Effects of Head Position on Stress Levels in Horses.

Tess C. Cummings

Dr. Kelly Walter

Truman State University

Question

1. Does the horse's head position while exercising contribute to the horse's stress level as measured through monitoring the heart rate (HR), Horse Grimace Scale (HGS), and blood cortisol levels (BCL)?

Rationale

Horses are used in a wide variety of tasks, many of which require a horse to assume a specific head position. For example, in upper level dressage, hyperflexion or rolkur has been the topic of much debate. Guidelines released by the International Federation for Equestrian Sports (FEI) defined hyperflexion or rolkur as "flexion of the horse's neck achieved through aggressive force, which is therefore unacceptable. Moreover, a long, deep, round (LDR) frame was classified as "flexion without undue force" and therefore acceptable. To preserve the welfare of horses involved in such activities, it is imperative to understand how head position affects the horse, and have appropriate head position recommendations. By combining the results from each of the three stress tests, meaningful data will be generated to help determine appropriate head position recommendations.

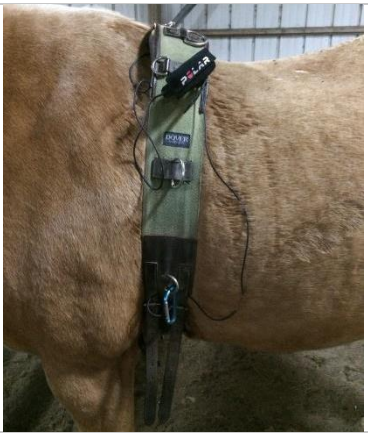
Methodology

Six horses that are similar in age, conformation, and athleticism each received the three treatment head positions. Treatments include: natural carriage, vertical, and hyperflexed (behind the vertical) head positions. The natural carriage position was used as the control treatment. The treatments were assigned in a random Latin Square experimental design to allow each of the three head positions or treatments to be applied to all six horses. Horses were allowed at least two days between treatments. For each treatment, the horse was allowed a warm-up period of walking for two minutes. Then the horse trotted for ten minutes, in the specific head position, while being lunged on a 15 meter circle. The head position was determined using the Equla Vert which "measures your horse's head angle in relation to the vertical [and] emits a light that changes color according to the head angle." The head position was then set within 15º to the desired angle using draw reins and a surcingle. The Equla Vert light can be seen in correlation with headset below. Note that the light on the side of the horse's head is the robot monitor, while the light at the horse's poll is the Equla Vert. Heart rate data and images were collected as the horse trotted for 10 minutes while being lunged in each direction.

Equla Vert Light Blue: Natural Carriage	**Equla Vert Light Green: Vertical**	**Equla Vert Light Red: Hyperflexed**
		

Heart Rate

With the use of a wireless HR monitor, a resting HR was recorded before each exercise test began. HRs were also recorded throughout each trotting test, and directly after the trotting test in each head position. The percent increases of HR were determined from comparing the rest HR to the HRs recorded while exercising and during recovery. The following image shows the placement of the HR monitor beneath the surcingle, with the ground at the withers and the electrode at the girth area. See the Data Table for recorded HRs, average HRs, and HR percent increases.

HR Monitor Placement


Horse Grimace Scale

HGS has been deemed an effective way to recognize pain or stress in horses (Dalla Costa et al., 2014). Video stills were taken at the five-minute mark during each trotting test and analyzed in conjunction with the HGS as outlined in the "Development of the Horse Grimace Scale (HGS) as a Pain Assessment Tool in Horses Undergoing Routine Castration" article. Each image was assigned a grimace score and the average grimace score for each head position was determined. The grimace scale scores are shown below in **Table 1.**

