



Thermography as an aid in the performance testing of Lipizzan horses

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OUTLINE

The athletic results or training performance of Lipizzan horses are hardly known in equestrian sports. Body skin temperatures (BST) at rest were different between different areas or body parts. After the work test, temperatures in all body skin areas were significantly elevated compared to those measured at rest and then decreased during the rest period after the work test. This study contributes to the knowledge of thermoregulation and the use of thermography in horses, and the results not only demonstrate the physiological responses to graded exercise in Lipizzaners, but also contribute to equine physiology and sports medicine.

The aim of this study was to determine the values of physiological parameters with emphasis on the temperature changes of the body skin areas by thermography and to investigate their acclimatization to different training loads.

METHODS

Horses : The study was performed with 6 pure-bred Lipizzans with a mean (\pm Standard Deviation (SD)) age of 9.0 ± 0.8 years and a mean (\pm SD) body mass of 455 ± 36 kg.

Test protocol and physical activity: The study consisted of two exercise tests, performed by lunging in riding indoor arena. The first test was implemented in May and the second one in October. The exercise test protocol consisted of 8 phases with specific activities (lunging at the walk, trot and canter or resting) and measurements of physiological values (BSTs of various body regions) and environmental parameters (air temperature and humidity). Each test was preceded by a 5-minute walk stable to the riding arena (Phase 1; P-1) and a 10 min. rest (Phase 2; P-2). Each horse was then lunged for 30 minutes at the walk, trot and canter (for 10 minutes at each gait), and left and right reins were exchanged every 5 minutes (Phase 3 to Phase 5; P-3 to P-5). This was followed by a 10-minute break (Phase 6; P-6) intended for the repetition of the measurements and then by 10 minutes of lunging at the walk (Phase 7; P-7). Thereafter, each horse was returned to its stall (Phase 8; P-8), and the measurements were repeated again.

CONCLUSIONS

The results of our study represent the physiological response of Lipizzan horses to graded exercise and can be considered an important contribution to sports physiology and medicine in relation to the Lipizzan breed. This study also contributes to the knowledge of equine thermography in different seasons and to the recognition of the complex physiological processes during exercise, which provide a basis for further research in the field of equine exercise testing and sports medicine.

RESULTS

The mean (\pm SD) distances covered during the exercise tests in May and October were 794 ± 25 m and 785 ± 78 m at the walk and 1851 ± 38 m and 1828 ± 48 m at the trot, respectively, and 3089 ± 10 m and 2432 ± 81 m ($P < 0.05$) at the canter. Temperature and air humidity are presented in Table 1.

Table 1: Air temperatures and air humidity (mean \pm SD) before exercise (P-2), immediately after exercise (P-6) and during recovery (P-8) of the May and October tests

| PARAMETER | TRIAL | PHASE | | |
|----------------------|---------|-------------------------------|-------------------------------|-------------------------------|
| | | P-2 | P-6 | P-8 |
| Air temperature [°C] | May | 18.42 \pm 0.77 ^a | 21.10 \pm 0.77 ^a | 21.27 \pm 0.68 ^a |
| | October | 11.38 \pm 0.70 ^a | 11.95 \pm 0.73 ^a | 12.48 \pm 0.71 ^a |
| Air humidity [%] | May | 62.48 \pm 4.32 ^b | 55.33 \pm 3.94 ^c | 50.63 \pm 4.20 ^b |
| | October | 81.47 \pm 4.62 ^b | 85.80 \pm 4.78 ^c | 84.15 \pm 5.09 ^b |

