

Analysis of Physical and Mental Performance of an Equine Rider Before and After of Equine Activities

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Abstract

Physical and psychological effects of equitation, particularly across different equine gaits, remain underexplored. This study investigates how lateral and diagonal gaits at varying speeds (walk, trot, gallop) influence a rider's physical and mental performance, focusing on cardio-respiratory coherence and cardiovascular response. Using a VO2 Master Analyzer and Polar H10 heart rate sensor, six trials were conducted with an off-track thoroughbred (diagonal gait) and a criollo pony (lateral gait). Each trial involved monitored rest, followed by gait-specific riding durations. Through a case study approach, the methodology was established for future research, revealing that increased velocity correlates with higher energy demand (VO2) and reduced heart rate variability (HRV), indicating diminished stress control.

Introduction

Equitation is the art and practice of horsemanship and horse riding. The physical benefits of the sport are widely documented, but there is limited information regarding the psychological impacts on riders (Legg et al., 2022) specifically regarding how the lateral and diagonal gaits compare or differ. The purpose of this research is to analyze how equine gaits, at different speeds, affect the physical and mental performance of the rider, by looking at specific variables of the cardio-respiratory system. The performance assessments will be conducted with an VO2Master Analyzer and the Polar H10 heart rate sensor (Pedersen, 2023) while an average rider executes the different speeds (walk, trot, and gallop) on a off the track thoroughbred (OTTB) with a diagonal gait, and a criollo pony with a lateral gait. After the trials are completed, a comparison will be made of the averages before and after the physical and psycho-physiological variables for each speed and gait.

Objective

The objectives consist of analyzing the effect of equine gaits and speeds on a rider's physical and mental performance. The study will primarily focus on how the diferente speeds (walk, trot, and gallop) of a diagonal, and a lateral gaited equine compare/effect the metabolic body energy and cardio-respiratory response of the rider. Different performance assessments will be performed with an OTTB and a criollo pony to obtain these variables.

Methodology



Nature Gold - Thoroughbred Diagonal Gait



Mani - Criollo Lateral Gait

A set of 6 trials were conducted using a thoroughbred (3 trials, specimen 1, *Nature Gold*) and a criollo horse (3 trials, specimen 2, *Mani*) with an instrumented spirometer (VO2Master Analyzer) and a heart rate sensor (Polar H10). Each trial included walk, trot, and gallop gaits within special facilities for the training and care of horses. The rider's VO2, heart rate (HR), Respiratory Frequency (RF), Heart Rate Variability (HRV) and O2 Cost were monitored, with rest periods until HR was stabilized, followed by 6 minutes per gait (3–4 minutes for gallop), and an 8-minute rider rest or until the heart rate settled.



