

EFFECT OF STRENUOUS SUB-MAXIMAL RACE ON HEART RATES OF ENDURANCE HORSES

LAWAN A.^{1,3}, NORANIZA M.A.¹, RASEDEE A.² AND BASHIR A.¹

1 Department of Veterinary Clinical Studies, Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

2 Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

3 Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, PMB1069, Borno State, Nigeria

Corresponding Author: drlawan3758@yahoo.com

ABSTRACT. The study was carried out to investigate the effect of prolong submaximal exercise on heart rate reflecting the performance of endurance horses after covering distances of 40 and 80 km races. This study was conducted in Malaysia to determine the post-race heart rates of endurance horses based on distances for the eliminated horses and those that completed the races with good performance. Heart rates of competing endurance horses were examined at pre- and post-race. Thirty-four endurance horses were sampled; N = 9 (40 km) and N = 9 (80 km) were the good performance horses while, N = 3 (40 km) and N = 13 (80 km) were the poor performance horses eliminated from the race. The mean heart rate of the good performance horses in the 40 km category was 53 ± 8 bpm and that of the 80 km in the good performance category was 56 ± 7 bpm, while the eliminated horses of the 40 km group had 74 ± 17 bpm and those in the 80 km group had 78 ± 7 bpm. The study showed that eliminated horses in the 40 and 80 km categories both exhibited high heart rates compared to the

good performance horses that were in the same racing category. Thus, the heart rates of horses during training may be used to predict performance based on distances covered in endurance races.

Keywords: endurance, heart rate, race category, performance.

INTRODUCTION

Measurement of the fitness or exercise tolerance of a horse is by assessment, through physical examination of heart rates and respiratory rates (Cottin *et al.*, 2006; Bashir and Rasedee, 2009). The active working muscle of endurance horses depends on heart size and capacity to deliver large volumes of blood to the tissue and the splenic reserve supply (Kenneth *et al.*, 2004; Lawan *et al.*, 2010). Endurance horses require calcium for muscle contractions and low plasma levels of calcium during strenuous endurance rides can lead to metabolic problems and failures, including synchronous diaphragmatic flutter. However, high blood calcium concentration is needless because it may

increase the frequency of thumps during endurance competitions (Lewis, 1995).

The best known abnormality in horses at risk of developing metabolic problems and exhaustion is persistently elevated heart rates after the competition (Rose *et al.*, 1977; Carlson, 1985; Schott and Charlton, 1996; Schott *et al.*, 1997, 2006; Harold, 2010). During endurance rides, cardiac output increases in response to the metabolic demands of active skeletal muscle and also due to a demand of increased skin blood flow for thermoregulatory cooling (Rowell, 1986; Hodgson *et al.*, 1994). Moreso, during a prolonged endurance ride, a decrease in blood flow may compromise function of less well-perfused organs. Specifically, the barrier function of the mucosal lining of the intestinal tract may become compromised. An intact mucosal barrier prevents absorption of many toxins that are present in the bowel lumen, but a prolonged decrease in intestinal blood flow during endurance exercise can lead to both decreased intestinal motility, increased absorption of toxins and heart rate variability which is an effective measure of equine fitness, overtraining and metabolic derangements (Harold, 2010).

High heart rate is the predominant indicator of decrease performance in strenuous equine endurance. Thus, this study was conducted to investigate the effect of prolonged sub maximal race on post-race heart rate as an indicator of performances in endurance horses after covering the distances of 40 and 80 km races.

MATERIALS AND METHODS

Subjects

Thirty-four endurance horses that participated in endurance competitions each consisting of 40 km (N=3) and 80 km (N=13) were eliminated from the race while the good performance horses that completed the race successfully are 40 km (N=9) and 80 km (N=9) were examined. Among these, 16 horses were eliminated and 18 horses completed the race successfully. The good performance horses are those that completed the race successfully while the poor performance horses are those that were eliminated due to high heart rate.

