EFFECT OF PHYSIOLOGICAL STRESS AND EXPERIENCE OF RIDERS WITH HIGH-REACTIVE AND LOW-REACTIVE HORSES WHILE RIDING BAREBACK

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ABSTRACT

Effect of Physiological Stress and Experience of Riders with High-Reactive and Low-Reactive Horses While Riding Bareback

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To quantify the relationship between experience level and physiological stress of horse and rider during a bareback riding session, 28 horses (geldings, ages 6-20 years) and 28 riders (16 male, 12 female, ages 19-22) were organized into a 2X2 factorial experimental design. Horses were categorized as either high-reactive or low-reactive based on their response to a reactivity test. Average daily distance travelled was monitored for the horses. Riders were split into two groups: novice (never have ridden a horse) and experienced (2-3 years of riding instruction). One riding session was evaluated for advanced riders, while two riding sessions were evaluated for novice riders. The second session occurred at three weeks after the initial session. Heart rates for both horses and riders were monitored before, during, and after the session. All data were analyzed using the PROC GLM procedure in SAS. Advanced riders presented with higher heart rates ($P < 0.01$) than novice riders during test 1. Novice riders did not have significant change in heart rate between the first (test 1) and second (test 2) ride sessions. Horses demonstrated unvarying heart rate patterns regardless of the rider's experience level.

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NOMENCLATURE

PMC	Parsons Mounted Cavalry
TAMU	Texas A&M University
BPM	Beats per minute

INTRODUCTION

The ability to directly feel the movement of a horse has been assumed to be one of the benefits of riding bareback. This argument is two-sided, however, because the horse can likewise feel the change in heart rate and muscular tension in the rider. It has been determined that riding bareback decreases the force of a rider's weight while simultaneously increasing the pressure on the horse's back compared to when a saddle is used (Clayton et al., 2013). Pairing a horse and rider with relatively different levels of experience can induce a higher stress response for the rider but not for the horse, especially if the riding takes place in an area familiar to the horse (Ille et al., 2013; Covalesky et al., 1992). This suggests that the experience of the rider does not impact the stress responsivity of the horse. While the rider's sex does not influence horse stress responsivity, personality type of the rider does influence the nature and success of interactions occurring with animals (Ille et al., 2014; Ravel et al., 1996).

Cortisol is a glucocorticoid that is released when an animal perceives a stressor and the hypothalamic-pituitary-axis is activated. The level of cortisol in a sample can be an indicator of how strongly an animal is responding to an external stimulus or situation. The more stress a perceived stimulus, the higher the concentration of cortisol will be measured in the sample. Typically, cortisol samples are obtained through blood and saliva, and these types of samples provide information about the current and immediate stress state of the animal. However, fecal sampling has also proven to be effective because it is non-invasive to the animal and represents a pooled sample of cortisol concentrations across a period of time (Möstl et al., 2002). For salivary cortisol collection, use of an eye sponge shows to be more effective than use of a conventional cotton swab (de Weerth et al., 2007).

Regardless of the method used to collect cortisol samples, attention should be given to the regularity and timeliness in which samples are taken. Horses experience a predictable fluctuation in cortisol levels due to their circadian rhythm, but this should not compromise the integrity of the sample as long as samples are taken during a consistent time frame (Irvine et al., 1994). A recent correlation between the subject's stress level, cortisol concentration, and S-IgA concentration has been observed (Viena et al., 2012), suggesting that the analysis of S-IgA in comparison with cortisol levels can further support data on potential stress levels.

Objective results for classifying a horse's temperament can be achieved through exposing the subjects to a novel stimulus test. This method typically consists of introducing stimuli (visual, auditory, tactile, or olfactory) to the animal, then categorizing the subjects' responses in an ethogram. Due to the prey animal mentality in equines, their reactions from the novel stimulus are often dramatic and provide strong indicators of the subject's temperament. Previous literature suggests that horse heart rate measurements post-stimulus in a reactivity test correlate with evaluations from the horse handlers on the animals' behavioral disposition (Momozawa et. al, 2003). Another study conducted using equine Polar brand heart rate monitors evaluated horses' responses to a visual stimulus and determined heart rate to be an accurate method for predicting the subject's temperament and behavior (Christensen et al., 2005).

Limited research has been conducted on the effect of direct physiological communication between rider and horse while riding bareback. Thus, the purpose of this study is to increase our understanding of the significance that direct physical contact (bareback) has on the communication of a rider's stress to the horse and compare this potential variation in stress levels between horses with riders of different experience levels.

