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No PTSD-related differences in diurnal cortisol profiles of genocide survivors

Cindy Eckart [a,*], Harald Engler [b,c], Carsten Riether [b], Stephan Kolassa [d], Thomas Elbert [a], Iris-Tatjana Kolassa [a,e,]**

[a] *Clinical Psychology & Neuropsychology, Department of Psychology, University of Konstanz, Germany*
[b] *Psychology & Behavioral Immunobiology, Institute for Behavioral Sciences, ETH Zurich, Switzerland*
[c] *Institute of Medical Psychology & Behavioral Immunobiology, University Hospital of Essen, University of Duisburg-Essen, Germany*
[d] *Research & Innovation, SAF Simulation, Analysis & Forecasting AG, Tägerwilen, Switzerland*
[e] *Zukunftskolleg, University of Konstanz, Box X 916, 78457 Konstanz, Germany*

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Summary Posttraumatic stress disorder (PTSD) has been associated with reduced cortisol levels. Opposing results have been interpreted as resulting from methodological differences between studies. We investigated the diurnal profile of salivary cortisol in a population of highly traumatized adult males from Rwanda with and without PTSD, who spent the whole day of examination together under a maximally standardized schedule. Besides the detection of PTSD-related alterations in cortisol release we aimed at determining physiologically relevant effects of cumulative trauma exposure on HPA functioning in interaction with or independent of diagnosis.

There were no differences in the diurnal pattern of cortisol release between subjects with and without PTSD. We observed an increasing prevalence of PTSD with increasing number of different traumatic event types experienced, replicating earlier results on a ''building-block effect'' of multiple traumatization. However, size of cumulative exposure was not related to any of the cortisol measures.

The results suggest that besides methodological constraints also confounding factors not previously controlled for, e.g., sex differences or current life stress, might contribute to the diverging results of lowered, unchanged or enhanced cortisol secretion in PTSD. Future research should therefore closely monitor these possible confounds to optimize models for cortisol in research on stress-dependent illnesses.

* Corresponding author at: University of Konstanz, Universitätsstr. 10, 78457 Konstanz, Germany. Tel.: +49 7531 88 3086; fax: +49 7531 88 4601.
** Corresponding author at: University of Konstanz, Universitätsstr. 10, 78457 Konstanz, Germany. Tel.: +49 7531 88 4003; fax: +49 7531 88 4601.
E-mail addresses: cindy.eckart@uni-konstanz.de (C. Eckart), iris.kolassa@uni-konstanz.de (I.-T. Kolassa).

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1. Introduction

The hypothalamus-pituitary-adrenal (HPA) axis is one of the key systems mediating the physiological reactions to acute and chronic stress (McEwen, 2000; Smith and Vale, 2006). Increased cortisol concentrations have been shown subsequent to multiple psychological and physical stressors (for a review see Kirschbaum and Hellhammer, 1994). In the short run an enhanced secretion of cortisol promotes adaptation to the challenges of the stressor through a process known as allostasis. In the long run, however, repeated stress might cumulate to a dysregulation of endocrinological mechanisms referred to as allostatic (over)load (McEwen, 2005). In line with this theoretical framework, chronically elevated cortisol levels were found in populations reporting continuously high life stress (Luecken et al., 1997; Powell et al., 2002) and in men of low socioeconomic status (Steptoe et al., 2003; Cohen et al., 2006). Furthermore, it has been suggested that sustained high life stress may lead to an enhanced cortisol variation (Kaspers and Scholz, 2004), which might partly be due to inter-individual differences in the reactivity to and recovery from stress (Kirschbaum et al., 1995; Roy et al., 2001).