Veterinary inspection

Veterinary inspection was conducted after each loop of the race on all competing horses and the resting heart rate was recorded. The heart rate was re-evaluated and recorded each time the horses enter the vet-check after each loop of the race. The heart rate was evaluated as (44-64 = normal, 65-70 = high, 71-90 = very high). Good performance horses continue the race in the subsequent loop, while poor performance horses that were eliminated due to heart rate were sent to the clinic for treatments and further workout. Descriptive statistic mean \pm SD was used to analyse the result at $P < 0.05$ using statistical software JMP 9, SAS

RESULT

Thirty-four horses participated in the endurance ride. Sixteen horses were eliminated from the endurance competition. Eighteen horses managed to complete the race without metabolic signs and all were from the N=9 (40 km) and N=9 (80 km) category. All horses from the N=3 (40 km), and N=13 (80 km) category were eliminated because of high heart rates. Horses that completed the races with good performance showed a lower mean heart rate post-race (Table 1) and those eliminated from the race because of poor performance had elevated heart rates post-race as shown in (Table 2).

DISCUSSION

Recent studies showed that up to 40% of the horse populations in Malaysia are eliminated from endurance race due to cardiorespiratory derangement. High heart rates appears to affect cardiopulmonary performance and tissue oxygenation in the endurance horses, subjecting the endurance horses to higher risk of developing hyperthermia and thumps caused by alterations in fluid and electrolyte status resulting in a large percentage of these horses ultimately being eliminated from endurance races. The heart rates are also reliant on the oxygen carriage capacity of blood, which is dependent on erythrocyte number and hemoglobin concentrations (McKeever *et al.*, 2000).

Table 1. Pre and post-ride heart rates of good performance horses

Pre and post-ride parameters of good performance horses				
Parameters Number (n)	Pre-ride (km)		Post-ride distances (km)	
	40	80	40	80
	(n=9)	(n=9)	(n=9)	(n=9)
Heart rate (bpm)	41 ^a ± 5	37 ^a ± 4	53 ^b ± 8	56 ^b ± 7

All values are expressed as mean ± Std Dev.

a, b., within each row, means with different superscript are significantly different at $P < 0.05$, n = the number of horses.

Table 2. Pre and post-ride heart rates of poor performance horses

Pre and post-ride parameters of poor performance horses				
Parameters Number (n)	Pre-ride (km)		Post-ride distances (km)	
	40	80	40	80
	(n=3)	(n=13)	(n=3)	(n=13)
Heart Rate (bpm)	43 ^a ± 8	45 ^a ± 6	74 ^b ± 17	78 ^b ± 7

All values are expressed as mean ± Std Dev.

a, b., within each row, means with different superscript are significantly different at $P < 0.05$, n = the number of horses

In the face of depletion of body fluid stores consequent to prolonged sweating, struggle for cardiac output may develop between active muscle and skin, resulting in a decrease in performance and heighten core temperature (Hodgson *et al.*, 1994; Harold, 2010). Thus from the results of this study, it seems that the depletion of body fluid stores due to prolonged sweating and decrease in cardiac output to active muscles and skin could be the resultant decrease in performance of endurance horses (Hodgson *et al.*, 1994). Thus, resulting in the persistent elevated heart rates in poor performance endurance horses.

CONCLUSION

The study indicates that eliminated horses have higher heart rates than the good performance endurance horses. Therefore, high heart rates may be used as an indicator of performance in endurance horses during the conditioning protocols and training.

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ACKNOWLEDGEMENTS. The authors appreciate the effort and assistance offered by Mr. Mohamed Halmi Othman, Mr. Abdullah Misron, the staff of Veterinary Teaching Hospital, Universiti Putra Malaysia especially Mr. Salehuddin and Drs Mohammad Fairuz Jamaluddin, Muhammad Munsiff Kamarudin and Mimi Armiladiana Mohamad for their assistance, advice and encouragement.