VO2Master Analyzer setting up



Polar H10

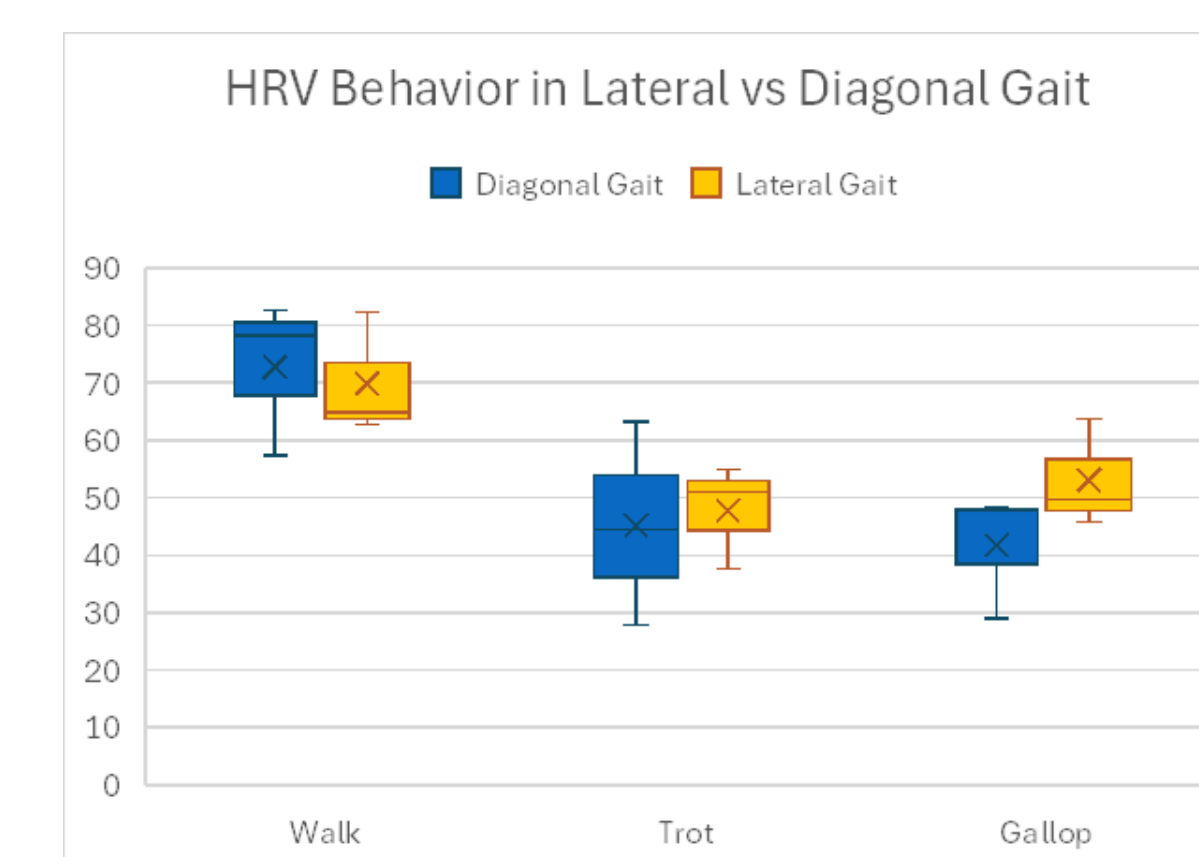
