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Hoof thermal and colour pattern changes in horses after trot-up using infrared thermography

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Abstract

Alterations in peripheral circulation and local metabolic activity within the equine hoof may precede overt clinical signs of lameness. This exploratory study aimed to characterise changes in hoof surface temperature and thermal colour distribution in clinically healthy horses following trot-up exercise at different distances using infrared thermography. Three clinically sound crossbred geldings underwent trot-up at baseline/0 m, 90 m, 180 m, and 270 m on a standardised hard, dry track under controlled environmental conditions. Thermographic images of the coronary band, hoof wall, sole, frog, and heel were obtained at rest and within 20-30 seconds after each trot-up distance using a fixed camera-hoof distance, a constant Iron bow colour palette and an emissivity setting of 0.95. Mean surface temperature for each region of interest was extracted as the primary quantitative variable, while pseudo-colour thermograms were analysed as complementary graphical maps of surface temperature distribution using predefined RGB-based thresholds. Hoof surface temperature increased progressively with trot-up distance in all examined regions ($P<0.05$), with the coronary band showing the greatest distance-related rise, and thermograms demonstrated a distance-dependent shift from cooler to warmer colour categories. These findings provide baseline information on physiological hoof surface temperature and thermal distribution responses to trot-up in a small sample of healthy horses and support the use of infrared thermography as a non-invasive, adjunctive tool for objective assessment during lameness evaluation. However, infrared thermography reflects surface temperature rather than blood flow or metabolism, and the small sample size and limited population restrict the generalisability of the results.

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Introduction

Infrared thermography is a non-invasive imaging technique that detects infrared radiation emitted from the body surface and converts it into a visual representation of surface temperature distribution (1). Accordingly, infrared thermography should be regarded as an indirect surrogate of underlying physiological processes, and not as a direct measure of tissue perfusion or metabolic activity. Although body surface temperature is influenced by cutaneous blood flow, tissue properties, and environmental conditions, infrared thermography itself only measures surface temperature and does not directly quantify blood flow or metabolic activity. Therefore, thermographic findings must be interpreted as indirect indicators of physiological changes within the distal limb (2,3).

Thermal colour patterns observed on infrared images represent relative differences in surface temperature distribution, with warmer colour categories corresponding to higher surface temperature ranges defined by the colour scale, and cooler categories indicating comparatively lower temperature (4). As such, thermographic colour images serve as pseudo-colour maps of surface temperature rather than direct images of blood perfusion or metabolic rate (5). In horses, such exercise-induced thermal responses can be detected using infrared thermography as regional variations in surface temperature and thermal colour patterns following controlled locomotor activity (6).

Based on its structural and vascular features, the equine hoof is particularly sensitive to circulatory changes during movement and plays a crucial role in weight-bearing and shock absorption (4). A significant percentage of equine lameness cases are caused by hoof-related disorders, underscoring the clinical significance of hoof physiology in relation to welfare and performance (7). As a result, functional changes in the hoof may occur early and be difficult to identify by visual inspection alone, especially during a routine clinical examination (8).

In equine veterinary medicine, infrared thermography has been applied as a complementary method to evaluate surface thermal changes associated with musculoskeletal disorders and exercise-related physiological responses, supporting its use as an adjunct rather than a standalone diagnostic tool (1,9,10). The trot-up examination is a controlled form of exercise routinely used in equine clinical practice to assess gait symmetry and limb function during lameness evaluation (11). As trot-up involves active locomotion, it may induce exercise-related physiological and circulatory responses in the distal limb and hoof, which could be detected as changes in surface temperature and thermal colour patterns via infrared thermography (5,8).

Despite the widespread clinical use of trot-up examination, information regarding hoof-specific surface thermal and thermal colour pattern changes following trot-up exercise remains limited, as previous thermographic studies have predominantly focused on treadmill exercise or proximal limb regions rather than the hoof during routine clinical gait assessment (5,8). Characterisation of physiological hoof thermal responses following trot-up exercise is therefore necessary to establish baseline reference patterns that may help distinguish normal exercise-induced changes from abnormal thermal alterations associated with hoof-related disorders (12,13).

Given that only three clinically healthy geldings were included, the present study was designed to provide detailed, repeated-measures observations of physiological hoof surface temperature responses to trot-up rather than to generate broadly generalisable population estimates. These baseline patterns will support future studies involving larger and clinically diverse equine populations.

Materials and methods

Ethical Approval

All experimental procedures were approved by the Animal Care and Use Committee, Universitas Brawijaya, Indonesia (Ethical clearance No. 073-KEP-UB-2024).

Animals

This controlled field experiment employed a within-subject repeated-measures design. Three clinically healthy crossbred geldings (*Equus ferus caballus*) were enrolled in this study, with a mean age of 8.7 ± 0.6 years and a mean body weight of 429.7 ± 50.5 kg. All horses were clinically examined and confirmed to be free of lameness, with a uniform history of hoof care. Prior to data collection, horses were acclimatised for 30 minutes under experimental environment to ensure thermal equilibration before baseline measurements were taken.