CHAPTER I

MATERIALS & METHODS

Human Subject Selection

Human subjects were surveyed via emailed responses. Criteria evaluated were gender and amount of riding instruction received. The advanced group of riders was composed of junior and senior cadets in the TAMU Parsons Mounted Cavalry. Among this group of potential subjects, those who had minimal to no riding experience prior to joining the Cavalry unit were selected to participate. The novice group of riders was composed of sophomore probationary members in the unit. Subject selection prioritized riders who had never ridden a horse before. All subjects from this pool either had no riding experience, or had not ridden within the past five years and had received less than one year of riding instruction.

Equine Behavior Classification

The method for classifying horses based on temperament was conducted over the course of one morning. Each horse was subjected to exposure to a novel stimulus, which was the rapid opening of an umbrella. The umbrella was hidden behind a wall, and was only opened once the horse set a foot within a two foot radius of the umbrella. Horses were lured to the stimulus by the presence of a grain bucket. Each horse was walked along the same path around the perimeter of the pen, passing within the grain bucket, and released in the middle of the pen at the same location. After the horse reacted to the stimulus and was caught (within 30 seconds of the stimulus exposure), its heart rate was taken at both one minute then two minutes post-stimulus exposure. This was compared to a resting heart rate taken prior to walking around the pen. The research assistants responsible for horse-handling, relaying the stimulus, taking heart rate, and recording the video were kept consistent throughout the whole test. The pen used was circular and 30 feet in diameter.

Subsequent classification of subjects as either "high-reactive" or "low-reactive" was organized based on the results from the novel stimulus test. Difference in heart rate was the primary selection factor, where the horses in the top 50th percentile in range of heart rate were classified as highly reactive. Video recordings were conducted as a secondary method and were used to visually classify subjects whose heart rate data was ambiguous.

Riding Tests

During all ride sessions, both equine and human subjects wore Polar Bluetooth heart rate monitors (model H7). The sensor was placed on an elastic belt, which was worn around the subject's heart girth. A separate Bluetooth receptor (digital watch) was secured to a collar around each horse's neck. Receptors were able to receive data from the sensor up to a 10 ft. radius and recorded a heart rate every second.

Equine subjects were wet down over the heart girth region where the sensor was placed. Electrode gel was placed between the underside of the sensor and the horse's skin. Human subjects wore the sensor beneath their clothes with gel applied in order to have direct contact with the electrode.

Part 1

Both advanced and novice (first day, Test 1) riders were exposed to a similar riding pattern. The course consisted of an outdoor uncovered arena over flat turf. Subjects rode bareback with a single halter and lead rope in a circle along the fence for 8 minutes. Every 2 minutes subjects were instructed to change direction. Advanced riders rode independently, while novice riders were led by a partner due to their lack of experience and safety concerns.

Part 2

Novice riders completed a second ride session (Test 2) three weeks after the first ride session (Test 1). The course travelled and duration of the session was modelled after Test 2, however, subjects rode independently from a partner and had complete control of the horse.

Data Analysis

Relationships and correlations between the different riding sessions were determined by calculating statistical significance through using the PROC GLM procedure of SAS. Main effects tested were treatment, day, and behavior. Significance was declared when $P \leq 0.05$.

CHAPTER II

RESULTS

Part A: Equine Subject Classification

Twenty eight horses were evaluated as potential subjects and exposed to the novel stimulus test. Four were omitted due to an absence of data from experimental error (2- equipment malfunction, 2- inability to be caught within 30 seconds). The upper 12 horses, classified as high-reactive, had a range of 28-12 beats per minute (BPM) between the baseline heart rate and 30 seconds post-stimulus. The lower 12 horses, classified as low-reactive, had a range of 12-4 BPM. Eight subjects had a range of 12 BPM and were classified based on further evaluation of video recordings from the stimulus test (seen in figure 1). The four subjects who visually displayed greater reactivity were classified as high-reactive.