Posttraumatic stress disorder (PTSD) is a psychiatric condition that may emerge in the aftermath of a potentially life-threatening experience. Since traumatic experiences imply an extreme stress for the organism, it has been suggested that persistent alterations in HPA axis functions might also be involved in the pathophysiology of PTSD. A substantial amount of research has focused on the diurnal profile of cortisol secretion in PTSD. Most of these studies reported lowered cortisol levels in subjects with PTSD: in a chronobiological analysis, a diminished cortisol secretion in PTSD patients was reported especially during the late evening and early morning hours (Yehuda et al., 1996). In an attempt to replicate these findings in a geriatric sample, Yehuda et al. (2005) found a slightly different pattern: elderly subjects with PTSD showed lowered cortisol levels at the time of awakening and at 08:00 h but increased salivary cortisol at 20:00 h, resulting in a flattened diurnal pattern of cortisol release (Yehuda et al., 2005). This pattern, in conjunction with an overall reduction of cortisol levels, has also been observed in Croatian (Lauc et al., 2004) and Bosnian (Rohleder et al., 2004) war refugees. Taken together, these data provide evidence for a diminished cortisol secretion in PTSD.

However, several studies have found opposing results as well. The diurnal cortisol profiles of women formerly subjected to childhood sexual abuse (Altemus et al., 2003) and of subjects from a low-income community (Young and Breslau, 2004; Young et al., 2004) showed no PTSD-related differences at all. Elevated cortisol levels on the other hand were found in women abused by their intimate partner (Inslicht et al., 2006). So far these discrepancies have mainly been attributed to methodological differences between studies. Co-morbid psychiatric illnesses, substance abuse, current medication, the time interval since traumatization and deficiencies in the standardization of the daily schedule of the subjects might interfere with PTSD-related endocrinological alterations (Rasmusson et al., 2003).

Furthermore the extent of traumatization might affect the cortisol release as well. A strong correlation has been documented between the number of different traumatic events reported by the subject and the diagnosis as well as symptom severity of PTSD (building-block effect; Neuner et al., 2004, 2006; Dohrenwend et al., 2006; Kolassa and Elbert, 2007). This finding might be interpreted in line with the assumption that repeated stress might enhance the allostatic load of an individual, resulting in increasing biological (e.g. cardiovascular and endocrinological dysregulation) and behavioral (e.g. antisocial responses, risk taking behaviors) consequences for the organism (McEwen, 2000; McEwen, 2005). Referring to this theoretical framework the cumulative exposure to traumatic events in interaction with or independent of PTSD might not only be reflected in stronger PTSD symptoms but might also alter the secretion of cortisol. This has also been supposed by Friedman et al. (2007) who investigated the 24-h urinary cortisol profile of women suffering from PTSD due to childhood sexual abuse. Women who were recurrently abused during their adulthood showed elevated cortisol levels compared to women without a history of repeated traumatization (Friedman et al., 2007).

In this study, we investigated the diurnal profile of cortisol release in a population of adult African refugees who had fled during the time of the Rwandan genocide (1994) to the Nakivale refugee camp in south-western Uganda. We exclusively concentrated on male subjects, as changes of basal saliva cortisol during the menstrual cycle cannot be ruled out (Kirschbaum et al., 1999). Our population is particularly homogenous, differing from those examined in previous studies in that all participants had (1) repeatedly experienced very similar traumatic events during the Rwandan genocide, (2) shared similar life circumstances before and during execution of the study, (3) received no psychiatric medication, (4) lived under natural circadian day—night rhythms (due to a lack of electricity in the camp), (5) showed almost no use of psychoactive substances (due to limited availability), (6) spent the whole day during the examination together in a maximally standardized daily schedule including food intake and rest, and (7) gave their saliva samples at exactly the same time. This design allowed us an exact monitoring of methodological factors previously proposed as reasons for the inconsistent findings in the endocrinological research on PTSD. As our non-PTSD control group was traumatized as well, we should furthermore be able to detect physiologically relevant effects of cumulative trauma exposure on HPA functioning (i.e. a building-block effect of trauma load on cortisol levels) in interaction with or independent of PTSD diagnosis.

2. Methods

2.1. Setting

Sixty male refugees participated in the study. All subjects had experienced traumatic events in conjunction with the Rwandan genocide in 1994 and subsequent persecution by Rwandan officials. Diagnostic procedures took place in the preparation phase of the study. Participants remained one entire day together at a designated place (in groups on three consecutive days) for cortisol specimen collection. Prior to the beginning of the study, the purpose of the investigation was explained in detail and informed consent was acquired. The study was conducted in accordance with the Declaration