Pilot Study on Impact on Balance of Autonomic Nervous System During Equine-Assisted Coaching: Simultaneous Heart Rate Variability in Horses, Coach, and Client

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Abstract

The rhythmic pattern of heart activity, heart rate variability (HRV), was used in this pilot study to evaluate quantitatively the autonomic nervous system of humans involved in an equine-assisted coaching session. HRV is responsive to states of human caring which include the experience of compassion, kindness, and empathy in humans and animals. Results indicated that emotions in humans impact their psycho-physiological state and resulted in healthy HRV patterns. This effect was enhanced in the presence of horses during triad-coaching sessions. The study signals that integrating coaching with horses can be a catalyst for healthful benefits associated with human caring.

Keywords: equine-assisted therapy, autonomic nervous, parasympathetic nervous, and sympathetic nervous systems

Introduction

This work presents findings from a pilot study measuring Heart Rate Variability (HRV) and positive and negative affect in equine-assisted coaching sessions. HRV is a noninvasive measure used to assess the stress response in humans. HRV studies indicate that therapeutic interventions with horses improves the psychological state and the physiological systems of humans during various states of interaction (Kaye Gehrke, 2009). The validated and reliable PANAS (Positive and Negative Affect Schedule) questionnaire was administered as part of the research process (Watson, 1998). This questionnaire consists of 20 words that describe different feelings such as strong, alert, nervous, and jittery and has been shown to be a valid and reliable measure of positive and negative affect. Positive affect has been well-associated with physical wellness (Pressman & Cohen, 2005).

As a parallel to workplace training, the equine-assisted coaching session focuses on the client's growth and development in their relationships and career. Typically, clients participate in an activity on the ground with horses. The trained coach guides the experiential learning process with the client in a safe environment (Salem, 2011). Research has shown that coaching with horses balances the autonomic nervous system which is linked to reduced stress and increased variation in HRV. Variation in heart rate is good for the heart and the body and has been documented in well-trained athletes (Mourot, 2004). HRV analysis is used by the best soccer teams in the world to care for athletes by allowing them to train better and recover faster (Fitzpatrick, 2013). Under stressful conditions, the body activates the sympathetic nervous system in a "fight or flight" response. Variation between heartbeats is lower as the heart starts to pump at a regular rate. The opposite occurs when the parasympathetic nervous system engages to counter the stress and relax and repair the heart and body. Variation between heartbeats is higher and the sympathovagal balance is restored.

Equine-assisted coaching sessions fall within the realm of animal-assisted therapies within the mind-body domain of complementary and alternative medicine (CAM). Scientific evidence for CAM practices is often limited, and this lack of reliable data makes it difficult to make informed decisions about using integrative health modalities. This research study addressed that lack by examining the physiological relationship in equine coaching sessions between coach, client, and horse. It also exposed clients to the caring and therapeutic effects of animals and nature.

Theoretical Framework

An important aspect of human caring concerns the dynamic relationships between clinicians and patients. It is well-known that equine-assisted coaching sessions have provided profound shifts in individual and group awareness, mindfulness, resilience, and compassionate behavior. Horses do the work of healing through a variety of interactions (Salem, 2011). It is speculated here that using a quantitative marker (HRV) can prove more scientific as a measure of the human-horse interaction.

When there is a balance in the autonomic nervous system, as determined by HRV, research demonstrates that there is more clarity of thinking, focus of attention, increase in confidence, improved decision-making, and reduced stress and anxiety (McCraty, 2006). There is little research on the physiological aspects of coaching interventions. Our research examined the physiological relationship between the coach and client and then between the coach, client, and horse. The goal of this work is to determine technological approaches to measuring caring related outcomes in equine-assisted coaching sessions.

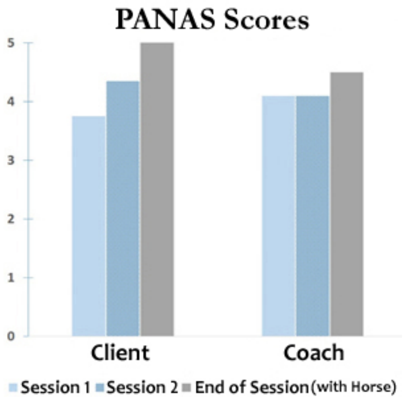
Method

The study was conducted at Rolling Horse Ranch in Ramona, California. The study explored the relationship between HRV, positive and negative affect, and the engagement of horses in a coaching relationship. Two coaching pairs were examined. One with just a coach and client (dyad team) and one with a coach, client, and horse (triad team). Both teams wore a heartrate monitor during a 45 min to 2 hr coaching session. A pre and post self-assessment of leadership competencies using the PANAS questionnaire was administered during each session. Participants indicated by Likert scale the extent to which they felt a certain affect. Results were transformed to all be in the positive direction of affect (e.g., disagreement with a negative affect was reflected as a positive value) so they could be analyzed in one charting.

