

# Detection of coronet temperature changes in horses using infrared thermography during partial limb occlusion and reperfusion

C. Maccario<sup>1</sup>, J. J. Kellershohn<sup>2</sup>, A. Bremhorst<sup>2</sup>, L. Dumont<sup>3</sup>, S. Montavon<sup>3</sup>, C. Spadavecchia<sup>2</sup>,  
M. Feighelstein<sup>4</sup>, A. Zamansky<sup>5</sup>, E. Dalla Costa<sup>1\*</sup>

<sup>1</sup> Dept. of Veterinary Medicine and Animal Sciences, Università degli Studi di Milano, Lodi, Italy; <sup>2</sup> Dept. für klinische Veterinärmedizin, Vetsuisse-Fakultät Universität, Bern, Switzerland; <sup>3</sup> Veterinary Dept. of the Swiss Armed Forces, Bern, Switzerland; <sup>4</sup> Engineering Cluster, Tel-Hai University of Kiryat Shmona on the Galilee, Israel; <sup>5</sup> Dept. of Information Systems, University of Haifa, Haifa, Israel

Skin temperature is determined by blood temperature and cutaneous blood flow, which is regulated primarily through sympathetic adrenergic vasoconstrictor activity. Thus, factors affecting periferic vasodilatation and vasoconstriction, such as diseases, injuries, and compression can alter infrared radiation, leading to an increased or decreased periferic body temperature. Infrared thermography (IRT) is a diagnostic imaging technique that captures infrared radiation emitted by the body and converts into thermal data [1, 2]. Recently, it has emerged in equine veterinary practice as a promising non-contact, non-invasive and low-cost examination to detect blood flow alterations, inflammation, and neurological dysfunction [3]. The aim of this study was to evaluate whether IRT can detect temperature changes in the distal forelimb (coronary band) of horses during partial vascular occlusion and re-perfusion induced by a pressure cuff. Fifteen adult healthy horses (12 geldings and 3 mares, mean age 9.3 years) underwent vascular occlusion of one forelimb using a cuff placed above the carpus. Horses were tested in two sessions under three conditions: (1) baseline (no cuff, 5 min duration), (2) occlusion (cuff inflated to 95% limb occluding pressure [4], 10 min duration), and (3) re-perfusion (cuff removed, 5 min duration). Images were acquired with a FLIR E76 thermal camera with an emissivity of 0.98, at 3 m in closed environment (stable). Three images per condition per session per horse were collected, resulting in a total of 9 images per session per horse and a total of 18 images per horse. Images were processed with FLIR Thermal Studio, defining an elliptical area on both coronets (Fig 1a). From each image, the mean temperature was measured from these areas and the delta temperature (occluded limb – not occluded limb) was calculated. A Repeated Measures General Linear Model (RGLM) analysed delta temperature with condition as the within-subject factor and session as the between-subject factor. Bonferroni post-hoc tests were applied.

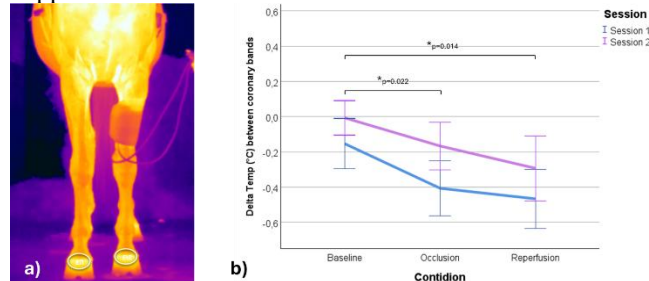


Figure 1 – a) Thermographic image showing the elliptical region of interest positioned over the coronary band for temperature calculation. b) Mean delta temperature across conditions in the two sessions. Error bars represent the 95th percentile. Significant differences are highlighted with asterisks.

Median delta temperature (°C) values decreased from baseline (Md=-0.10, 95th percentile=0.70) to occlusion (-0.35+/-0.80) and to re-perfusion (-0.35+/-0.70) (Fig 1b). Condition significantly affected delta temperature (RGLM, p=0.005), whereas session had no effect. Significant differences were found between baseline and occlusion (p=0.022) and between baseline and re-perfusion (p=0.014). These results indicate that IRT was useful in identifying a decrease in temperature due to a partial limb occlusion.

[1] M. Alisi, J. Al-Ajlouni, M. K. Ibsais, Z. Obeid, Y. Hammad, A. Alelaumi, M. Al-Saber, O. Abuasbeh, and F. Abuhajleh, "Thermographic Assessment of Reperfusion Profile Following Using a Tourniquet in Total Knee Arthroplasty: A Prospective Observational Study" *Med. Devices Evid. Res.*, vol. 14, pp. 133–139, 2021, doi: 10.2147/MDER.S300726.

[2] Q. Liu, M. Li, W. Wang, S. Jin, H. Piao, Y. Jiang, N. Li, and H. Yao, "Infrared thermography in clinical practice: a literature review" *Eur. J. Med. Res.*, vol. 30, art. no. 33, pp. 1–17, 2025, doi: 10.1186/s40001-025-02278-z.

[3] V. Redaelli, D. Bergero, E. Zucca, F. Ferrucci, L. N. Costa, L. Crosta, and F. Luzi, "Use of Thermography Techniques in Equines: Principles and Applications" *J. Equine Vet. Sci.*, vol. 34, no. 3, pp. 345–350, 2014, doi: 10.1016/j.jevs.2013.07.007.

[4] S.A. Johnson, D.D. Frisbie, G.M. Griffenhagen, and M.R. King, 2023. "Equine blood flow restriction training: Safety validation" *Equine Veterinary Journal*, 55(5), pp.872-883.

\* e-mail: [emanuela.dallacosta@unimi.it](mailto:emanuela.dallacosta@unimi.it)