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Cortisol dysregulation in school teachers in relation to burnout, vital exhaustion, and effort–reward-imbalance

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Abstract

We analyzed whether burnout and vital exhaustion or job-related chronic stress is associated with hypothalamic-pituitary–adrenal (HPA) axis dysregulation in school teachers ($N = 135$; 25–63 years; mean age 46.1 ± 9.20 years). Participants collected seven saliva samples (0, 30, 45, and 60 min after awakening, 11 a.m., 3 p.m., 8 p.m.) on 2 working days, 1 leisure day, and after pre-medication with 0.25 mg dexamethasone (very low-dose dexamethasone suppression test) to assess basal cortisol day profiles and HPA axis negative feedback sensitivity. No associations were found between basal cortisol activity and burnout (Maslach burnout inventory, teacher burnout scale), vital exhaustion (Appels vital exhaustion questionnaire), or any component of Siegrist's effort–reward-imbalance model. However, after dexamethasone higher burnout and vital exhaustion and lower reward were significantly related to stronger cortisol suppression, pointing to altered HPA axis negative feedback sensitivity. Though, all teachers were working and in a good health status, burnout/exhaustion as well as facets of the ERI model appear to be associated with subtle dysregulation, manifested as heightened HPA axis negative feedback although not in basal cortisol day profiles.

Keywords: Burnout; Vital exhaustion; Effort–reward-imbalance; HPA axis; Salivary cortisol; Dexamethasone suppression test (DST); Teacher stress

1. Introduction

Early retirement due to chronic work stress is a major problem among German school teachers. Recently, Weber et al. (2002) analyzed 605 case reports and found that the predominant factors leading to premature retirement in teachers are psychosomatic disorders, with depression and exhaustion/burnout (BO) being the most common amongst them.

Burnout is a non-psychiatric syndrome principally defined by the three-core dimensions emotional exhaustion, work-related cynicism, and feelings of work inefficacy or reduced productivity. It has been proposed that BO is a prolonged response to chronic emotional and interpersonal stress usually accompanied by insufficient recovery (Maslach et al., 2001). BO is often accompanied by reports of physical symptoms such as recurrent headaches, gastro-intestinal discomfort, disturbed sleep patterns, or non-specific pain and has been positively associated with various illnesses such as infections, cardiovascular diseases, or type 2 diabetes (reviewed in Melamed et al., 2006). Though BO pervades every occupation, it is thought to be more prevalent among service and people-oriented professionals such as teachers, health practitioners, caregivers, fire fighters, and policemen (Maslach et al., 2001; Melamed et al., 2006).

Vital exhaustion (VE), a psychological concept that originates from clinical work with cardiovascular patients, is closely related to the burnout syndrome and was originally identified as an independent risk factor for coronary artery disease (for reviews see Kop, 1999; Appels, 2004). VE is thought to be a potential consequence of long-term stress or chronic BO, resulting in excessive fatigue, loss of mental and physical energy, increased irritability, and feelings of demoralization.

The hypothalamic-pituitary–adrenal (HPA) axis, a key stress-responsive endocrine system, may link both BO and VE to the observed health impairments. The HPA axis regulates the adaptation to increased demands and enables the organism to maintain homeostasis under acute stress. However, exposed to chronic stress an originally adaptive response can have numerous deleterious consequences.

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Both hyper- and hypo-activity of the HPA axis have been associated with stress related pathologies (for reviews see Heim et al., 2000; Raison and Miller, 2003). For example, hypercortisolemia is often found in major depression (for reviews see Holsboer, 2001; Parker et al., 2003) while hypocortisolemia was found in PTSD (Rohleder et al., 2004), fibromyalgia (Demitrack and Crofford, 1998), and chronic fatigue syndrome (Demitrack, 1997; Gaab et al., 2002).

In ambulatory settings, HPA axis dysregulation is best assessed by investigation of the salivary cortisol awakening response (CAR) and the diurnal secretory activity (Edwards et al., 2001; Kudielka and Wüst, 2008). The cortisol day profile covers the peak waking level, the decrease over the course of the day and low evening levels. An important advantage of salivary cortisol assessment is that repeated saliva collections can be accomplished outside the laboratory, for example in the workplace (Soo-Quee Koh and Choon-Huat Koh, 2007; Kudielka and Wüst, 2008). The dexamethasone suppression test (DST) can be applied for the assessment of negative feedback sensitivity of the HPA axis. The synthetic glucocorticoid dexamethasone binds selectively, and with high affinity to the glucocorticoid receptor (GR). Dexamethasone, acting primarily at the level of the pituitary, inhibits ACTH release and subsequent cortisol release, thereby mimicking the negative feedback effects of endogenous cortisol. Hence, feedback sensitivity is indicated by the extent of cortisol suppression after oral dexamethasone intake (de Kloet et al., 1998; Cole et al., 2000).