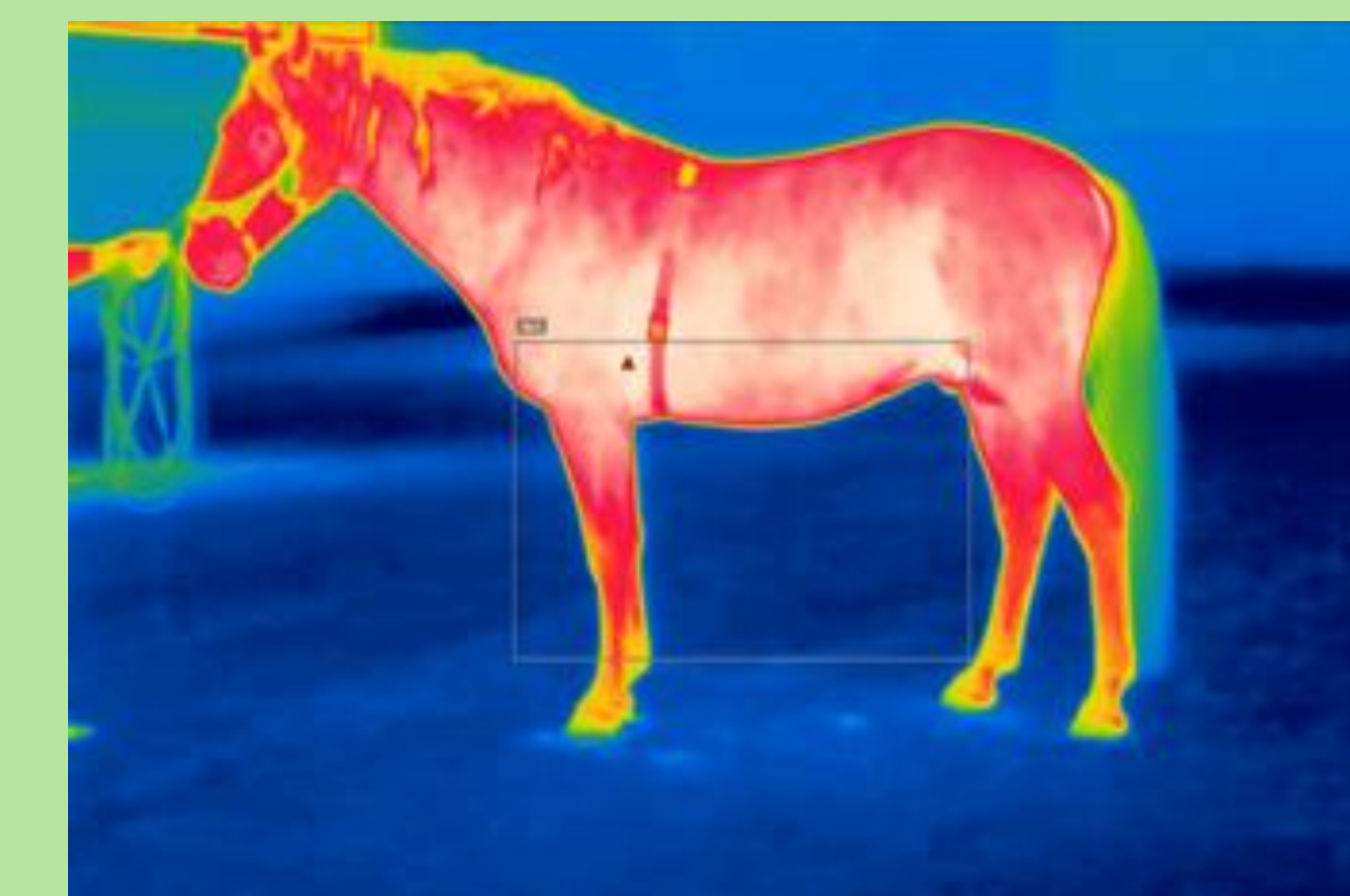
^{a,b} $P < 0.001$; ^c $P < 0.01$ for values in the same column

A significant increase in BSTs was noted immediately after the exercise test (P-6) compared with basal values (P-2) in May ($P < 0.001$ for buttocks, chest, and neck, $P = 0.003$ for croup, and $P = 0.005$ for back) and in October ($P < 0.0001$ for all regions). In October, a significant decrease in BSTs was observed when comparing P-6 and P-8 ($P = 0.05$ for buttocks, $P = 0.016$ for neck, $P = 0.001$ for back, $P = 0.003$ for chest), but the difference for back was insignificant ($P = 0.095$).

