Movement Asymmetry in Thoroughbred Racehorses During Lungeing

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Summary

This study examined movement asymmetry in racehorses lunged in both directions. While turning motion naturally induces asymmetry, significant differences between clockwise (CW) and counter-clockwise (CCW) directions suggest that inherent asymmetries from specialized training also play a role. These asymmetries could be misinterpreted as lameness using standard thresholds. Our results underscore the need for racehorse-specific lameness criteria to distinguish training-related adaptations from clinically relevant asymmetries.

Introduction

Equine lameness evaluations rely on visual assessment of horses trotting in a straight line and on a circle, where altered force distribution can exaggerate movement imbalances, aiding clinical assessment [1]. A recent study established threshold values for interpreting asymmetry indices in horses lunged in circles, based on a sample of sound and lame horses from various disciplines, including showjumping, eventing, and dressage [2]. However, racehorses often present with a degree of inherent asymmetry due to their specialized training [3], whether standard thresholds are applicable remains uncertain. This study investigates movement asymmetry in racehorses lunged CW and CCW. Understanding how turning affects symmetry is crucial to distinguishing training-related adaptations from asymmetries linked to pain or injury.

Methods

Twenty-nine Thoroughbred racehorses, all trained and raced in a CW direction, were initially screened for movement asymmetry. Within this population, the majority present either no detectable asymmetry or a right-forelimb asymmetry. Horses exhibiting left-forelimb asymmetry or signs of hindlimb asymmetry during a straight-line trot-up were excluded from analysis, resulting in a final sample of 22 horses. Each remaining horse was lunged at its preferred speed in both directions (CW and CCW). IMU sensors placed on the poll and withers recorded acceleration data, which were high-pass filtered, rotated, and double-integrated to obtain vertical displacement curves based on established methods [3]. For each sensor location, movement asymmetry was quantified by calculating differences in vertical displacement between the first and second halves of each stride, including differences of the maxima (maxDiff), minima (minDiff), and the amplitude (upDiff). Asymmetry values were adjusted to allow comparison of differences in relation to the direction of the circle, with positive values indicating reduced movement during the stance of the limb on the inside of the circle (i.e., right limb for the CW condition). Paired t-tests were conducted to compare the asymmetry values between directions. Additionally, Cohen's d was calculated as effect size (ES).

Results and Discussion

Movement asymmetry is expected during lungeing due to the need to generate centripetal force and resulting body lean. In theory, a symmetrical horse would show equal degrees of asymmetry, but in opposite directions, between the CW and CCW directions. In this study, paired t-test results showed significant differences in asymmetry values between CW and CCW for all variables ($p < 0.04$, ES = 0.46 – 1.63) except for minDiff at the poll ($p=0.75$). This suggests that racehorses in this study, while sound, are not perfectly symmetrical. When lunged CW, the average asymmetry values for all variables (maxDiff, minDiff, upDiff) at the poll and withers were positive (Table 1), indicating reduced movement during the stance of the inside limb. However, when lunged CCW, the asymmetry values were not consistently positive, with maxDiff at the poll and withers being negative, suggesting that the inside leg reached a higher vertical height after stance. These findings suggest that the differences in asymmetry are not solely due to the physiological effects of turning, but may also be influenced by the horses' inherent asymmetry from their specialized training. While the horses in this study were clinically assessed as sound, their asymmetry could potentially be mistaken for lameness. Overall, our results highlight the need for racehorse-specific thresholds for identifying lameness during lungeing.

Table 1: Mean ± SD of Asymmetry Values (mm) for Horses Lunged Clockwise and Counter-Clockwise. Bolded rows indicate significant differences ($p < 0.05$).

		Clockwise			Counter-clockwise		
Poll	minDiff	8.9	±	9.5	7.8	±	12.6
	maxDiff	**8.6**	**±**	**11.9**	**-5.9**	**±**	**14.0**
	upDiff	**17.4**	**±**	**17.2**	**1.2**	**±**	**20.1**
Withers	**minDiff**	**3.2**	**±**	**6.8**	**10.2**	**±**	**16.4**
	maxDiff	**7.9**	**±**	**7.8**	**-19.0**	**±**	**14.6**
	upDiff	**11.3**	**±**	**11.4**	**-8.6**	**±**	**16.8**

Conclusions

Racehorses show significant movement asymmetry differences between CW and CCW lungeing, influenced by both turning motion and training-related adaptations. These asymmetries, though seen in sound horses, could be mistaken for lameness under standard thresholds. Our findings highlight the need for racehorse-specific criteria for lameness evaluation.

Acknowledgments

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References

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