Sample size estimation was performed a priori using G*Power software (version 3.1) for a repeated-measures ANOVA (within factors), assuming an effect size (f) of 0.40, an α error probability of 0.05, and a desired statistical power ($1-\beta$) of 0.95, in order to guide the design and ensure that the chosen protocol could detect within-subject changes in hoof surface temperature. The analysis indicated that, under these assumptions, the repeated-measures design would provide sufficient statistical power to detect distance-related effects. Each horse contributed repeated hoof surface temperature measurements at four trot-up distances (baseline rest/0 m, 90, 180, and 270 m) across multiple hoof regions. Data collection was conducted over four consecutive weeks, during which all three horses were examined weekly. For each distance and each week, six thermographic images were acquired per horse, and within each imaging session six repeated images were obtained for each region of interest (hoof wall, sole, frog, coronary band, and heel). This resulted in a within-subject repeated-measures design with a large number of observations per individual, improving sensitivity for detecting within-horse changes in hoof surface temperature over distance. Nevertheless, the small number of animals inevitably restricts the assessment of inter-individual biological variability and limits the generalisability of the findings to the wider equine population; thus the present study should be regarded as an exploratory physiological characterisation rather than a definitive population-level estimate.

Trot-up examination

All trot-up examinations were performed on the same straight 15 m track with a flat, dry, non-slippery, hard surface to standardise hoof-ground interaction and ensure consistent footing throughout all trials. Horses were trotted at a consistent pace using a halter and lead rope. The order of trot-up distances (baseline/0 m, 90 m, 180 m, and 270 m) was assigned in a fixed sequential order from shortest to longest to reflect a progressive exercise loading protocol; no randomisation of distance order was applied, as each distance represented a cumulative locomotor stimulus rather than an independent treatment. A standardised rest period of 10 minutes was provided between each trot-up distance to allow partial recovery and minimise residual thermal carryover between exercise bouts.

Baseline thermographic images were obtained at rest prior to any exercise (baseline, 0 m), followed by sequential trot-up at 90 m, 180 m, and 270 m. Thermographic images were consistently acquired within 20-30 seconds after the horse came to a halt at the completion of each distance, a time window selected to capture the immediate post-exercise surface temperature response before substantial passive cooling occurs. The same operator and acquisition sequence were applied across all distances and horses to reduce temporal and operator variability. All exercise sessions and image acquisition were conducted during morning hours on the same days to minimise circadian variation in body surface temperature.

All thermographic images were acquired in a shaded area under controlled environmental conditions (14). Environmental conditions (ambient temperature, relative humidity, light intensity, and temperature-humidity index) were continuously monitored and maintained within a narrow range, and direct solar radiation and wind exposure were avoided throughout the protocol, in accordance with current recommendations for equine thermography. During image acquisition, the mean ambient temperature was 21.46 ± 1.41 °C, the relative humidity was 80.72 ± 5.26%, the ambient light intensity was 192.74 ± 59.36 lux, and the temperature–humidity index (THI) was 69.28 ± 2.30. These conditions were considered stable and comparable across all sessions, thereby minimising the influence of environmental variability on hoof surface temperature measurements.

Infrared thermography

Infrared thermographic imaging was performed using a Seek CompactXR® infrared camera (Seek Thermal Inc., USA) equipped with a 206 × 156 pixels thermal sensor and a 20° field of view. The camera employs an internal electromechanical shutter for automatic calibration during operation. Thermographic images were acquired within 20-30 seconds after completion of each trot-up distance at a fixed camera-to-hoof distance of approximately 30 cm, with the camera positioned perpendicular to the hoof surface to minimise geometric distortion and ensure consistent image geometry across all acquisitions. Manual focus adjustment was performed prior to each image acquisition. An emissivity value of 0.95 was applied throughout the study, consistent with values reported in the literature for keratinised biological surfaces including equine hoof horn. The reflected apparent temperature was set to match the mean ambient temperature recorded at the time of each imaging session. No software-based distance correction was applied, as a fixed and standardised camera-to-hoof distance of 30 cm was maintained throughout all acquisitions. Spot mode was used to obtain surface temperature measurements at each region of interest, and the Iron bow colour palette was selected and kept fixed throughout the study to enhance visual contrast of thermal distribution and ensure comparability of pseudo-colour thermograms between sessions and individuals. Identical camera settings (emissivity, reflected apparent temperature, temperature span, colour palette, and focus) were maintained across all imaging sessions and horses to minimise systematic measurement bias and ensure consistency of surface temperature data.

