The Shape of Stress:
Differing autonomic patterns of response to an acute stress task

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Background

In examining the effect of acute psychological stress on physiology, it is important to understand how quickly these changes occur, whether they sustain throughout the entire stress period, and how quickly measures return to baseline during subsequent recovery. The purpose of this study was to measure and describe the effects of acute stress on a variety of physiological measures.

Method

Twenty-two female college students (mean age 20.2 (2.1)) were recruited for the study.

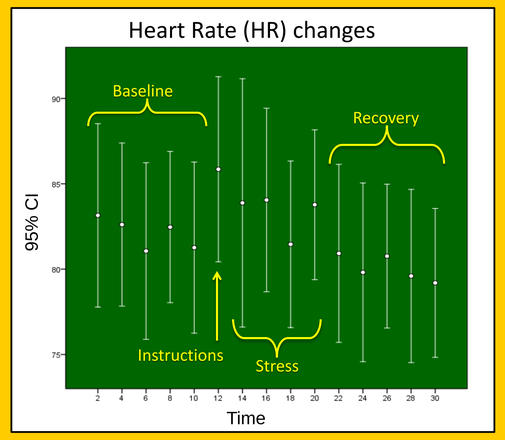
Participants sat quietly for a 10-minute rest period (**Baseline**), were given 2-minutes of task instructions, (**Task Instructions**) completed an 8-minute metal arithmetic stress task (Paced Auditory Serial Addition Task (PASAT); **Stress Task**), and then sat quietly for an additional 10-minute recovery period (**Recovery**).

A within-subjects design was used to examine changes in:

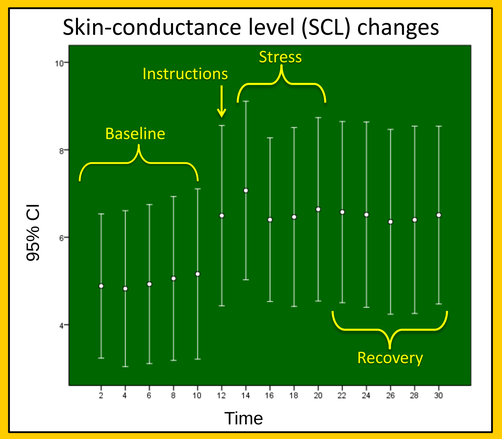
- Heart rate (HR) measured using a heart rate monitor
- Respiration rate (RR) measured using a respiration sensor
- Skin-conductance level (SCL) measured using a skin-conductance sensor
- Blood pulse volume (BVP; phasic change in blood volume with each heartbeat): measured using a photoplethysmograph

Results

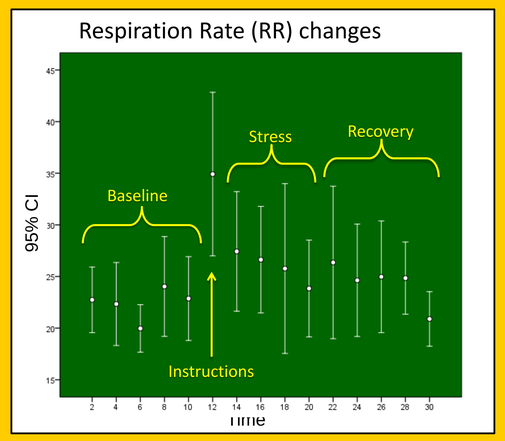
T-tests were conducted to test for significant differences between the last two minutes of the baseline period and (i) the 2-min period during which instructions for the stress task were given, (ii) the first 2-minutes of the stress task, (iii) the last 2-minutes of the stress task, and (iv) the final 2-minutes of the recovery period.



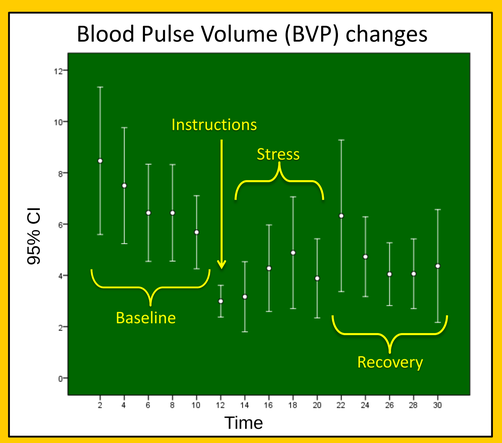
HR was significantly elevated after the task instructions (baseline M=81.2 (11.6), post instructions M=85.9 (12.6); t(24)=.-2.11, p<.045) but quickly recovered after instructions and was not significantly different from baseline measures during any portion of the stress task or recovery period.



SCL was significantly elevated after the task instructions (baseline M=5.1 (4.7), post-instructions M=6.4 (4.9); t(24)=-8.48, p<.001) and remained elevated throughout the rest of the session (final 2-mins of recovery period M=6.5 (4.9); t(24)=-.68, p<.001).



RR was significantly elevated after the task instructions (baseline M=22.86 (9.8), post-instructions M=34.9 (19.2); t(24)=-3.4, p<.002), but quickly recovered after instructions and was not significantly different from baseline measures during any portion of the stress task or recovery period.



BVP amplitude was significantly reduced after the task instructions (baseline M=5.6 (3.4), post-instructions M=3.0 (1.5); t(24)=.3.54, p<.001), remained significantly reduced throughout the stress task, but returned to baseline levels by the end of the recovery period.

Discussion

The present study demonstrates how a variety of physiological measures are differentially affected by task instructions, stress task, and recovery period. By using 2-minute averages, the study provides better temporal resolution of these changes – showing how the "shape" of stress varies depending on the modality being assessed. Several physiological measures showed rapid changes in response to the task instructions that sustained during the stress task itself while others measures showed return to baseline shortly after the instructions had ended. These results contribute to the evolving body of literature examining physiological responses to acute stress.

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