For HRV data collection, the participants' and horses' electrocardiography (ECG) were recorded with a Polar Equine RS800CX G3 ambulatory ECG recorder set. Each set consists of a Polar Equine RS800 Heart Monitor with software, a receiver, a Human HR Monitor, and a Polar WINDlink remote 30 feet transmission USB antenna to transmit the ECG signal from the horse to the receiver. The timing of the three ECG monitors was synchronized during the recording periods. Data from the monitors were transferred to a password-protected PC using Polar Pro Trainer 5 software. The transferred data were then analyzed by Kubios software (Tarvainen, 2009). The software allows one to measure the exact R to R (time interval between R waves, measure of HRV) intervals between heartbeats of the QRS (complex that represents combination of three of graphical deflections seen on ECG that denotes ventricular contraction) complex from the ECGs. HRV was measured by the software which calculated SDNN (standard deviation of the normal to normal heartbeats), pNN50 (measures the percent of R to R intervals that greater than 50 milliseconds [ms] away from their adjacent interval), and the low frequency to high frequency ratio (LF/HF) frequency domain analysis value (ratio of sympathetic to parasympathetic activity). Another analysis of HRV that was performed involved making a Poincaré plot of the data. The parameters of this plot are easy to compute via the Kubios software and have been demonstrated to quantify the involvement of the autonomic nervous system in HRV (Kamen et al., 1996). Every dot on the plot is a combination of two R to R intervals that are right next to each other in time (RR_n and RR_{n+1}). Thus, points along a straight diagonal line represent low HRV as their length would be the same (no variation). Points falling outside that line represent different RR intervals and increased HRV. The width of the Poincaré plot, as quantified by SD1, is a measure of short-

Figure 1

PANAS Scores from Three Sessions for
?1 *Coach and Client*



PANAS = Positive and Negative Affect Schedule

Table 1

Heart Rate Variability Analysis Indices for Coach: Sessions 1, 2, and 3

Index	Session 1	Session 2	Session 3	Standard
SDNN	44.8	120.5	109.6	104.0
pNN50	0.2	11.6	10.1	64.6
LF/HF	2.95	0.650	0.877	0.47

SDNN = standard deviation of normal to normal R-R intervals, where R is peak of QRS complex (heartbeat)
pNN50 = percent of RR intervals that are greater than 50 ms
LF/HF = ratio of low frequency to low frequency wave forms

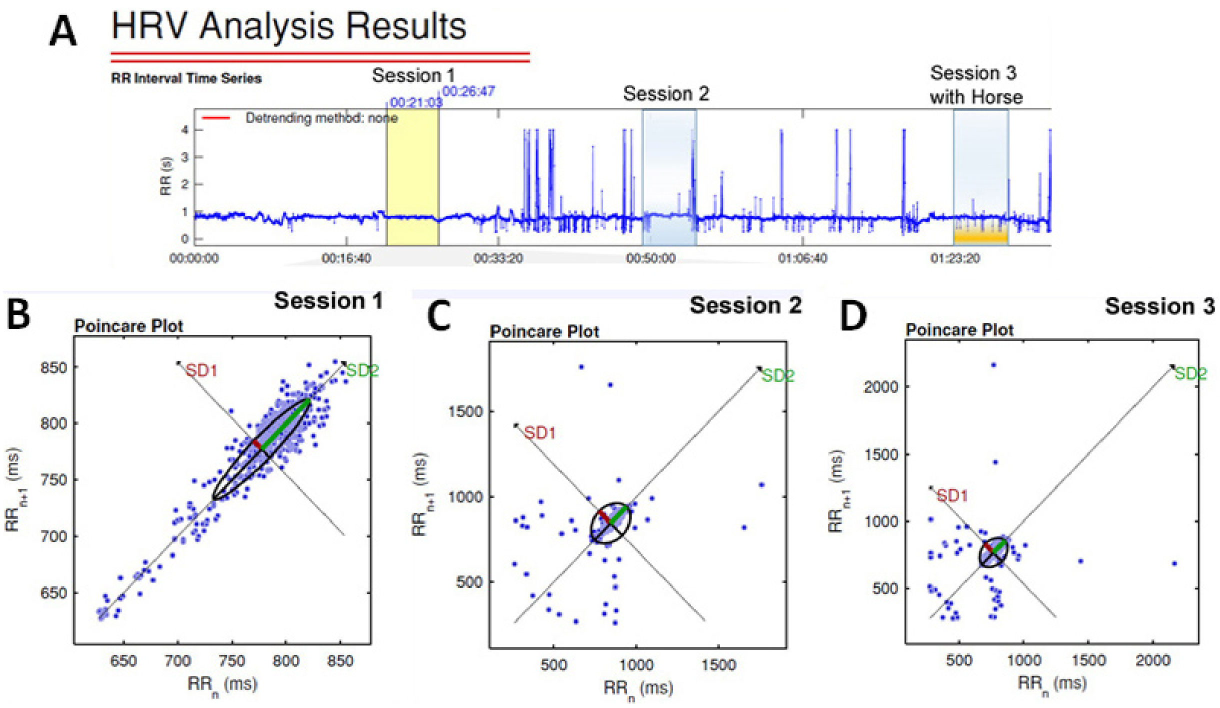
term variability and gets larger with greater HRV. An even more robust quantitative analysis of the R to R intervals involved using the Kubios software to perform a frequency domain analysis. This involved taking the wave forms of the R to R intervals and breaking them down to see the component frequencies that can be ascribed to different involvements of the autonomic nervous system. Low frequency (LF) waveforms reflect contributions from both the parasympathetic and sympathetic nervous systems. High frequency (HF) waveforms reflect contributions from the parasympathetic nervous system. Thus the LF/HF ratio measures the involvement of the sympathetic and parasympathetic nervous system. As the ratio gets larger, the sympathetic nervous system becomes more controlling. A LF/HF value less than 1 indicates greater control via the parasympathetic nervous system. Three session times were evaluated using the following protocol: Session 1 (Baseline with Client), Session 2 (Coach-Client interaction before horse), and Session 3 (time just after Coach-Client interaction with horse).

