



Psychophysiological Markers of Trauma: A Descriptive Analysis

Investigating the Absence of Vagal Brake in Veterans with a History of Interpersonal Trauma

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Background

- No research in the field of psychophysiology has examined the relationship between Interpersonal Trauma (IPT) and vagal tone in a Veteran population.
- IPT and its sub-category of Military Sexual Trauma (MST) is a widespread problem that has been found to be associated with a number of medical and mental health outcomes.
- According to Allard & colleagues (2011) prevalence rates among female victims of MST ranged between 22% to 45%; higher prevalence rates have been found in male samples when sexual harassment experiences are included and when accurate MST definitions are incorporated.^[1]
- Kelly and colleagues (2012) identified that in 135 Veteran participants, 95% reported at least one trauma in addition to MST, most notably sexual abuse as (77%) adult civilians and (53%) children; chronic mental and physical health symptoms were present in all participants who reported at least one IPT experience in addition to MST.^[4]
- Porges (2011) recommends a unique approach to understanding the underlying physiological mechanisms of trauma through the assessment of cardiovascular regulation variables during both baseline and following a stressor.^[2, 5]
- Dale and her colleagues (2009) demonstrated that adult women with depressed cardiac vagal tone were unsuccessful in their ability to recruit and successfully reinstate the vagal brake following the transitory physiological state disruption due to mild exercise.^[2]
- During challenges demanding mobilization there is an instant withdrawal of the vagal inhibition on the heart to increase heart rate supporting metabolic demands.^[2, 6]
- Heart-rate variability (HRV) refers to beat-to-beat intervals in heart rate. The measurement of HRV provides an opportunity to monitor changes in the vagal regulation of the heart during recovery from exercise.^[7]
- Monitoring HRV patterns during mild exercise, such as riding a mini exercise bike, enables evaluation of an individual's ability to self-regulate and promote a calm state following vagal withdrawal. A calm recovery following exercise requires the reinstatement of the vagus nerve. Porges refers to this "rapid regulation of the vagus in support of social engagement behaviors" as the "vagal brake."^[2, 5, 6]

Objective

The main objective of our study is to examine the physiological impact of the vagal brake on male and female Veterans with a history of Interpersonal Trauma. In better understanding these relationships and processes in a military population, interventions to improve physiological health of trauma victims may be developed or implemented, that in turn influence PTSD treatment outcomes in this population.

Methods

Inclusion Criteria	Exclusion Criteria
Male & Female Veterans age range = 18-65	Medical cond. exacerbated by physical activity
Undergoing therapeutic treatment/Available to participate for up to 1 hour	Not undergoing therapeutic treatment/abnormal heart-beats (e.g. ectopic)
Participant is able to ride stationary recumbent bike for 10 minutes or 1 mile.	Medication that would interfere with physiological results (Benzodiazepines)
No reported injury or health conditions that might limit physical activity (i.e. cardiac issues or asthma)	Severe mental health concerns or active psychosis.

Methods

Recruitment

- The recruitment of Veteran participants will take place at the MST & IPT outpatient clinic, located on the 2nd floor of the Veteran Affairs San Diego HealthCare Service in Mission Valley, California.
- Flyers were placed on the first and second floor of the San Diego Veteran Affairs.
- Prospective participants were approached during the specified hours for intake orientation evaluations.

Participants

- Pre and post intervention analysis was conducted on 8 female Veterans.
- Pre and post intervention analysis was conducted on 12 male Veterans.

Procedure

- Cardiac physiology of each male and female Veteran was measured with non-invasive biofeedback electronic instruments and provided real time physiological data about the participant's autonomic activity.
- The specific physiological characteristics that were examined included heart rate, skin conductance, respiration, and temperature.
- (1) Protocol began with education on the biofeedback instruments, measures, and sensors, (2) then 5 minutes of baseline, (3) followed by riding a stationary bike at their own pace for approximately 1 mile (Participant heart-rate will be raised to 20% above resting heart-rate, (4) followed by 5 minute recovery period.
- Physiological data will be collected through J&J C2+ engineering windows software program. Data collection will be analyzed through Kubios Heart-Rate Variability software program.

Statistical Analysis

- A two-way repeated measures ANOVA was used to investigate an interaction between condition and time.
- One-way ANOVAs were used to investigate if any individual physiological measures changed between pre and post intervention.
- At pre and post-intervention, a one-way repeated measures ANOVA was used to determine changes in Heart-Rate (HR) by condition at baseline and post-exercise recovery.
- At pre and post intervention, a one-way repeated measures ANOVA was used to determine changes in overall heart-rate variability by condition at baseline to post-exercise recovery, measured by the natural log of High Frequency (LnHF).
- At pre and post intervention, a one-way repeated measures ANOVA was used to determine changes in vagal activity by condition at baseline to recovery, measured by the Standard Deviation of Normal-to-Normal heart-beats (SDNN).

