AWAKENING CORTISOL IS DEPENDENT ON AWAKENING TIME BUT AWAKENING RESPONSE IS NOT
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INTRODUCTION
Cortisol has widely been used as a measure of strain at work and in sport settings. Cortisol awakening response (CAR) has been shown to be a discrete part of the circadian cortisol rhythm, and the magnitude of CAR has been linked to general chronic stress and work stress (1). Some studies have reported that awakening time (AT) affects CAR (e.g. 2), while others have not found such a connection (e.g. 3). To further clarify the inconsistent results, this study evaluated whether AT is related to either awakening cortisol (AC) or CAR. In addition, connections between autonomic cardiac modulation during sleep and awakening cortisol values were examined.

METHODS
Ambulatory ECG and activity recordings were conducted in 27 healthy women, of whom 26 were members of cleaning staff and one was a supervisor, using Alive Heart Monitors for 2.5 workdays, including 3 consecutive nights. After the second night-sleep, saliva cortisol samples were collected with strict reference to AT immediately (AC0), 30 (AC30), and 60 minutes (AC60) after awakening. The samples were accompanied with ratings of perceived stress on a 6-point scale (not at all – very much) and averaged to express the self-reported stress level. AT was confirmed from ECG, movement and posture data in addition to self-reports. Saliva samples were analyzed with IBL-Hamburg LIA. CAR was calculated as the area under curve for the 60-min period with respect to increase (AUCi) and as the change in absolute values (AC60-AC0=CAR60 and AC30-AC0=CAR30). Heart rate (HR), heart rate variability (HRV) and stress and relaxation indices based on HR and HRV were analyzed from ECG data with Firstbeat PRO heart-beat analysis software for the sleep period.

RESULTS
AT ranged from 3:30 to 6:58 (5:08±1:01), and it was positively associated with AC0 (r=−.517, p<0.01), but not with CAR or self-reported stress. Self-reported stress was not associated with CAR, but there was a tendency for a positive association between stress level and AC0 (r=−.351, p=0.073). Cardiac autonomic modulation (HR, HRV, stress and relaxation indices) during sleep was not associated with cortisol variables, even when age and/or self-reported stress were controlled.

DISCUSSION
The results showed that awakening time per se affects cortisol values after awakening, but it does not seem to be associated with the magnitude of CAR. The results also suggest that other factors than cardiac autonomic modulation during sleep might be more closely related to cortisol values. The physiological significance of CAR remains to be further elucidated.

REFERENCES
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