Grimace Scale Example Images

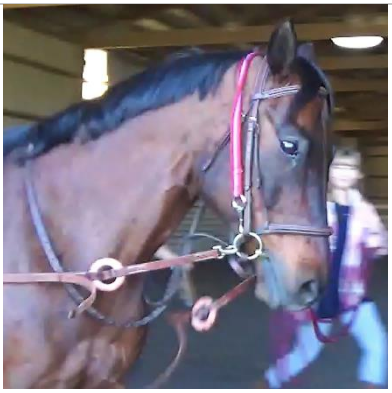
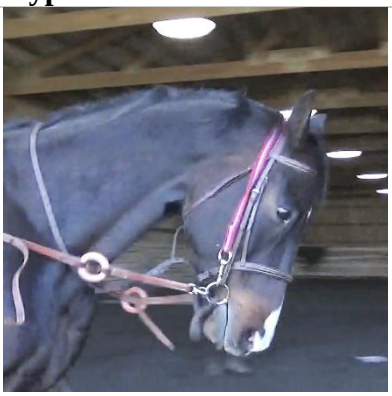
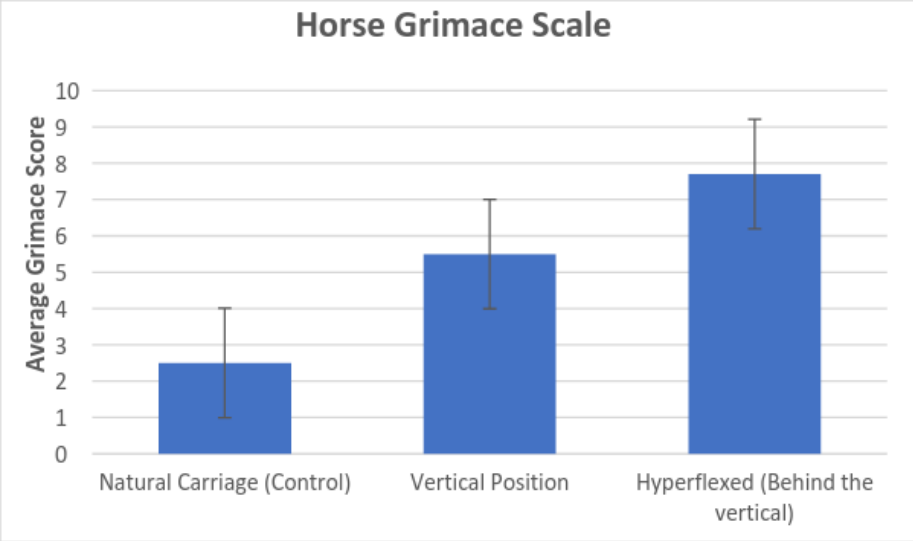
Natural Carriage	**Vertical**	**Hyperflexed**
		

Table 1

Head Position	Average Grimace Score	Standard Deviation
Natural Carriage (Control)	2.5	1.12
Vertical Position	5.5	2.14
Hyperflexed (Behind the vertical)	7.7	1.49

Graph 1: Average Horse Grimace Scores in relation to head position.

