Time-dependent Stress Response during High Performance Force-on-Force Training

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Summary: Close-quarters combat (CQC) engagements activate the "fight-or-flight" response which activates the sympathetic-nervous system (SNS) and hypothalamic-pituitary-adrenal (HPA) axis to respond to the perceived threats. However, currently there is a limited understanding of the biological response during force-on-force CQC environments.

Methods-Results: United States infantry personnel (*n*=24; 26.3 ± 0.3 yrs, 177.2 ± 0.3 cm, 85.4 ± 0.5 kg) participated in a 15-day CQC training program. The CQC program included large amounts of force-on-force training with the use of non-lethal training ammunition. Data collections occurred on training Days 1 and 4, during a simulated force-on-force, hostage rescue scenario (HR), and a single peer-to-peer (P2P) engagement. During the HR, participants engaged an adversary and completed the task in < 2.0 min; the P2P engagement occurred in a 10x10ft room and lasted for 28.0 ± 1.9 min. Salivary alpha-amylase (sAA) and cortisol were obtained immediately prior to entering and exiting the shoothouse or room. *T*-tests were used to determine the differences between time points.

Cortisol did not change pre- to post-HR (0.109 ± 0.014 vs 0.134 ± 0.016 µg/dL; $p > 0.050$). However, cortisol significantly decreased pre- to post-P2P engagement (0.126 ± 0.023 vs 0.833 ± 0.060 µg/dL; $p < 0.001$). Conversely, sAA increased pre-to post-HR (113.66 ± 15.38 vs 161.26 ± 22.77 U/mL; $p < 0.012$); but did not change pre- to post-P2P engagement (164.35 ± 29.45 vs 190.88 ± 30.00 U/mL; $p > 0.050$).

Conclusions: Cortisol increased over the course of the P2P engagement, but not over the course of the HR; most likely due to the increased duration of engagement which allowed for HPA axis activation and saturation of cortisol into the saliva. Alternatively, sAA increased acutely in response to the stress of the HR, likely due to its association with norepinephrine and the acute SNS response. Cumulatively, these data indicate that there is a time dependent response curve for varying biomarkers of stress. Therefore, duration of exposure to a stressor should be considered when attempting to assess the biological stress response during training/operations. These data can be useful in efforts to mimic high-stress combat operations during training and/or the understanding prospective high performance training effects.