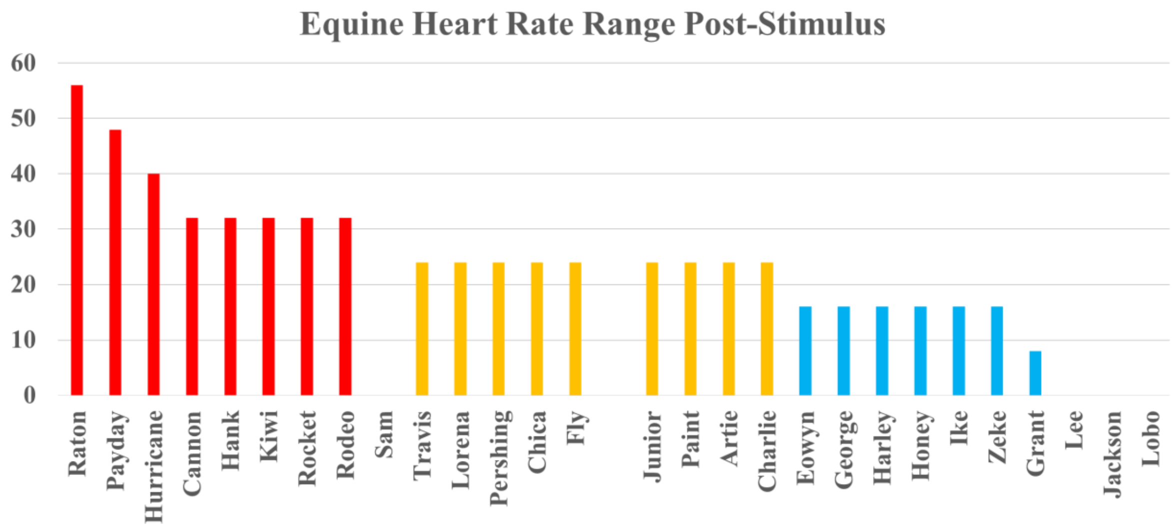

Figure 1. Equine subject heart rate ranges from baseline to 30 sec post-stimulus. Subjects ordered from most reactive to least reactive.

Part B: Horse and Rider Heart Rate Analysis

Heart rate values were compared between advanced riders and novice riders during Test 1 (first day of riding). Significant variation was found between the two groups, with a P value of 0.0076. Advanced riders were observed to have a higher average, maximum, and minimum heart rate than the novice group (seen in figure 2).

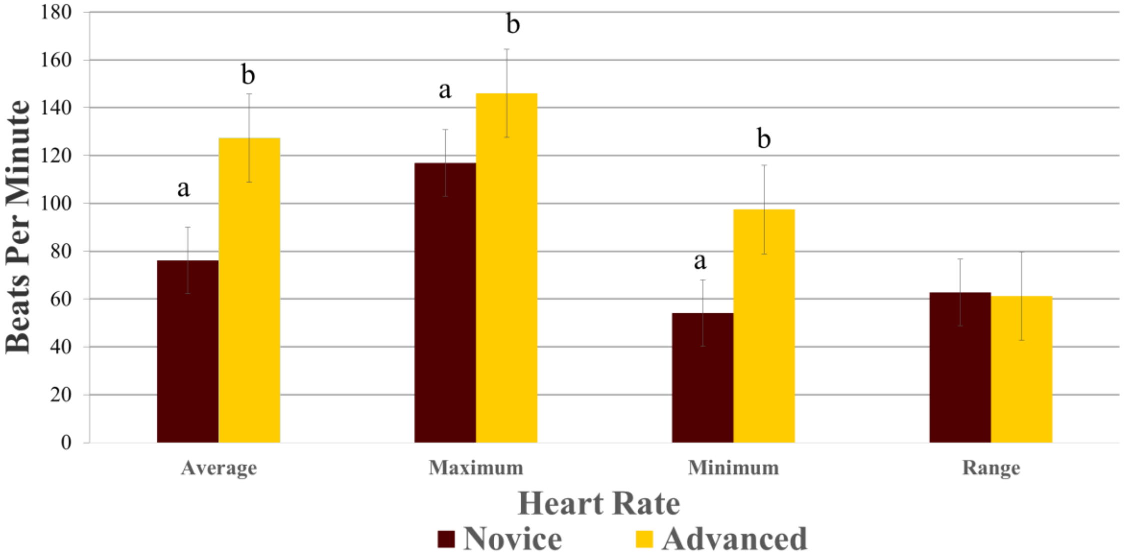

Figure 2. Novice vs. Advanced Human heart rate during the first riding session.
a and b superscripts indicate $P < 0.01$.

Comparisons were also made between human heart rate in Test 1 and Test 2 in the novice riders, equine heart rate between the novice riders (Test 1) and advanced riders, as well as equine heart rate between Test 1 and Test 2 in the novice riders (figures 3, 4, & 5). All comparisons indicated no significant variation between the two groups.