To-date, there is a paucity of data on psychophysiological correlates of BO and even fewer studies report on HPA axis regulation in vitally exhausted though still working employees (Kudielka et al., 2006a; Soo-Quee Koh and Choon-Huat Koh, 2007). Naturally, most ambulatory studies with sampling at the workplace have been constrained in terms of number of volunteers, quantity of samples or assessment days, ranging from single blood draws or urine collections to repeated salivary cortisol sampling at work and/or non-work days. The DST is however rarely applied in ambulatory assessments of stress at work although it is routinely used in clinical settings.

The existing literature on HPA axis functioning in BO is rather inconsistent (for a recent review see Kudielka et al., 2006a), with some studies reporting no associations between cortisol levels and BO (CAR: Langelaan et al., 2006; CAR + diurnal profile: Mommersteeg et al., 2006a), and others reporting on either HPA axis hyperactivity (CAR + 12 a.m. salivary sample: De Vente et al., 2003; CAR: Grossi et al., 2005; CAR + diurnal profile: Söderström et al., 2006) or hypoactivity (CAR: Pruessner et al., 1999; Sonnenschein et al., 2007; CAR + diurnal profile: Mommersteeg et al., 2006b). Of the four studies on HPA axis feedback sensitivity (all using 0.5 mg dexamethasone), two did not find any associations with BO (Langelaan et al., 2006; Mommersteeg et al., 2006a) while Pruessner et al. (1999) observed greater cortisol suppression after dexamethasone intake in teachers scoring high versus low on BO. Sonnenschein et al. (2007) found a positive association between more severe BO symptoms and stronger cortisol suppression in 42 burnout patients using the experience sampling method, an effect which could not be observed with retrospectively assessed BO by questionnaire. While the VE literature is scarce, the majority of studies show a down-regulation of the HPA axis under basal conditions and acute (laboratory) stress (Kristenson et al., 1998; Nicolson and van Diest, 2000; Kudielka et al., 2006b).

Psychosocial workplace characteristics have recently been implicated in the genesis of chronic work stress (Siegrist et al., 2004). The effort–reward-imbalance (ERI) model postulates that a lack of reciprocity between personal costs (effort) and personal gains (reward) at the workplace leads to stress and that ERI consequently increases the risk for stress-related disorders. In this model, the inability to withdraw from work obligations is additionally conceptualized as a personality trait called overcommitment (OC). Indeed, ERI and OC have been shown to be related to self-reported health (Kudielka et al., 2005), VE (Preckel et al., 2005) as well as manifest health problems (for recent review see van Vegchel et al., 2005). To-date, only three studies have investigated the association between ERI/OC and HPA axis regulation. While Hanson et al. (2000) could not find significant associations, the two others report on (minor) positive relationships between cortisol levels and variables derived from the ERI/OC model (Steptoe et al., 2004b; Eller et al., 2006).

The aim of this study was to investigate possible HPA axis dysregulation in either BO, VE, or ERI/OC using a relatively broad sampling design. Daily cortisol profiles consisting of seven time points were measured across 2 working days, 1 leisure day, and after a very low-dose DST (0.25 mg).

2. Methods

2.1. Participants and general experimental outline

One hundred and ninety currently employed school teachers were recruited by personal visits to local schools and via newspaper announcements in the region of Trier (Germany) and Luxembourg (Luxembourg). Eligibility, demographics, current health status, and health behaviour (smoking status, medication intake) were assessed by telephone interview. Exclusion criteria for all participants included psychiatric disorders, diabetes, pregnancy, and corticosteroid or psychotropic medication. Eligible volunteers were mailed a package of psychometric assessment questionnaires and invited for a laboratory visit (Bellingrath et al., submitted). Participants received the domestic saliva sampling materials together with both spoken and written instructions, and a prepaid return envelope. The study protocol was approved by the ethics committee of the University of Trier as well as the Rheinland-Pfalz State Medical Association. Written informed consent was provided by all participants. Participants received €50 after completion of the study protocol.

2.2. Psychological assessment

2.2.1. Demographics

Demographic variables (gender, age, years of employment, and type of school) were recorded based on verbal and written self-reports at the telephone interview and laboratory visit.

2.2.2. Burnout

BO was measured using a validated German version (Schwarzer and Jerusalem, 2001) of the Maslach burnout inventory (MBI) (Maslach and Jackson, 1986). The MBI is composed of three subscales (MBI-EE: emotional exhaustion; MBI-DP: depersonalization; and MBI-LA: lack of accomplishment) with a total