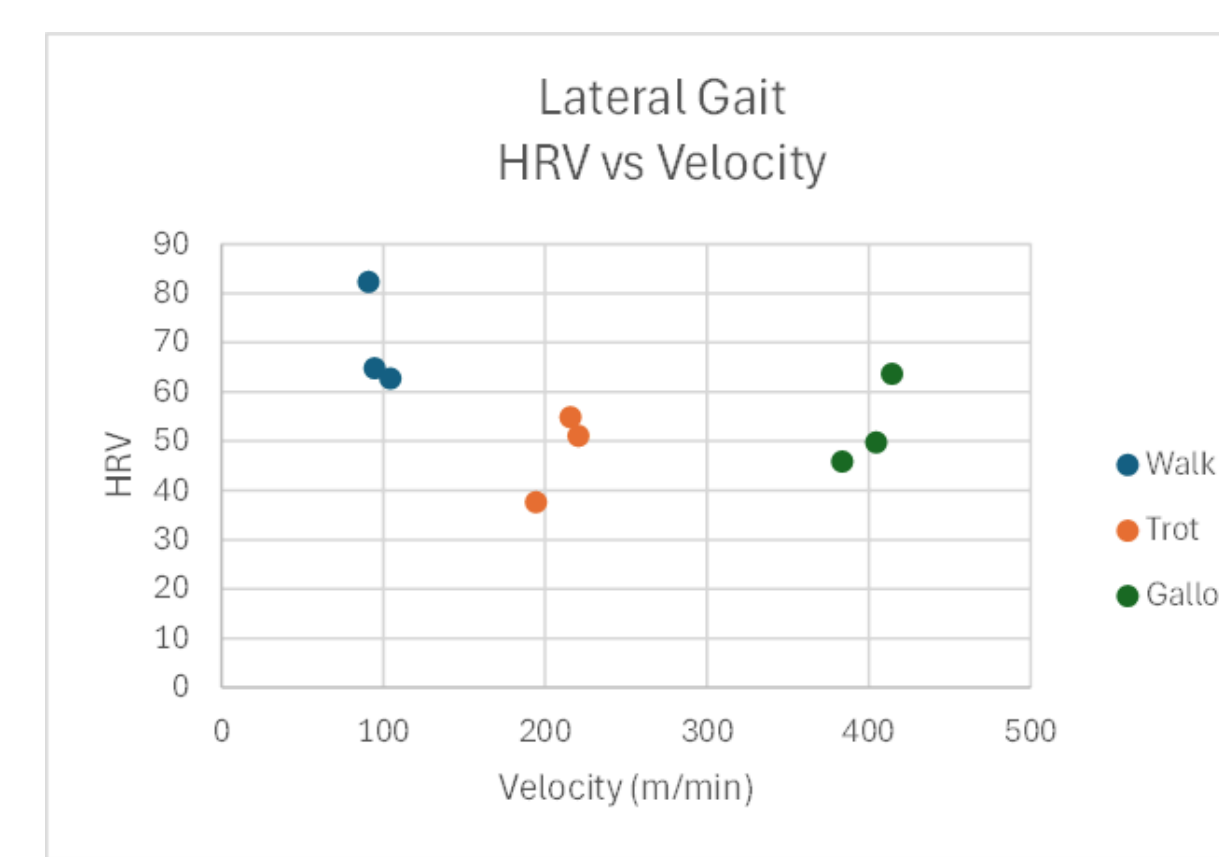
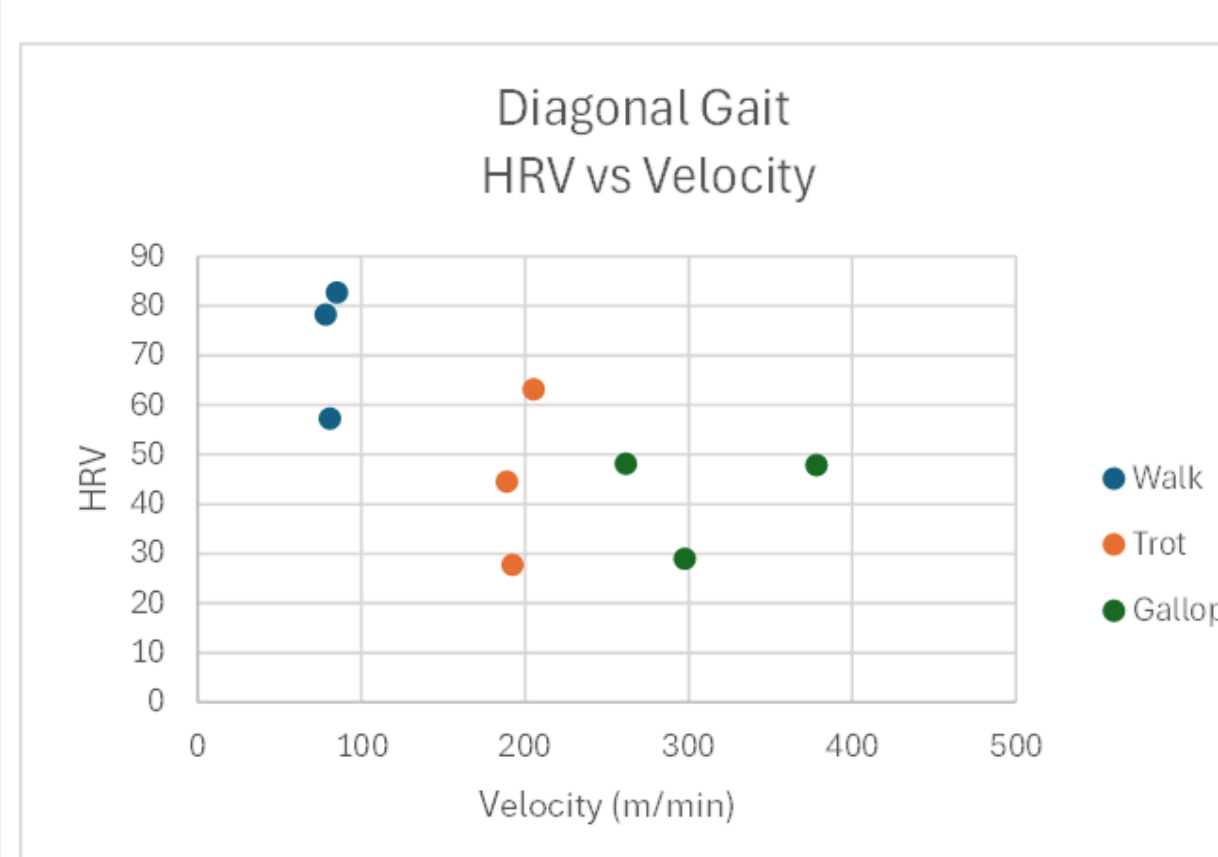