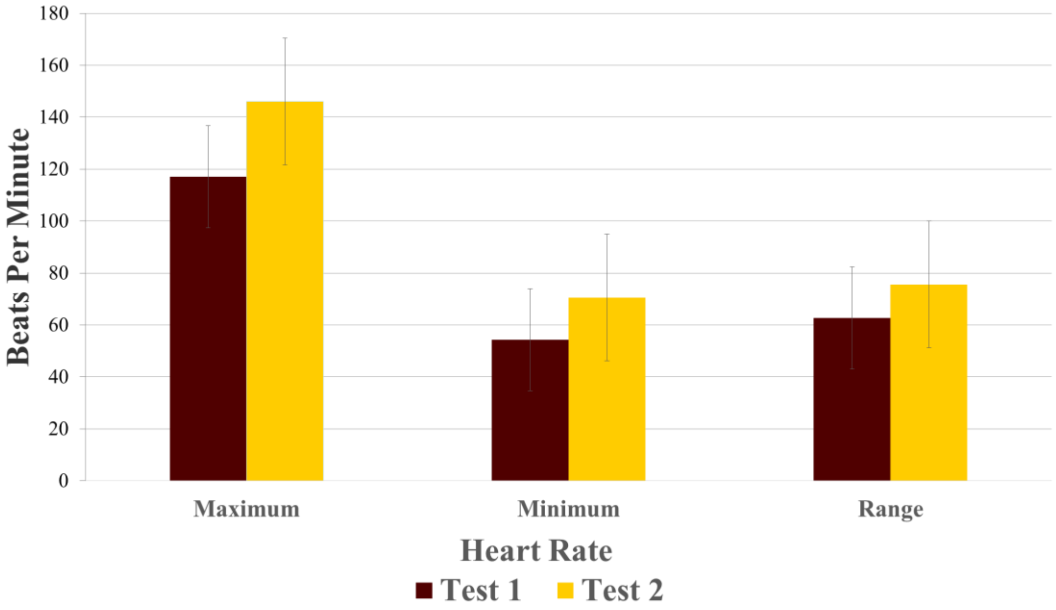

Figure 3. Novice rider human heart rate comparing first ride session and second ride session three weeks later.

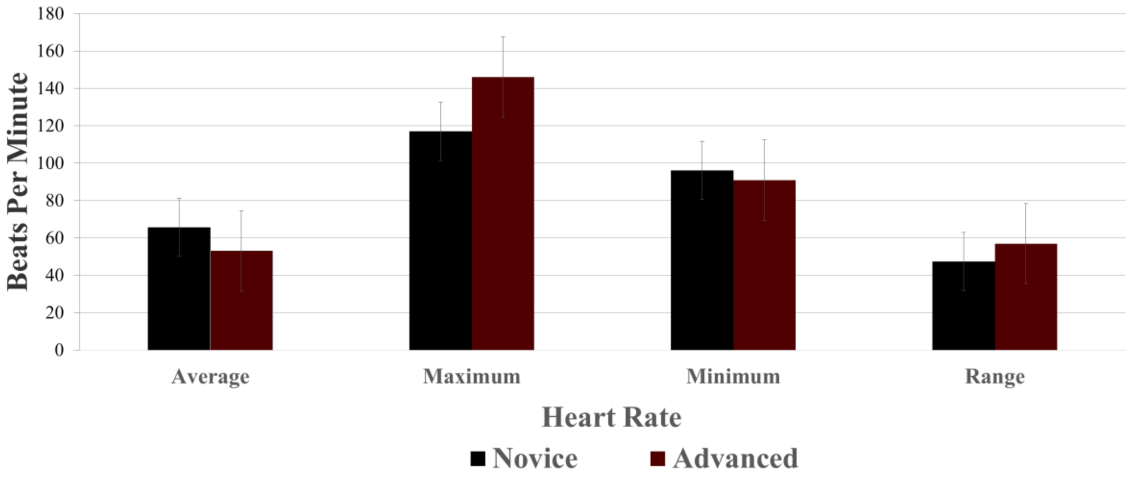

Figure 4. Equine heart rates from novice and advanced riders during the first riding session.