Thermal image analysis

Thermographic images were analysed using ImageJ (v1.54g). Mean surface temperature (°C) was extracted for each region of interest (ROI) as the primary quantitative variable. Pseudo-colour thermograms were treated as graphical temperature distribution maps, with a fixed colour bar mapping each colour category to a predefined temperature range (14). Thermal colour distribution within each ROI was segmented in RGB display space using the Colour Threshold tool, applying fixed 8-bit RGB thresholds to derive the proportional area occupied by each colour category (15). In the RGB model, displayed colours can be expressed as combinations of the red (R), green (G), and blue (B) components, with coefficients within a unit cube ('RGB cube'). In this representation, the vertices {0,0,0} and {1,1,1} correspond to black and white, respectively, while the primary vertices are {1,0,0} (red), {0,1,0} (green), and {0,0,1} (blue); the secondary vertex {1,1,0} corresponds to yellow (16). Fixed 8-bit RGB thresholds (0–255) were applied to classify pixels into five colour categories based on relative channel dominance: white ($R > 184$, $G > 80$, $B > 82$), red ($R > 64$, $G < 90$, $B < 81$), yellow ($R > 119$, $G > 93$, $B < 80$), green ($R < 119$, $G > 82$, $B < 80$), and blue ($R < 133$, $G > 49$, $B > 83$). The proportional area of each colour category was calculated as the percentage of pixels in each ROI, representing the spatial temperature distribution across the hoof surface. Quantitative temperature values were therefore used as the principal outcome, while colour-based area measurements provided complementary, semi-quantitative information on the spatial redistribution of surface temperature across the hoof.

Data analysis

Surface temperature data were analysed using a non-parametric repeated-measures approach. Because hoof surface temperature was measured repeatedly in the same horses across trot-up distances (within-subject design) and the small sample size did not allow robust confirmation of normality assumptions, the Friedman test was used to evaluate the effect of distance on hoof surface temperature. When the Friedman test indicated a significant overall effect, Dunn's post hoc test with Bonferroni correction was applied for pairwise comparisons between distances. Results are reported as median (interquartile range, IQR). Thermal colour distribution is described using representative thermograms and heatmaps. Statistical significance was set at P<0.05.

Results

Hoof surface temperature across all evaluated regions showed a consistent, distance-dependent increase following trot-up examination. This confirms that the exercise protocol was sufficient to elicit measurable changes in hoof surface temperature in clinically healthy horses. Friedman test demonstrated a significant overall effect of trot-up distance on hoof surface temperature in all regions examined: coronary band ($\chi^2(3)$= 12.00, P<0.007), hoof wall ($\chi^2(3)$= 11.77, P<0.008), sole ($\chi^2(3)$= 12.00, P<0.007), frog ($\chi^2(3)$= 11.45, P<0.01) and heel ($\chi^2(3)$= 12.00, P<0.007), indicating that trot-up exercise was associated with significant increases in hoof surface temperature (Table 1).

Hoof surface temperature across all evaluated regions showed a consistent, distance-dependent increase following trot-up examination when expressed as median (IQR). At the coronary band, median temperature rose from 29.0°C (29.0-29.0) at baseline to 32.0°C (32.0-33.0) after 270 m, indicating a clear upward shift in surface temperature with increasing exercise distance. Hoof wall temperatures followed a similar pattern, increasing from 28.0°C (27.0-28.0) at baseline to 31.0°C (31.0-32.0) at 270 m, demonstrating progressive warming of the dorsal hoof capsule.

In the solar aspect of the hoof, median sole temperature increased from 26.0°C (26.0-26.0) at baseline to 30.0°C (30.0-30.0) after 270 m, while frog temperature rose from 28.0°C (28.0-28.0) to 31.0°C (31.0-31.0) over the same distance range. The heel region also exhibited a marked increase, with median temperature rising from 27.0°C (27.0-27.0) at baseline to 31.0°C (31.0-31.0) at 270 m, reflecting a robust thermal response to increasing locomotor demand. These median (IQR) values, together with the significant Friedman test results for all regions, confirm that the trot-up protocol elicited consistent exercise-induced increases in hoof surface temperature in clinically healthy horses.

These numerical findings were supported by thermographic imaging. Representative infrared images of the coronary band and hoof wall demonstrated a gradual expansion of warmer colour regions with increasing trot-up distance, which was more pronounced in the coronary band compared with the hoof wall, particularly after 270 m trot-up (Figure 1). Comparable distance-related thermal pattern changes were observed in the sole, frog, and heel regions, with the heel exhibiting more evident increases in warmer colour distribution than the sole and frog at longer trot-up distances (Figure 2).