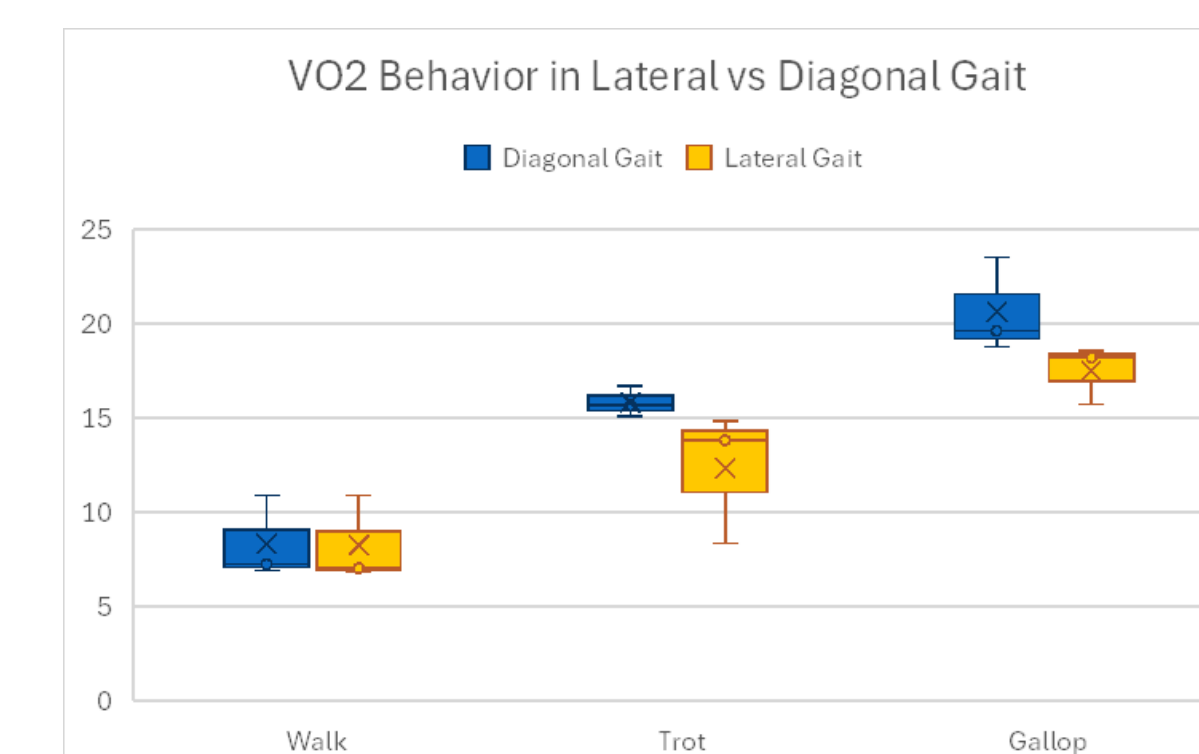
