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### **A combination of multiple autonomic parameters, rather than each parameter alone, yields significant differentiation between heat pain intensities**

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**Background and aims:** Multiple attempts to correlate autonomic parameters to reported pain intensities have been conducted, yet with only limited success. The aim of the present study was to compare between a combination of multiple autonomic parameters and each parameter alone in their ability to differentiate between four categories of pain intensity.

**Methods:** Tonic heat stimuli (1 min) were individually adjusted to induce no-pain, mild, moderate and severe pain in 56 healthy volunteers. Electrocardiogram (ECG), Photo-Plethysmogram (PPG) and Galvanic Skin Response (GSR), were recorded and the following five parameters were calculated: Heart rate (HR), Heart Rate Variability - High Frequency (0.15–0.4 Hz) spectral power (HRV-HF), Skin Conductance Level (SCL), Number of Skin Conduction Fluctuations (NSCF), and Photoplethysmographic pulse wave Amplitude (PPGA). A linear combination of these parameters was created by fitting an ordinal cumulative logit model. Multiple Paired T-tests were used to compare between each two pain categories for each parameter alone and for their linear combination.

**Results:** Each parameter by itself successfully differentiated between 'no pain' and all other pain categories. However, none of the parameters could by itself differentiate between all three painful categories (i.e. between mild and moderate; moderate and severe; mild and severe). In contrast, the linear combination of all parameters significantly differed not only between pain and no-pain, but also between all painful categories ( $p < 0.001-0.016$ ).

**Conclusions:** The linear combination of five autonomic parameters, rather than each parameter alone, yielded significant differentiation between all heat pain intensities studied.

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