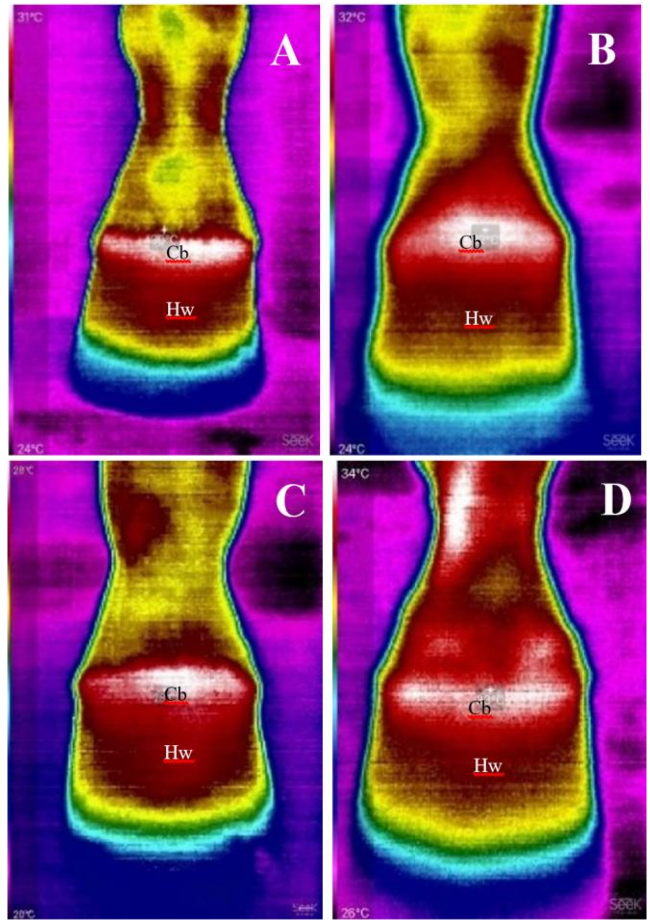

Figure 1: Representative infrared thermographic images showing surface temperature distribution in the coronary band (Cb) and hoof wall (Hw) at (A) baseline (0 m) and after trot-up at (B) 90 m, (C) 180 m, and (D) 270 m.

Analysis of thermographic colour area distribution further corroborated these observations. Representative infrared images of the coronary band (Figure 3) and hoof wall (Figure 4) demonstrated a gradual expansion of warmer colour categories (corresponding to higher surface temperature ranges on the colour scale) with increasing trot-up distance. In contrast, the sole and frog regions retained higher proportions of intermediate and cooler colour categories, with only moderate increases in warmer colour areas (Figures 5 and 6). The heel displayed an intermediate response pattern, characterized by a marked increase in warmer colour proportions relative to the sole and frog (Figure 7). These observations are based on qualitative assessment of colour coded thermograms using a fixed temperature scale and colour palette, and are intended to complement, rather than replace, the quantitative temperature measurements.

Table 1: Changes in hoof surface temperature (°C) in different hoof regions following trot-up at increasing distances (baseline/0 m, 90, 180, and 270 m)

Hoof region	Median (IQR)				*P. value*
	Baseline (0 m)	90 m	180 m	270 m	
Coronary band	29.0 (29.0-29.0)[a]	30.0 (30.0-31.0)[b]	32.0 (31.0-32.0)[c]	32.0 (32.0-33.0)[d]	<0.01
Hoof wall	28.0 (27.0-28.0)[a]	29.0 (28.0-29.0)[b]	30.0 (30.0-31.0)[c]	31.0 (31.0-32.0)[d]	<0.01
Sole	26.0 (26.0-26.0)[a]	27.0 (27.0-27.0)[b]	29.0 (28.0-29.0)[c]	30.0 (30.0-30.0)[d]	<0.01
Frog	28.0 (28.0-28.0)[a]	29.0 (29.0-30.0)[b]	30.0 (30.0-31.0)[c]	31.0 (31.0-31.0)[d]	<0.01
Heel	27.0 (27.0-27.0)[a]	28.0 (28.0-29.0)[b]	30.0 (30.0-30.0)[c]	31.0 (31.0-31.0)[d]	<0.01

Values are presented as median (interquartile range). Different superscript letters within the same row indicate significant differences between distances (P<0.05).