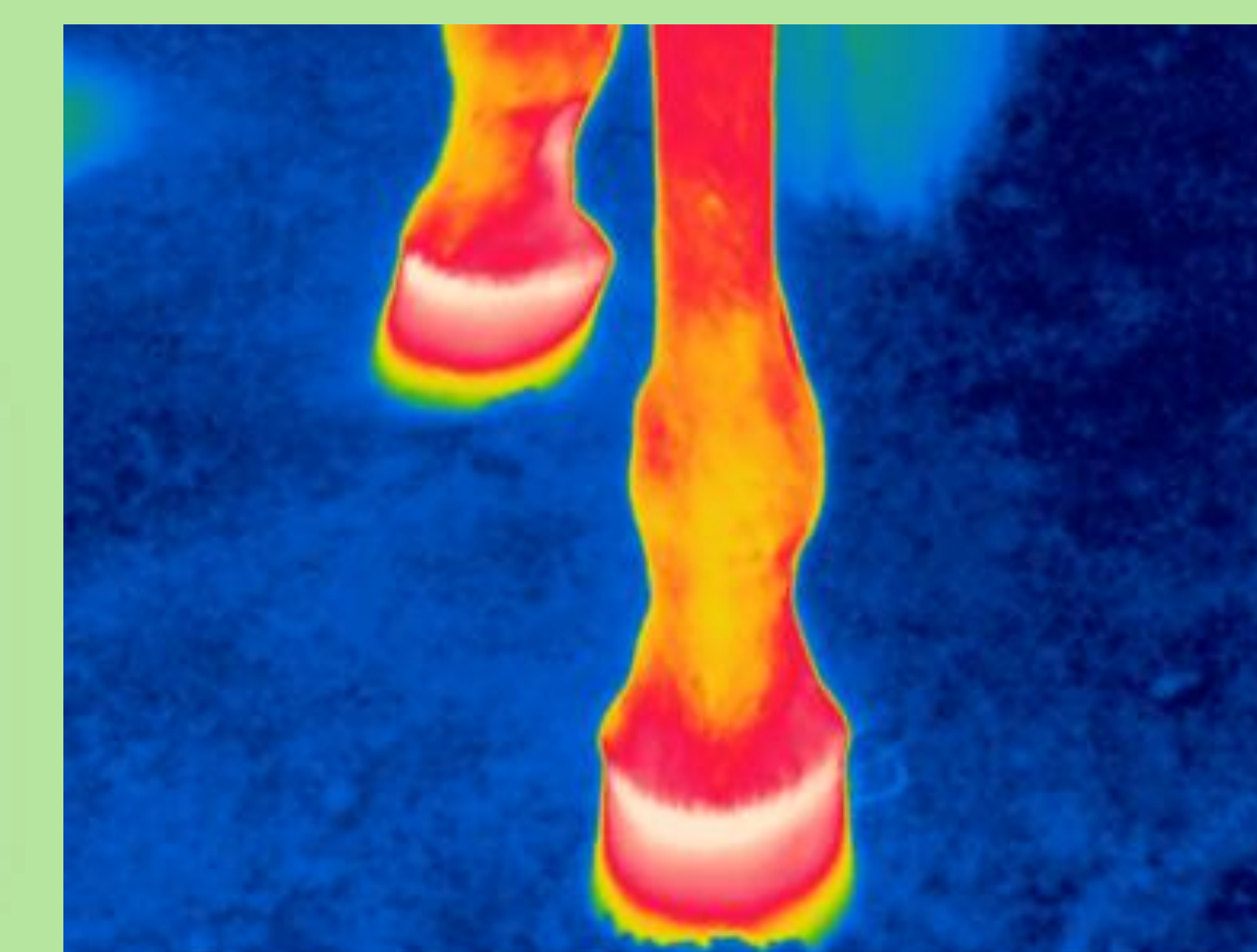
Table 2: Changes in the body skin temperature of various body regions before the exercise test (Phase 2; P-2), immediately after the exercise test (Phase 6; P-6) and during the recovery (Phase 8; P-8) in both periods (May and October).

| BODY REGIONS | MONTH | AVERAGE BODY SKIN TEMPERATURE (BST) °C | | |
|--------------|---------|--|-------------------------------|-------------------------------|
| | | P-2 | P-6 | P-8 |
| Buttocks | May | 30.2 \pm 0.6 ^{A,B} | 33.4 \pm 1.6 ^{A,B} | 33.6 \pm 1.1 ^{A,B} |
| | October | 26.8 \pm 1.8 ^a | 32.6 \pm 0.7 ^a | 30.7 \pm 0.7 ^{a,b} |
| Croup | May | 26.5 \pm 1.5 | 29.6 \pm 2.1 | 30.5 \pm 1.8 |
| | October | 22.7 \pm 2.2 | 27.5 \pm 2.2 | 26.1 \pm 2.3 |
| Back | May | 27.7 \pm 1.3 | 30.6 \pm 2.3 | 31.4 \pm 1.3 |
| | October | 24.1 \pm 1.5 | 29.1 \pm 1.3 | 27.5 \pm 1.4 ^c |
| Chest | May | 30.4 \pm 1.8 ^A | 34.0 \pm 2.7 ^{A,B} | 33.6 \pm 1.4 ^{A,B} |
| | October | 28.7 \pm 1.1 ^b | 34.9 \pm 1.3 | 32.0 \pm 1.5 ^a |
| Neck | May | 29.8 \pm 1.6 ^A | 33.1 \pm 2.0 ^{A,B} | 33.1 \pm 1.3 ^B |
| | October | 28.0 \pm 1.7 ^{a,b} | 32.5 \pm 2.0 ^a | 30.2 \pm 1.5 ^b |