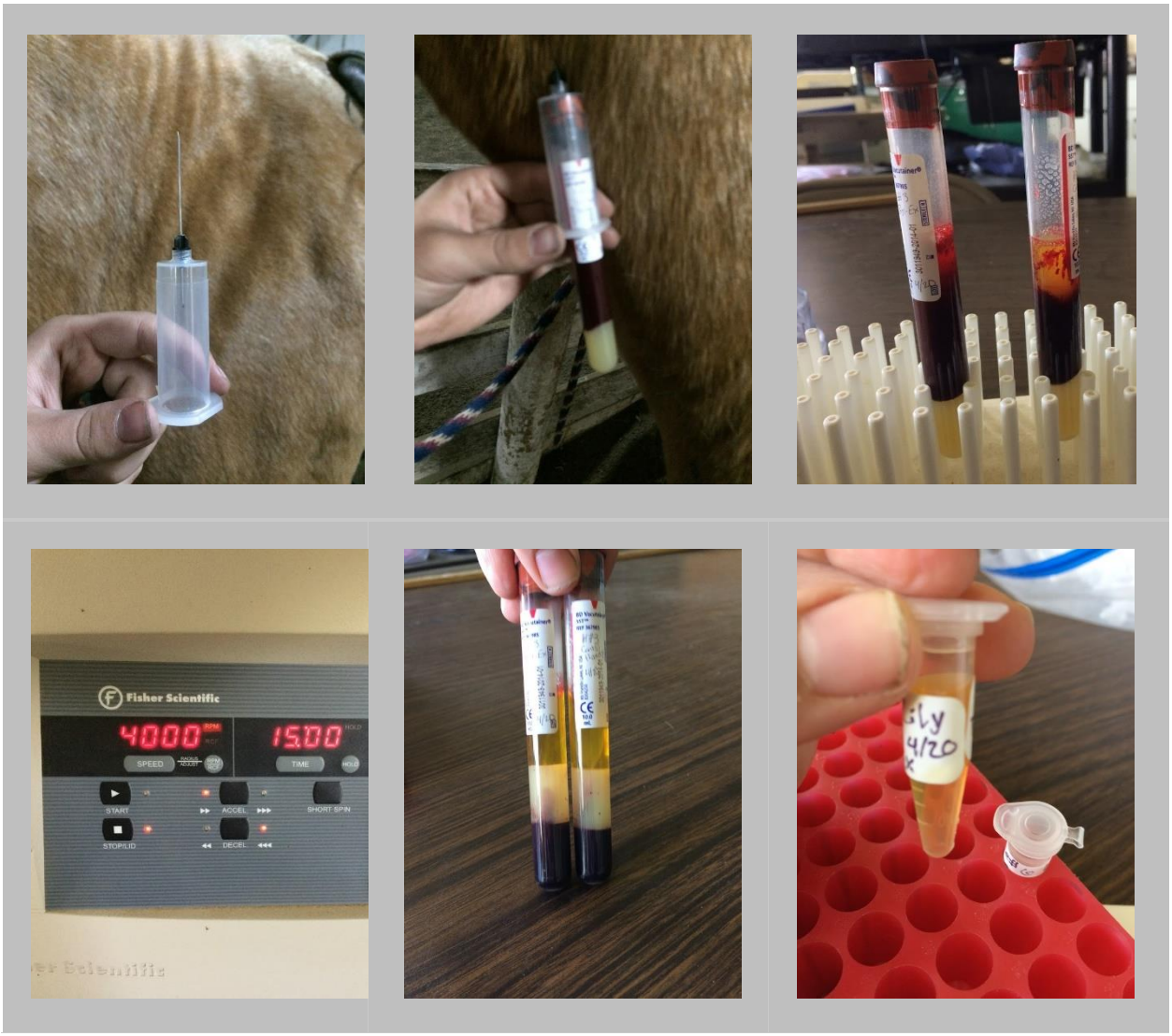


Blood Cortisol Levels

To perceive any elevated BCL, blood samples were drawn from the External Jugular Vein with the use of a vacuum tube after resting heart rate is recorded, and again immediately after each head position trotting test. The blood samples were allowed to clot for approximately 45 minutes and then centrifuged (at 4000 RPMs for 15 minutes) in the animal science laboratory. Serum was then pipetted into microcentrifuge tubes, labeled, frozen, and sent to the University of Missouri Veterinary Science lab for cortisol level testing. The results of the cortisol test are pending.

After receiving results from the cortisol level testing, statistical significance of results will be determined.

Images of Blood Cortisol Level Process



Educational Benefits

As a biology major on a pre-veterinary, equine specialization track, research experience, especially research experience that involves working with animals, is extremely valuable for not only admission to veterinary school, but also for my future career. Beginning research as a freshman, and continuing research throughout my college career, allows me to have real-world applications of my course work, and gain experience in the equine industry.

References

Becker-Birck, M., Schmidt, A., Wulf, M., Aurich, J., von der Wense, A., Möstl, E., . . . Aurich, C. 2013. Cortisol release, heart rate and heart rate variability, and superficial body temperature, in horses lunged either with hyperflexion of the neck or with an extended head and neck position. Journal of Animal Physiology and Animal Nutrition, 97(2), 322-330.

Christensen, J. W., Beekmans, M., van Dalum, M., & VanDierendonck, M. (2014). Effects of hyperflexion on acute stress responses in ridden dressage horses. Physiology & Behavior, 128, 39.

Dalla Costa, E., Minero, M., Lebelt, D., Stucke, D., Canali, E., & Leach, M. C. 2014. Development of the horse grimace scale (HGS) as a pain assessment tool in horses undergoing routine castration. PloS One, 9(3).

Dalla Costa, E., Stucke, D., Dai, F., Minero, M., Leach, M. C., & Lebelt, D. 2016. Using the horse grimace scale (HGS) to assess pain associated with acute laminitis in horses (equus caballus). Animals : An Open Access Journal from MDPI, 6(8), 47.

Gleerup, K. B., Forkman, B., Lindegaard, C., Andersen, P. H., & Sveriges lantbruksuniversitet. 2015. An equine pain face. Veterinary Anaesthesia and Analgesia, 42(1), 103-114.

Wagner, A. E. 2010. Effects of stress on pain in horses and incorporating pain scales for equine practice. The Veterinary Clinics of North America. Equine Practice, 26(3), 481.

Zebisch, A., May, A., Reese, S., & Gehlen, H. (2014). Effect of different head-neck positions on physical and psychological stress parameters in the ridden horse. Journal Of Animal Physiology & Animal Nutrition, 98(5), 901-907.