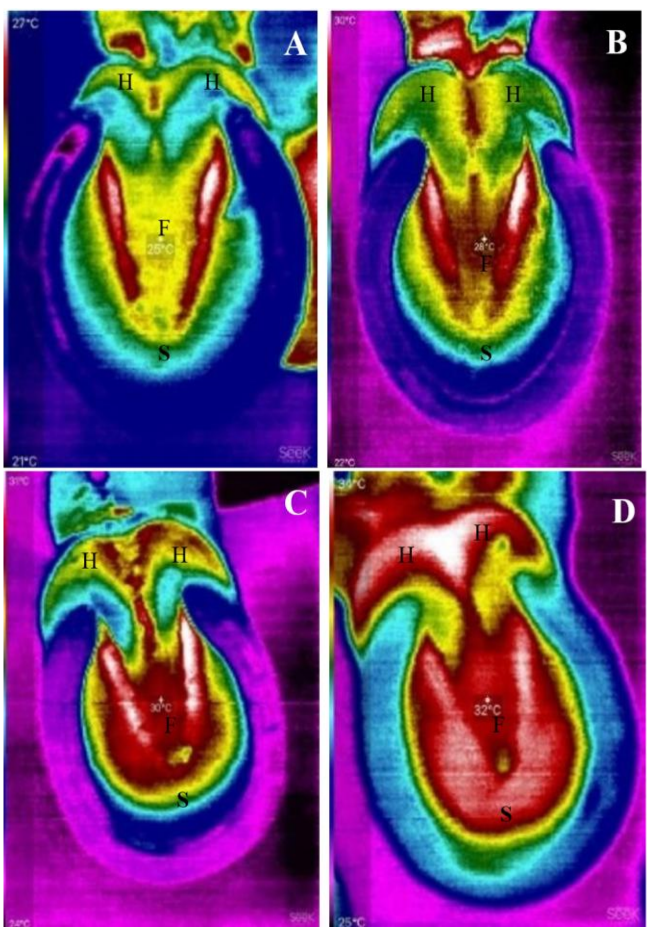

Figure 2: Representative infrared thermographic images showing surface temperature distribution in the sole (S), frog (F), and heel (H) at (A) baseline (0 m) and after trot-up at (B) 90 m, (C) 180 m, and (D) 270 m.

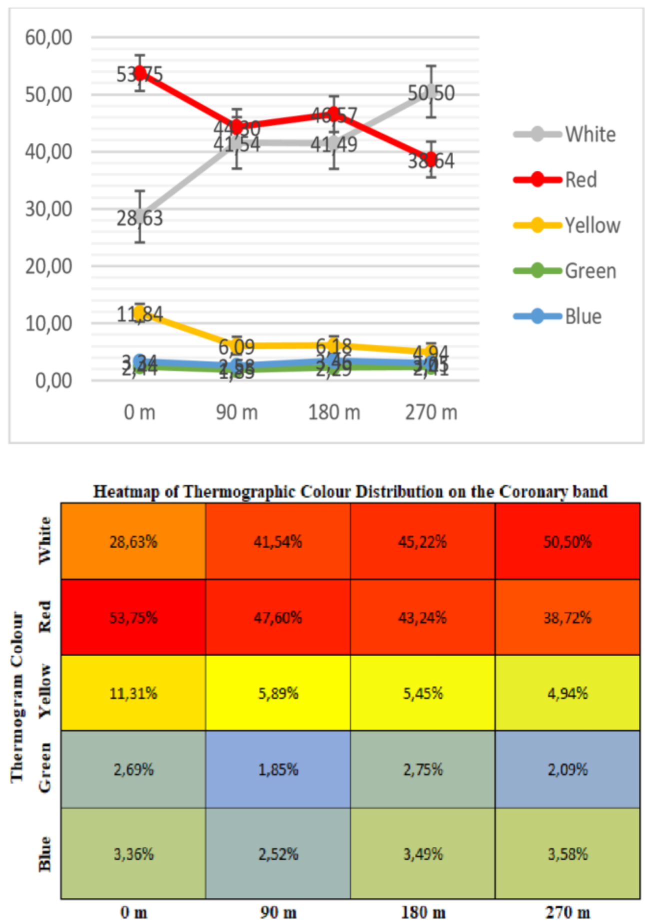

Figure 3: (A) Changes in the percentage distribution of thermographic colour areas in the coronary band following trot-up at increasing distances. (B) Heatmap illustrating the relative thermographic colour distribution in the coronary band at each trotup distance.

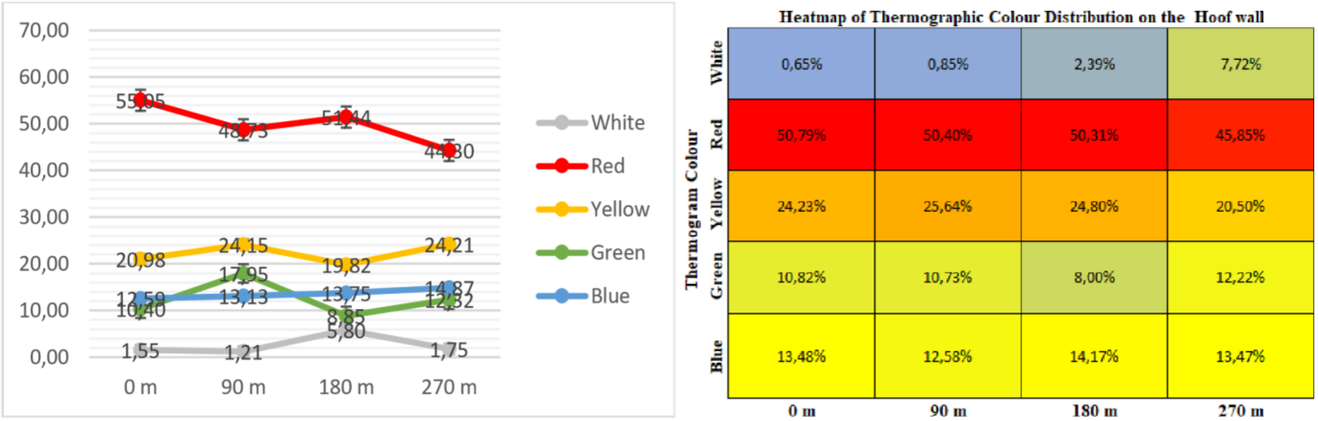

Figure 4: (A) Changes in the percentage distribution of thermographic colour areas in the hoof wall following trot-up at increasing distances. (B)-Heatmap illustrating the relative thermographic colour distribution in the hoof wall at each trot-up distance.