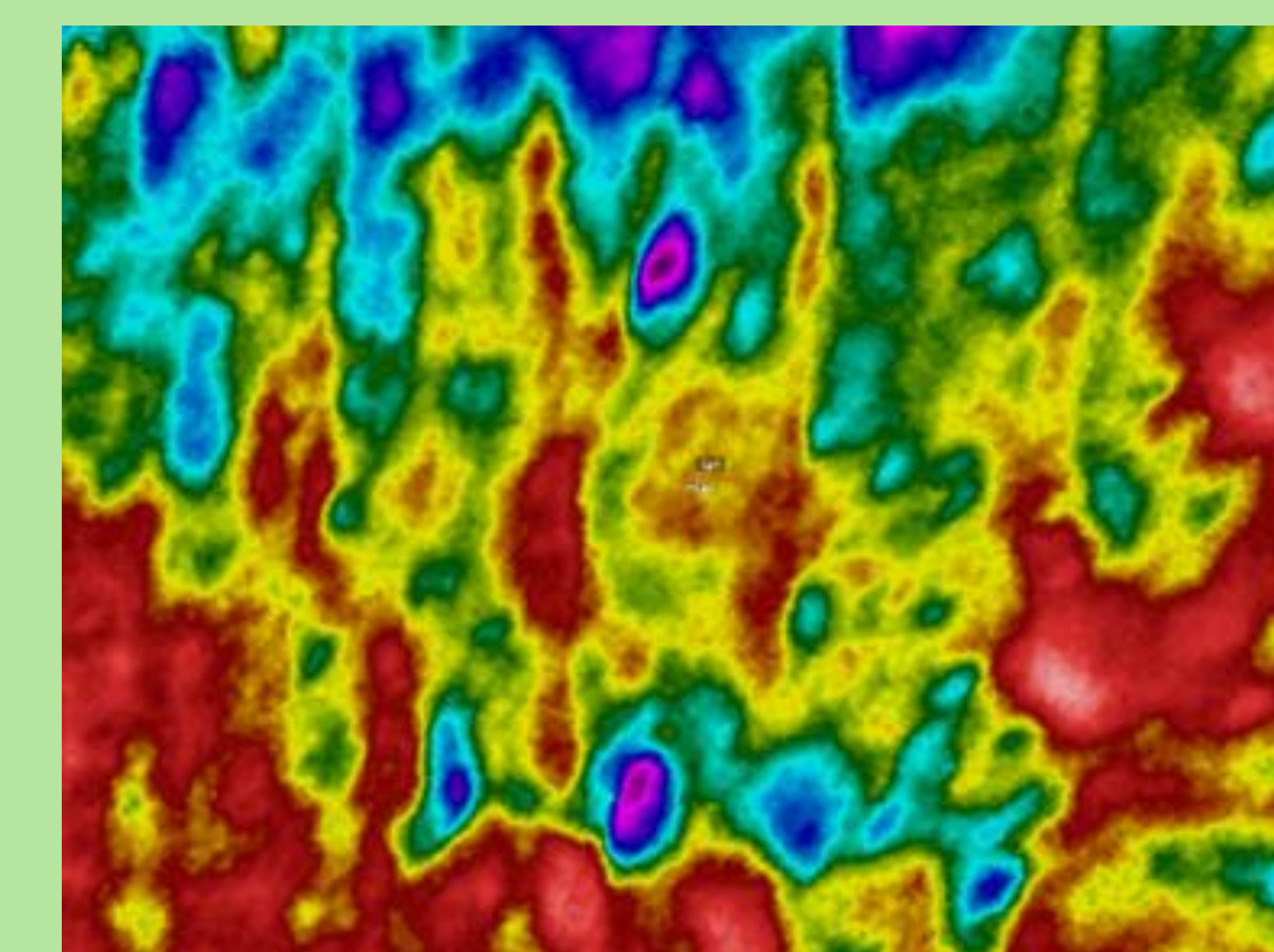
^{A,B,C} $P > 0.05$ for values in a row with the same labels; other combinations of values for May in the same column are significantly different ($P < 0.05$)
^{a,b,c} $P > 0.05$ for values in a column with the same labels; other combinations of values for October in the same column are significantly different ($P < 0.05$)