Results

The PANAS results (Figure 1) showed an increase in positive affect for both client and coach during the coaching session with the horse. The client showed a further increase with the horse present above interacting with the coach alone. HRV analysis of the R to R intervals of one heartbeat (of the QRS complex) from the ECGs showed a clear increase in HRV during the coaching sessions as seen in Table 1. This analysis was done only on the coach as the

Figure 2

Heart Rate Variability Analysis Results



Note. Panel A displays the RR interval time series over the entire sessions. Panel B through D are the Non Linear Analyses displayed as a Poincaré Plot for each session.

recordings from the client and the horse were not readable. The coach's SDNN, a direct measure of HRV, increased from 44.8 in session 1 to 120.5 in session 2 and then stabilized to 109.6 in session 3 with the horse involved (SDNN is measured in ms). This final session with the horse matched the values of a well-trained athlete (Mourot, 2004). The pNN50, another direct measure of HRV, increased from 0.2 in session 1 to 11.6 in session 2 and then stabilized to 10.1 in session 3 with the horse involved.

The coach's LF/HF ratio went from 2.95 (demonstrating stress and sympathetic nervous system control) in session 1 to 0.650 and 0.877 in session 2 and session 3, respectively. These results demonstrated clear involvement of the parasympathetic nervous system with client interaction and with the horse interaction involved (Table 1).

A Poincaré plot of the data is seen in Figure 2, panels B through D. Figure 2 panel B shows the Poincaré plot of the coach in session 1 just starting with the client. Note the elongated influence of SD2 showing decreased HRV as evidenced by identical side-by-side RR values that influence the shape of the plot to an elongated ellipse. Note how dramatically the Poincaré plot changes in session 2 when the coach and client have been interacting (Figure 2, panel C) and session 3 when the horse is added to the session (Figure 2, panel D). The Poincaré plot changes to a shortened ellipse displaying lower long-term variability and greater short-term variability. The Poincaré plots all show clear increased HRV with the coach-client and the coach-client-horse interaction.

Conclusions

Preliminary findings of this pilot study show favorable results for engaging horses in a professional coaching session. There are few studies in the literature showing physiological relationships between client and coach. These findings indicate that HRV as a measure of the physiological state improved in brief one-on-one coaching sessions. In health coaching, there are little if any data in this area. When a horse is added to create a triad relationship there were HRV improvements in both the coach and the client. Unfortunately, the data were not substantial enough to claim that the client HRV improved more with the horse than without. However, the PANAS results indicate a favorable improvement from the coach only session. It is interesting to note that the coach's HRV demonstrated a well-balanced autonomic nervous system (ANS) that is comparable to a well-trained athlete at the end of the coaching session. The authors are encouraged from the preliminary results and plan further research modeling the same methodology but expanding the sample size of professional coaches, a range of client interests and well-trained horses.

- We were able to measure usable HRV data in our coaching subject
- Coach-client-horse interaction resulted in the highest affect for our coach and client
- HRV analysis revealed increased HRV and increased sympathetic tone with client and horse interaction that matched a well-trained athlete
- Further study will be needed to investigate coach-client-horse triad team
- Health and Wellness coaching using HRV could prove beneficial for case management and improving health and human performance outcomes.

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