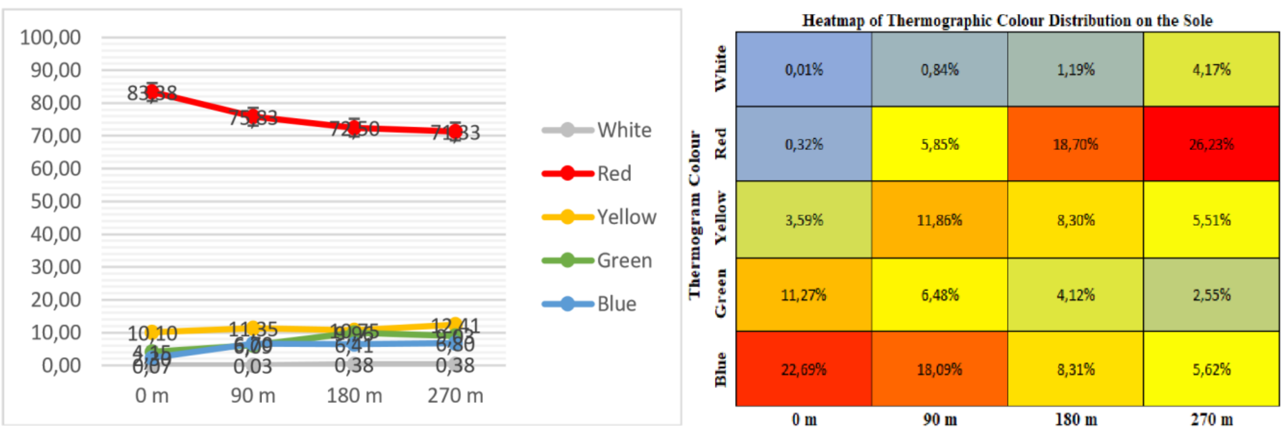

Figure 5: (A) Changes in the percentage distribution of thermographic colour areas in the sole following trot-up at increasing distances. (B) Heatmap illustrating the relative thermographic colour distribution in the sole at each trot-up distance.

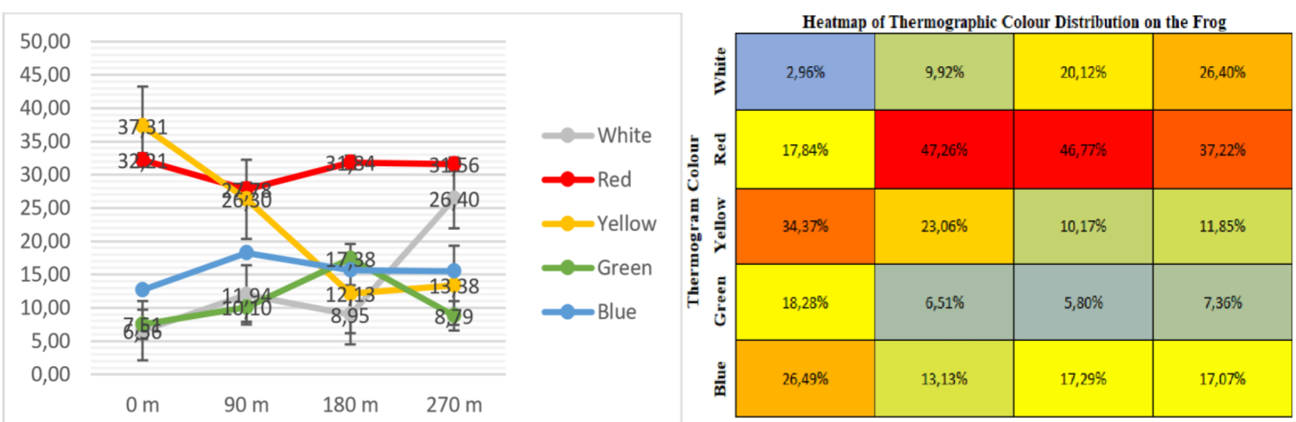

Figure 6: (A) Changes in the percentage distribution of thermographic colour areas in the frog following trot-up at increasing distances. (B) Heatmap illustrating the relative thermographic colour distribution in the frog at each trot-up distance.