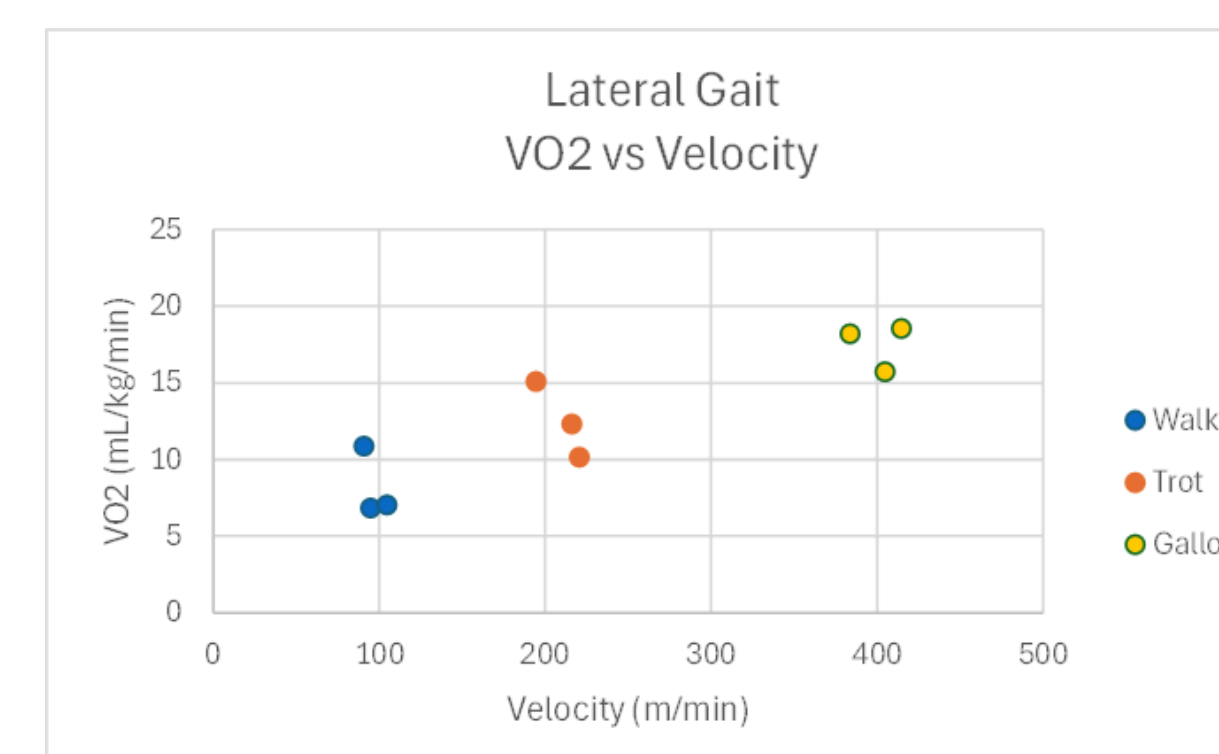
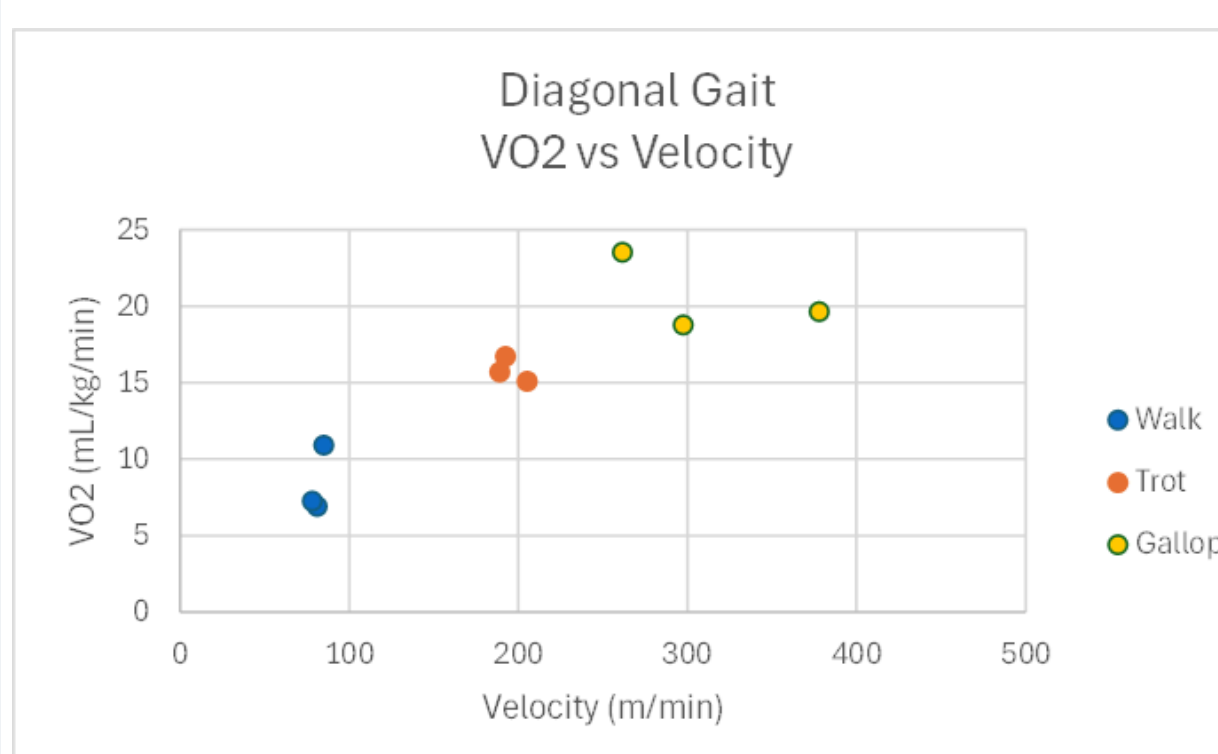
Data