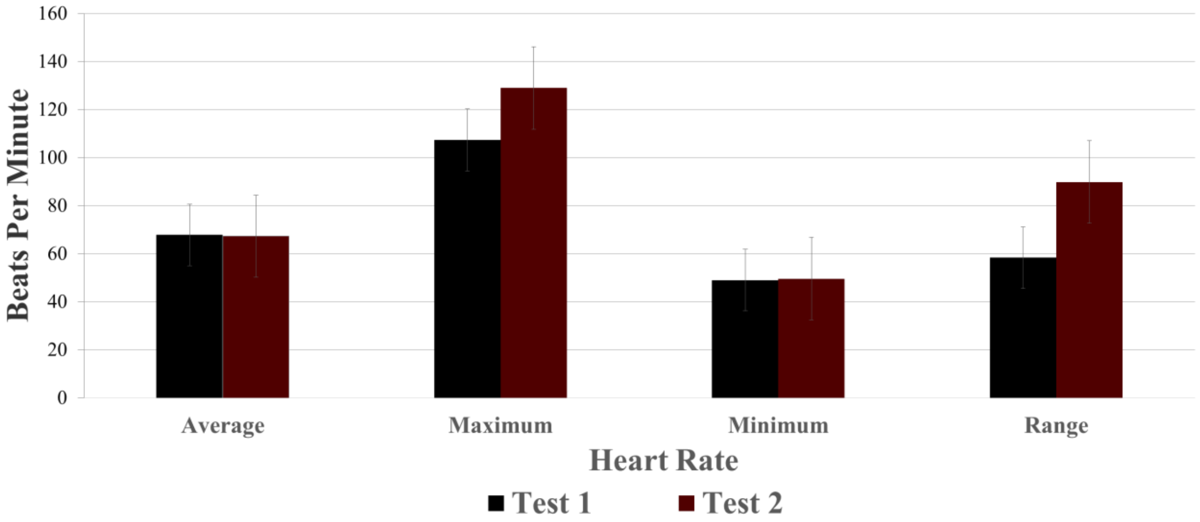

Figure 5. Equine heart rates from novice riders during the first test (test 1) and the second test that occurred 3 weeks later

DISCUSSION

Contrary to initial predictions, results from this study showed elevated heart rate in the advanced riders compared to the novice. This may be due to the advanced riders feeling pressure to perform at an expected level, while the novice riders did not know what to expect. The equine heart rates did not significantly vary between the two groups of riders, which aligns with findings from previous studies. One possibility for the relatively consistent heart rates and behavior of the equine subjects between the two riding groups is the ability of the advanced riders to physically appear calm through their body language to the horse, despite a more rapid heart rate.

During the initial riding sessions, the Polar heart rate monitors proved to be challenging to work with in terms of reading an acceptable resting heart rate (20-40 bpm). This presented a concern for the functionality of the equipment on a moving subject during the ride tests. A study examining the accuracy of a similar model of an equine Polar heart rate monitor when compared to simultaneous ECG readings found the equipment to be inaccurate unless the subject was stationary (Parker et al., 2010). Over the duration of this experiment, the rate of equipment error decreased. Although the readings tended to show a higher than expected heart rate, upon exercise the reading would show an acceptable range. In order to improve experiments such as this one, other models of equine heart rate monitors should be tested for improvement in the accuracy of the readings. On the other hand, this technology was extremely good at reading elevation, change in velocity, and path travelled, which may have uses in different types of studies.

It is important to note that the population of horses chosen as potential participants in this experiment have undergone similar and repetitive riding experiences throughout their time in PMC. All potential subjects had been ridden bareback with a halter and single lead rope in prior training before this experiment and they were familiar with the surroundings. Additionally, potential equine subjects were chosen for the novel stimulus test based on a perceived calm disposition. This precaution was taken to limit the risk of injury for the novice riders. Further experimentation is required in order to reaffirm these theories.

SUMMARY

Based on these results, the horses that were ridden by novice riders did not show a significant difference in physiological stress indicated by the relatively consistent heart rate measurements between the equine subjects in the novice group and the advanced group. Additionally, advanced riders consistently had greater heart rates than novice riders. These findings are consistent with previous studies, which also saw little variation in equine heart rate accompanied by significant variation in rider heart rate (Ille et al., 2013; Covalesky et al., 1992). The lack of noteworthy variation in equine heart rate values between the groups may indicate that the horses were content to be in a familiar environment regardless of the experience level of the rider on them. It is also possible that advanced riders are able to mask their stress and are able to physically communicate to the horse that they are relaxed and confident. Further experimentation with a larger population size is needed in order to strengthen this theory.

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