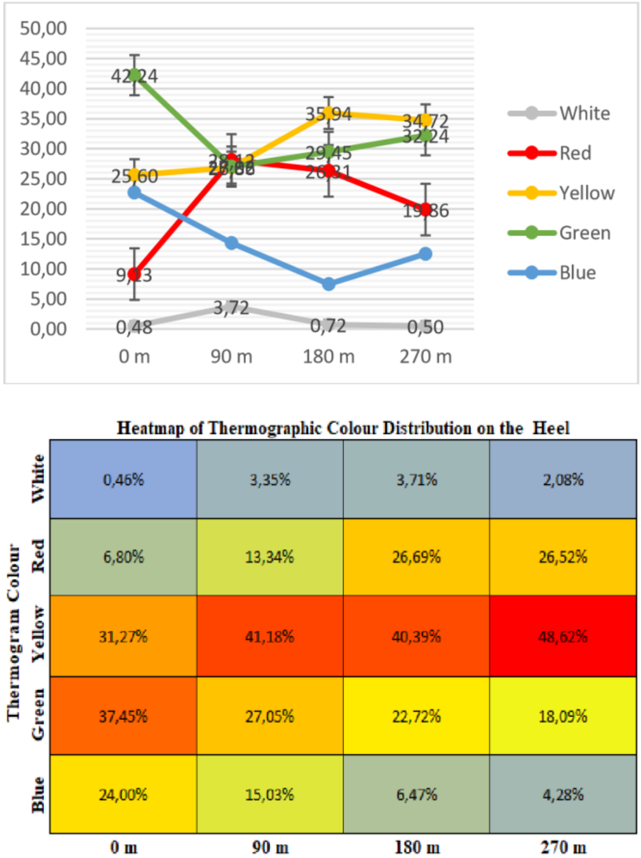

Figure 7: (A) Changes in the percentage distribution of thermographic colour areas in the heel following trot-up at increasing distances. (B) Heatmap illustrating the relative thermographic colour distribution in the heel at each trot-up distance.

Discussion

The present study demonstrated a progressive increase in hoof surface temperature following trot-up examination, with greater thermal responses observed at longer distances, indicating that locomotor activity induces measurable changes in distal limb surface temperature. In previous studies, exercise-induced increases in surface thermal have been interpreted as consistent with increased cutaneous blood flow and changes in thermal physiology; however, infrared thermography provides only an indirect estimate of such processes because it measures surface temperature rather than blood flow or metabolism directly (1,5,6). Increases in surface temperature during exercise have been interpreted in previous studies as being associated with enhanced peripheral blood flow and increased metabolic activity, reflecting a normal physiological adaptation to locomotor demand, although such processes were not directly measured in the present study (3,14,17).

The relationship between skin temperature and blood flow is complex and affected by anatomical structures, tissue composition, hair coat, and environmental conditions. Consequently, thermographic patterns should be interpreted as indicators of altered surface heat distribution that may be associated with physiological changes rather than as direct measurements of microcirculation or metabolic rate. This is particularly relevant for the hoof, where different structures (hoof wall, sole, frog, and coronary band) likely differ in emissivity and thermal inertia.

In the present study, more pronounced surface temperature increases were observed in the coronary band and hoof wall compared with other hoof regions, suggesting regional differences in surface thermal responsiveness to exercise (12). These regions are known to be anatomically and functionally important for hoof horn production and load transmission, and they contain a relatively rich vascular network; thus, it is plausible that they exhibit greater exercise-related changes in surface temperature. However, these functional explanations remain inferential and were not directly tested here, and they should therefore be regarded as hypotheses for future targeted investigations rather than definitive mechanistic conclusions.

Thermal responses in the sole, frog, and heel regions followed a comparable distance-dependent trend but with a lower magnitude than that observed in the coronary band (15,18). The higher proportion of cooler and intermediate thermal patterns in the sole and frog is consistent with their more heavily keratinised structure and their roles in load distribution and shock absorption, whereas the more marked shift towards warmer thermal patterns in the heel may relate to its involvement in weight-bearing, deformation, and energy dissipation during the stance phase of locomotion. Again, these interpretations are biologically plausible but speculative within the context of the present dataset and should be confirmed in future studies specifically designed to test structure-function relationships in hoof thermoregulation. (19-21).

Analysis of thermographic colour distribution provided complementary information to numerical temperature measurements by illustrating spatial changes in surface thermal patterns across different hoof regions (6,22). Colour-based analysis has been shown to enhance the interpretation of infrared thermographic images by facilitating the visualization of regional temperature redistribution that may not be fully captured by point temperature values alone (23,24). Similar analytical approaches have been successfully applied in equine studies to characterize physiological and exercise-induced thermal responses using infrared thermography, supporting the relevance of combining quantitative and colour-based assessments (25,26). In the present study, numerical temperature data were used as the primary outcome for statistical analysis, whereas colour-area distributions were intentionally restricted to descriptive evaluation of spatial patterns. This approach is in line with recent advanced image-processing studies that apply colour models to support, rather than replace, quantitative thermometric data in equine thermography.