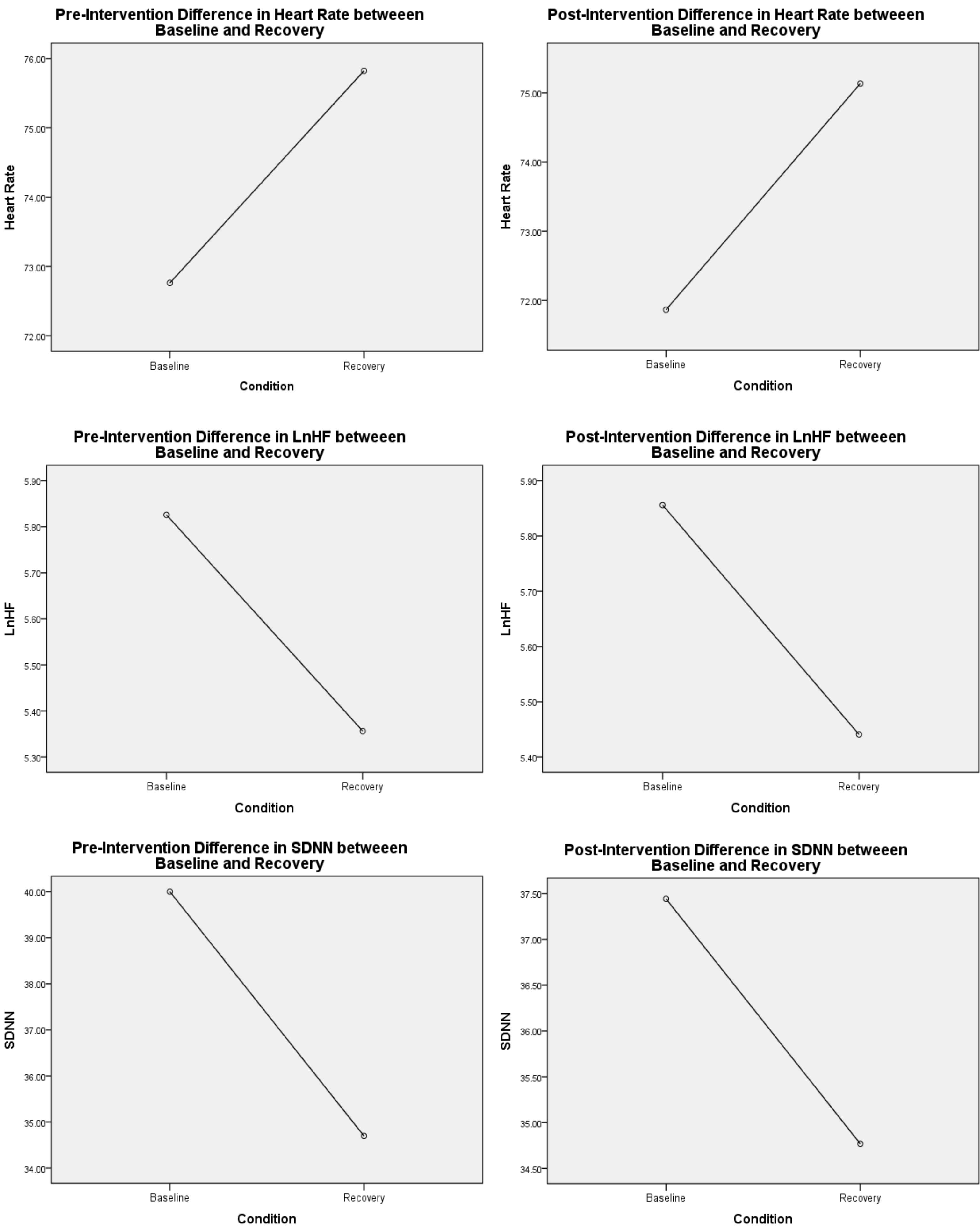
Results

- No measure significantly changed between baseline and recovery from pre to post.
- Heart rate changes were significant from baseline to recovery conditions in both pre $F(1,19) = 17.555, p < .01, \eta_p^2 = .480$ and post interventions $F(1,19) = 11.211, p < .01, \eta_p^2 = .371$.
- Changes in LnHF were significant from baseline to recovery conditions in both pre $F(1,19) = 25.575, p < .01, \eta_p^2 = .574$ and post interventions $F(1,19) = 18.352, p < .01, \eta_p^2 = .491$.
- Though not significant, SDNN trends showed from baseline to post-recovery, vagal tone was impacted by a sympathetic nervous system predominance at pre ($\eta_p^2 = .117$) and post interventions ($\eta_p^2 = .048$).

Table 1

Differences in Heart-rate variability Indexes between Baseline & Post-Exercise Recovery, Pre & Post Intervention

	Pre			Post		
	F (1,19)	p	η_p^2	F (1,19)	p	η_p^2
Heart Rate	17.555	.001	.480	11.211	.003	.371
LnHF	25.575	.001	.574	18.352	.001	.491
SDNN	2.523	.129	.117	.962	.339	.048



Discussion

- Participants with reported IPT produced impacted cardio-vagal changes from mild exercise from baseline to recovery at pre and post intervention.
- During both pre and post intervention, HR increases from mild exercise and does not return to baseline in a 5 minute period. Additionally, vagal activity increases from mild exercise and did not return to baseline levels within a 5 minute period.
- This outcome data shows a clear contrast to a previous study that in a normative sample of individuals without history of trauma, HRV, as measured by SDNN, as well as heart-rate and vagal tone return to baseline within a 5 minute recovery post-exercise period.^[3]
- These findings show that physiological profiles in individuals with a history of trauma do not greatly improve with psychotherapy, though the magnitude of the effect between recovery and baseline does show a diminishing trend. Psychotherapy alone may not be sufficient in altering physiology in those with history of trauma.
- These findings support and extend the *Polyvagal Theory Model* by specifying that individuals with a history of trauma were unable to successfully reinstate the vagal brake following the transitory physiological state disruption due to mild exercise.^[2, 5, 6]
- Previous psychological profiles can damage physiological stress profiles, thereby creating the necessity to intervene with psychophysiological modalities to help repair autonomic function.
- This study is limited by small sample size. However, these findings warrant further research investigating impairments in vagal withdrawal and recovery as a possible differentiation between those with history of trauma from those without.

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