Pain increases arterial blood pressure (BP) in an intensity-dependent manner. US Army Tactical Combat Casualty Care guidelines recommend ketamine (a N-methyl-D-aspartate receptor antagonist) or fentanyl (a μ-opioid receptor agonist) for pain management in the prehospital setting. It is unclear if pain perception and related BP responses are different between these analgesics.

**PURPOSE:** We sought to determine if reductions in pain perception and BP responses during a cold pressor test were different between ketamine or fentanyl administration.

**METHODS:** Thirty-four healthy participants (16M/18F; 28±6 y; 26.3±3 kg·m⁻²; systolic BP 122±12 mmHg, diastolic BP 73±8 mmHg) completed two experimental visits in random crossover fashion, receiving either intravenous drug administration (n=22 with 20 mg ketamine, n=5 with 75 µg fentanyl, n=7 both crossover trials) or placebo (saline). Four minutes post-drug infusion, a cold pressor test was performed by placing the participant’s hand in an ice water bath (−0.4°C) for two minutes. Pain perception was assessed using a 10-cm visual analogue scale immediately after the cold pressor test. Peak BP responses were calculated as the increase in BP during the second minute of the cold pressor test relative to BP just before the onset of the cold pressor test (post-infusion). Pain perception and peak mean BP changes were compared between drugs and placebo using one-way ANOVAs and Tukey’s post hoc tests.

**RESULTS:** Post-infusion, resting mean BP was higher (p<0.01) following ketamine compared to both fentanyl and placebo administrations (Ketamine: 106±13 mmHg; Fentanyl: 91±13 mmHg; Placebo: 93±8 mmHg; main effect: p<0.01). Ketamine and fentanyl similarly (p=0.66) attenuated pain perception to the cold pressor test compared to the placebo conditions (Ketamine: 2±3 cm; Fentanyl: 3±1 cm; Placebo: 7±1 cm; main effect: p<0.01). Consistent with reductions in pain perception, ketamine and fentanyl similarly (p=0.86) attenuated the peak mean BP response during the cold pressor test compared to placebo conditions (Ketamine: Δ 6±7 mmHg; Fentanyl: Δ 6±5; Placebo: 12±8 mmHg; main effect: p<0.01).

**CONCLUSIONS:** These preliminary data suggest that ketamine and fentanyl similarly blunt pain perception and the associated BP response to a cold pressor test, despite ketamine raising BP.

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**Analgesics In The Pre-hospital Setting: Fentanyl Does Not Alter Tolerance To Simulated Hemorrhage In Humans**

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Hemorrhage is the leading cause of battlefield and civilian trauma deaths. Given that a hemorrhagic injury on the battlefield is usually associated with pain, it is paramount that the administered analgesic does not disrupt the physiological mechanisms that are beneficial towards the maintenance of blood pressure and vital organ blood perfusion during that hemorrhagic insult. Current guidelines from the US Army’s Committee on Tactical Combat Casualty Care (CoTCCC) for the selection of pain medications administered to a hemorrhaging soldier are based upon limited scientific evidence, with the majority of supporting studies being conducted on anesthetized animals. Specifically, the influence of fentanyl, one of three analgesics employed in the pre-hospital setting by the US Army, on hemorrhagic tolerance in humans is entirely unknown.

**PURPOSE:** The aim of this study is to test the hypothesis that fentanyl impairs the capacity for a conscious human to tolerate a simulated hemorrhagic insult.

**METHODS:** Fourteen subjects (8 females, 27±7 years old, 173±9 cm; 77±12 kg; 2012) were recruited. Statin (S) users were matched by age, sex, VO₂ max, 2% incline; WBGT 23.42±0.77°C) about two weeks prior to the race. Measures of heart rate (HR), rectal temperature (Trec) and race finish time (min) were collected. Paired samples t-tests were conducted to evaluate delta values for variables collected at pre to post HTT and pre to post race day. Significance was set a priori at p<0.05.

**RESULTS:** Five S users (3 males, 2 females) were identified. Demographic data for S and S same sex CON were: age, 53±8y; 51±10y; height 168±7 cm; 71±11 cm; VO₂max 44.46±14.00mmol·kg⁻¹·min⁻¹; 45.66±10.77ml·kg⁻¹·min⁻¹; and BSA 1.75±0.18m², 1.86±0.18m², respectively. Pre to Post HTT Trec delta for S (0.97±0.25°C) and CON (1.24±0.53°C) were similar (p>0.05). Pre to Post race Trec delta for S (2.64±1.30°C) and CON (2.67±1.43°C) were similar (p>0.05). Pre to Post HTT HR delta for S (17±9 bpm) and CON (19±13 bpm) were similar (p>0.05). Pre to Post race day HR delta for S (38±28 bpm) and CON (65±23 bpm) were significantly different (p=0.012). Finish time on race day was similar between S (60.9±11.8) and CON (60.5±10.7min).

**CONCLUSION:** While HR and Trec delta values appeared to be similar during submaximal exercise, HR delta was significantly lower in the S group compared to CON during a race scenario, despite similar Trec delta values. This may be a result of the known influence statins have on skin blood flow and reflect a potential for changes in cardiovascular regulation during exercise in the heat when individuals regularly use statins. Future research is warranted to determine the source of these potential thermoregulatory responses and impact on heat related illnesses.

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**Impact Of Statin Use On Thermoregulatory Outcomes During Submaximal And Maximal Exercise**

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