The use of trot-up as an active lameness examination is clinically relevant, as it is routinely employed in equine practice to assess gait symmetry and limb function under controlled conditions (27,28). Despite its widespread use, the trot-up examination relies primarily on visual assessment and may fail to detect subtle physiological alterations at an early stage (7,8). The ability of infrared thermography to detect objective surface thermal responses following trot-up exercise in healthy horses is consistent with its proposed use as a non-invasive adjunct tool in lameness evaluation, as reported in previous studies, rather than as a standalone diagnostic method (9,10).

Several limitations of the present study should be acknowledged, including the use of a limited number of clinically healthy horses, which restricts interpretation to physiological rather than pathological thermal responses (8,29). The small sample size further limits the statistical power and generalizability of the findings to the wider equine population. In addition, infrared thermography is influenced by assumptions about surface emissivity, and different hoof structures, such as keratinized horn tissue and skin at the coronary band, may exhibit varying emissivities that can affect absolute temperature measurements (2,14,30). Although environmental conditions were carefully controlled, surface temperature measurements may still be affected by ambient and technical factors inherent to the method. Furthermore, while the present findings demonstrate clear exercise-induced thermal changes in clinically healthy horses, further studies involving larger samples and horses with clinically evident lameness are required to confirm these findings and to establish the diagnostic performance of infrared thermography in lameness detection (31,32).

Overall, the present study provides baseline information on hoof surface temperature and thermal colour distribution following trot-up examination in clinically healthy horses (1,12). Establishment of such baseline physiological thermal patterns is essential for future investigations aimed at distinguishing normal exercise-induced responses from abnormal thermal patterns associated with hoof-related disorders and lameness (13,33).

Conclusion

This study showed that hoof surface temperature increased and the colour distribution shifted towards warmer categories with longer trot-up distances in healthy horses. These changes provide baseline data and support the use of infrared thermography as a non-invasive tool for assessing hoof thermal responses. However, the small sample size of only three horses means that these results should be interpreted with caution and cannot be directly generalized to the wider equine population. Future studies including larger and clinically diverse cohorts are needed to confirm and extend these preliminary observations.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication and/or funding of this manuscript.

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تغيرات نمط ولون الحافر الحراري في الخيول بعد الهرولة باستخدام التصوير الحراري بالأشعة تحت الحمراء

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الخلاصة

قد تسبق التغيرات في الدورة الدموية الطرفية والنشاط الأيضي الموضعي داخل حافر الخيول العلامات السريرية المشاهدة للعرج. هدفت هذه الدراسة الاستكشافية إلى توصيف التغيرات في درجة حرارة سطح الحافر وتوزيع الألوان الحرارية في الخيول السليمة سريريا بعد تمرين الهرولة على مسافات مختلفة باستخدام التصوير الحراري بالأشعة تحت الحمراء. خضعت ثلاثة حيوانات مهجنة سليمة سريريا للهرولة عند خط الأساس صفر متر و ٩٠ متر و ١٨٠ متر و ٢٧٠ متر على مسار صلب وجاف موحد في ظل ظروف بيئية خاضعة للرقابة. تم الحصول على الصور الحرارية للشريط التاجي وجدار الحافر والنعل والكعب أثناء الراحة وفي غضون ٢٠-٣٠ ثانية بعد كل مسافة هرولة باستخدام مسافة ثابتة للكاميرا والحافر ولوحة ألوان ثابتة للقوس الحديدي وإعدادات انبعاثية تبلغ ٠,٩٥. تم استخراج متوسط درجة حرارة السطح لكل منطقة ذات أهمية كمتغير كمي أساسي، بينما تم تحليل المخططات الحرارية ذات الألوان الزائفة كخرائط رسومية تكميلية لتوزيع درجة حرارة السطح باستخدام عتبات محددة مسبقا معتمدة على قاعدة الالوان الثلاثة الاحمر الاخضر والازرق. زادت درجة حرارة سطح الحافر تدريجيا مع مسافة الهرولة في جميع المناطق التي تم فحصها ($P<0.05$)، حيث أظهر الشريط التاجي أكبر ارتفاع مرتبط بالمسافة، وأظهرت المخططات الحرارية تحولا يعتمد على المسافة من فئات الألوان الأكثر برودة إلى الأكثر دفئا. توفر هذه النتائج معلومات أساسية عن درجة حرارة سطح الحافر الفسيولوجية واستجابات التوزيع الحراري للهرولة في عينة صغيرة من الخيول السليمة وتدعم استخدام التصوير الحراري بالأشعة تحت الحمراء باعتباره غير جراحي، أداة مساعدة للتقييم الموضوعي أثناء تقييم العرج. ومع ذلك، يعكس التصوير الحراري بالأشعة تحت الحمراء درجة حرارة السطح بدلا من تدفق الدم أو التمثيل الغذائي، ويحد حجم العينة الصغير والمجموعة المحددة من تعميم النتائج.