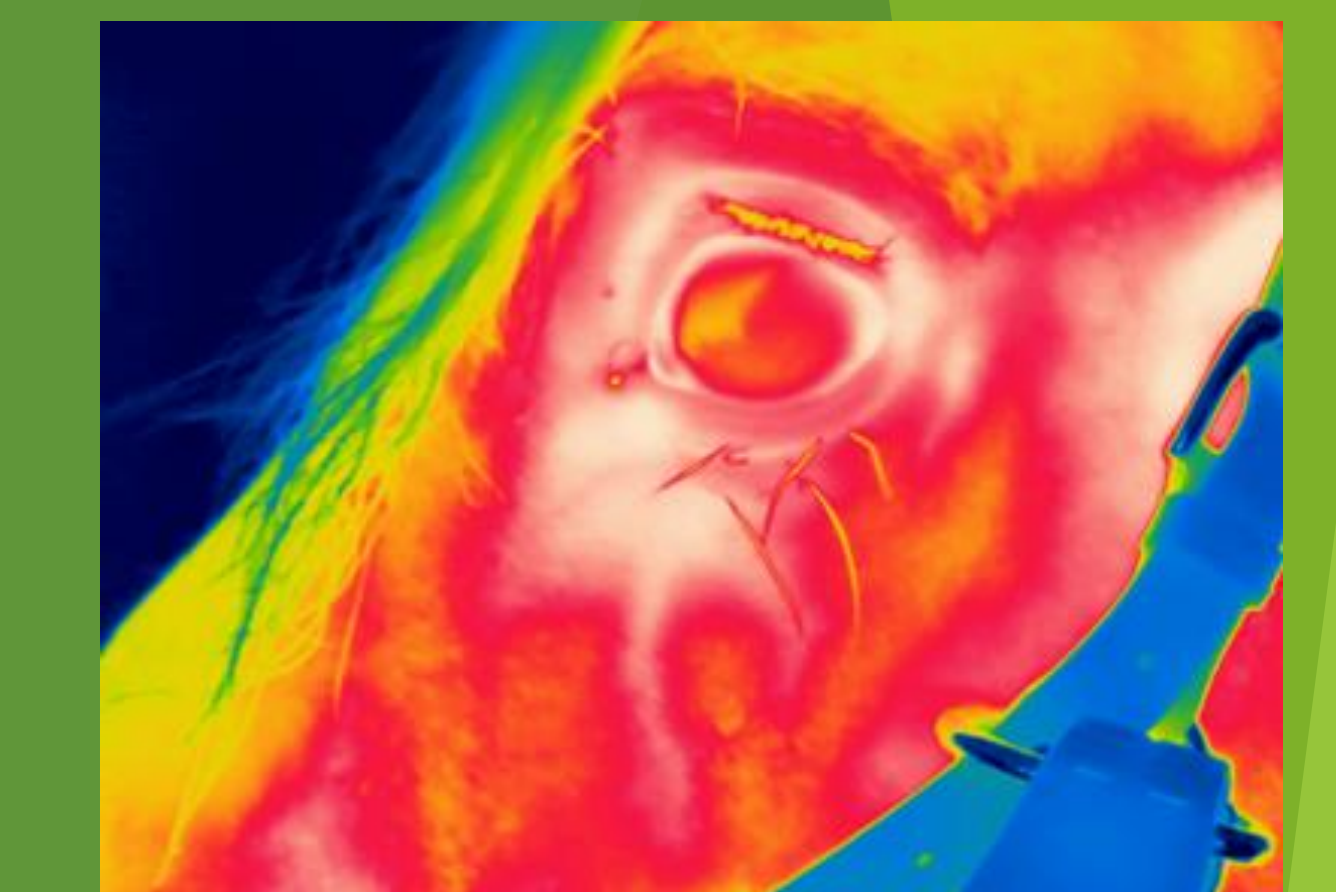
Thermogram of the Lipizzan horse



Thermogram of the forelegs of the Lipizzan horse



Neck thermogram of a Lipizzan horse after training



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Thermogram of a Lipizzan horse with trainer

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