Diagonal Gait

	Walk						Trot						Gallop					
	Velocity (m/min)	VO2 (mL/kg/)	HR (bpm)	RF (bpm)	HRV	O2 Cost (mL/kg/)	Velocity (m/min)	VO2 (mL/kg/)	HR (bpm)	RF (bpm)	HRV	O2 Cost (mL/kg/)	Velocity (m/min)	VO2 (mL/kg/)	HR (bpm)	RF (bpm)	HRV	O2 Cost (mL/kg/)
Trial 1	80.83	6.90	104.12	22.28	57.31	11.72	192.37	16.71	145.20	28.89	27.82	11.52	261.67	23.52	169.74	44.86	48.22	11.13
Trial 2	85.00	10.90	102.74	22.24	82.75	7.80	188.92	15.68	143.29	32.40	44.58	12.05	297.37	18.78	159.31	36.83	29.06	15.84
Trial 3	78.13	7.25	99.32	19.06	78.32	10.78	205.28	15.09	131.80	31.09	63.25	13.61	378.01	19.63	150.80	40.37	47.96	19.26
Average	81.32	8.35	102.06	21.20	72.79	10.10	195.52	15.82	140.10	30.80	45.22	12.39	312.35	20.64	159.95	40.69	41.74	15.41
STDEV	2.83	1.81	2.02	1.51	11.10	1.67	7.04	0.67	5.92	1.45	14.47	0.89	48.66	2.06	7.74	3.29	8.97	3.33

Lateral Gait

	Walk						Trot						Gallop					
	Velocity (m/min)	VO2 (mL/kg/)	HR (bpm)	RF (bpm)	HRV	O2 Cost (mL/kg/)	Velocity (m/min)	VO2 (mL/kg/)	HR (bpm)	RF (bpm)	HRV	O2 Cost (mL/kg/)	Velocity (m/min)	VO2 (mL/kg/)	HR (bpm)	RF (bpm)	HRV	O2 Cost (mL/kg/)
Trial 1	94.79	6.86	97.94	19.01	64.81	13.83	194.50	15.10	117.75	19.78	37.60	12.88	404.50	15.73	141.25	31.59	49.74	25.71
Trial 2	90.83	10.90	102.77	22.03	82.36	8.34	215.83	12.33	119.12	24.29	54.86	17.50	383.50	18.22	129.98	25.85	45.88	21.05
Trial 3	104.48	7.05	101.94	24.97	62.76	14.83	220.54	10.17	107.34	29.54	51.04	21.70	414.42	18.55	124.70	48.56	63.69	22.34
Average	96.70	8.27	100.88	22.00	69.98	12.33	210.29	12.53	114.74	24.53	47.83	17.36	400.81	17.50	131.97	35.33	53.10	23.03
STDEV	5.73	1.86	2.11	2.43	8.80	2.85	11.33	2.02	5.26	3.99	7.40	3.60	12.89	1.26	6.90	9.64	7.65	1.97



Analysis and Results

In this work, a case study was carried out to establish the foundations of a methodology for future investigations. The physical performance of the rider is observed in the graphs of VO2 vs velocity, in which a major velocity leads to a greater energy demand from the rider. It is also observed that the greatest dispersion of velocity occurs during the gallop gait, in which controlling the specimen becomes more difficult. This was observed for both horses; however, the demand is higher for the thoroughbred horse. As the speed of the task increases, HRV decreases, which shows a greater predominance of the sympathetic nervous system over the parasympathetic, resulting in a consequent decrease in stress control.

Conclusions and Recommendations

In horse riding tasks, at higher velocity, the demand of energy (increase in VO2), for the rider is greater, while their response to stress control was lower and there is a greater imbalance in the autonomic nervous system (decrease in HRV). The type of equine gait influences the physical and mental demand of the task. It is recommended to increase the sample size and trials, and to conduct more research on this topic.

Future Work & Acknowledgement

Research is primarily done with diagonal gaits because of the availability of horses with this pace. This research provides an opportunity to explore the mental and physical performance of both diagonal and lateral gaits with different riders of distinct experiences. We give a special thanks to the Caribbean Thoroughbred Aftercare (CTA) for supporting our investigation by lending us their facilities and equines.



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