active as one awakens.3 It may function to provide a physiologic boost in preparation for anticipated demands. Chronic worrying predicts greater day-to-day variability of the awakening response.4

Prediction 2. Mindfulness will be related to less day-to-day variability of the cortisol awakening response.

Sadness-related Cortisol: Longer term intervention studies that involve attachment (i.e., instructors or peers may involve separation-related sadness or loneliness) increase the level of cortisol.5 Such cortisol responses may be greater if HPA-axis reactivity has been up-regulated, which may result from frequent activation of the HPA axis (e.g., ruminate thought), as the neuroendocrine system adapts to a higher, chronic demand.6 A mindful focus on present experience may reduce the frequency of HPA-axis activation, which may down-regulate HPA-axis reactivity, and in turn attenuate the cortisol response to separation-related sadness.

Prediction 3. Mindfulness will reduce cortisol reactivity to separation-related sadness.

Methods

Overall Study Design: Self-reported mindfulness and sadness were assessed before and after a 3-month, concentrated meditation retreat and related to measures of cortisol.

Mindfulness

Cortisol (3 consecutive days) Mindfulness

Sadness (3 consecutive days)

PRE-RETREAT Post-retreat Mindfulness

Measure

Participants: A healthy, non-clinical sample (N = 60; age range 22-69) was recruited. Complete data across all variables, was collected for N = 56.

Meditation Training: (instruction and practice was primarily concentrative meditation [shamatha], where attention is directed toward a chosen object (e.g., breathing) and away from distracting thoughts.8 Supporting emotion-regulation techniques were also practiced.9 Data from two identical retreats were combined. Participants reported 6 hrs of practice per day.

Mindfulness Measure: Assessed using the Five Factor Mindfulness Questionnaire. Two of the facets (Mindful Observeing and Mindful Acting With Awareness) must closely parallel the meditation practices in the present study. These two facets were averaged and related to cortisol.

Sadness Measure: Assessed using the Positive and Negative Affect Scale. Items included sad, alone, and lonely.

Saliva Collection and Cortisol Assay: Saliva was collected at waking, 30-mins after waking, 2 hrs after lunch, and bedtime. Cortisol concentrations were estimated (nMol/L) using commercial radioimmuno kits.


Pre-Post Effects of the Meditation Retreat

Mindfulness

Sadness Cortisol: PM Cortisol: Awakening response variability

* p < 0.001

Cortisol Reactivity to Sadness

Linear regression. Changes in sadness predicted changes in PM cortisol: Post-retreat sadness significantly predicted post-retreat PM cortisol, after controlling for all pre-retreat baselines, as well as covariates (F = 13.6, p = .002).

Mindfulness & Cortisol Reactivity to Sadness

Linear regression: The sadness-cortisol relation was dependent on mindfulness, although the effect was marginal: The interaction term, post-retreat mindfulness x post-retreat sadness, predicted PM cortisol at post retreat (F = 5.2, p = .03, controlling for all pre-retreat baselines and covariates, at a marginal value (F = 24, t = 3.44, p < .07). Predicted values, derived from the regression, are shown below.

Mindfulness & Cortisol Reactivity to Sadness


day to day variability of cortisol awakening response

Mindfulness & Cortisol Reactivity to Sadness

Summary & Interpretation

Higher mindfulness was significantly related to lower PM cortisol and less day-to-day variability of the cortisol awakening response. These are the first data to report direct relations between cortisol and self-reported mindfulness.

An increase in sadness was associated with higher PM cortisol, consistent with previous studies. Although mindfulness moderated this relation, the effect was only marginally significant, possibly due to low statistical power.

We speculate that learning to mindfully focus on the present may affect cortisol (PM levels, reactivity to waking, reactivity to sadness) by reducing the frequency of HPA-axis activation (as preoccupations with past or future stressors attenuate), which may down-regulate HPA-axis reactivity, as the neuroendocrine system adapts to a lower level of demand.