



Comparison of Non-Contact Infrared Thermometry and Rectal Thermometry in Cats

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INTRODUCTION

Body temperature is frequently measured to assess the health status of cats. High temperatures can result from infection, inflammation, neoplasia, exercise, overheating, or nervousness. Low body temperatures can result from septic shock, hypoperfusion, cardiac failure, cold exposure, or anesthesia. Rectal thermometry is currently the most common method for measuring body temperature, but it is invasive, stressful, has the potential for injury, and is not efficient for the examination of large numbers of animals.

Non-contact infrared thermometers (NIRT) have been used to measure temperature in humans and other species with mixed success. NIRT is performed by aiming an electronic measuring device at a body area from a distance of 1-4 inches. If NIRT is accurate across a wide range of temperatures in cats, it could be used to decrease stress during veterinary examination, improve efficiency of measuring temperatures in large numbers of cats, minimize handling of fractious animals, enhance monitoring for infectious diseases, and reduce the risk of fomite transmission among diseased cats.

METHODS

Phase 1: Establishment of the reference interval for rectal temperature in adult indoor cats
Rectal temperatures were measured with a digital thermometer in 200 healthy adult indoor cats at animal shelters, veterinary clinics, and private homes. The reference interval was established using the method of the Clinical Laboratory and Standards Institute.

Phase 2: Selection of optimal infrared thermometry devices and anatomic measurement sites
Six infrared devices and 15 anatomic sites (Figure 1) were screened in 14 adult DSH cats for consistency and similarity to rectal temperatures. A plastic ruler was affixed to the front of each device to assure that all measurements were made at a distance of 1 inch. Three temperature measurements were made at each site to assess for repeatability. In total, 270 NIRT measurements were made for each cat. The rectal temperature was obtained for each cat using a digital thermometer.

Phase 3: Assessment of infrared thermometer performance
The 3 NIRT devices and 3 anatomic sites found to correlate best with rectal temperature in Phase 2 were selected for further evaluation in hypothermic (42), normothermic (147), and hyperthermic (13) adult DSH cats. Measurements were collected from 202 adult DSH cats located in shelters, clinics, and homes. Temperatures were measured in triplicate at a 1 inch distance, with a total of 27 measurements per cat. The rectal temperature was obtained for each cat using a digital thermometer. The ambient room temperature, cat signalment, and cat phenotype was recorded.

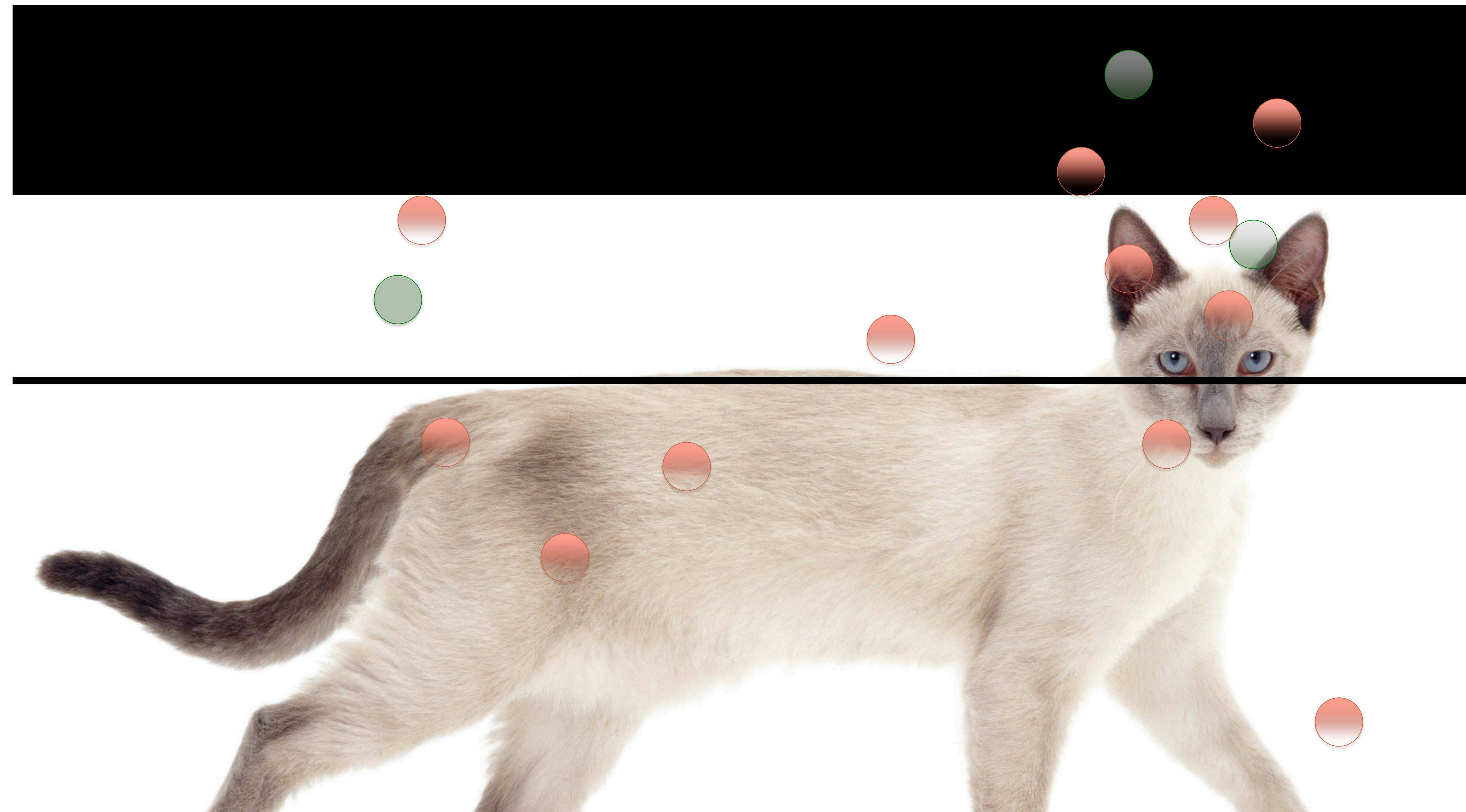


Figure 1. Anatomic sites tested by infrared thermometers. **Green sites** had the strongest correlations with rectal temperatures (pinna, gingiva, perineum). **Red sites** had the weakest correlations with rectal temperatures (preauricular area, nasal planum, dorsal neck, lateral neck, ventral neck, metacarpal pad, thorax, axilla, abdomen, inner thigh, outer thigh, tail).

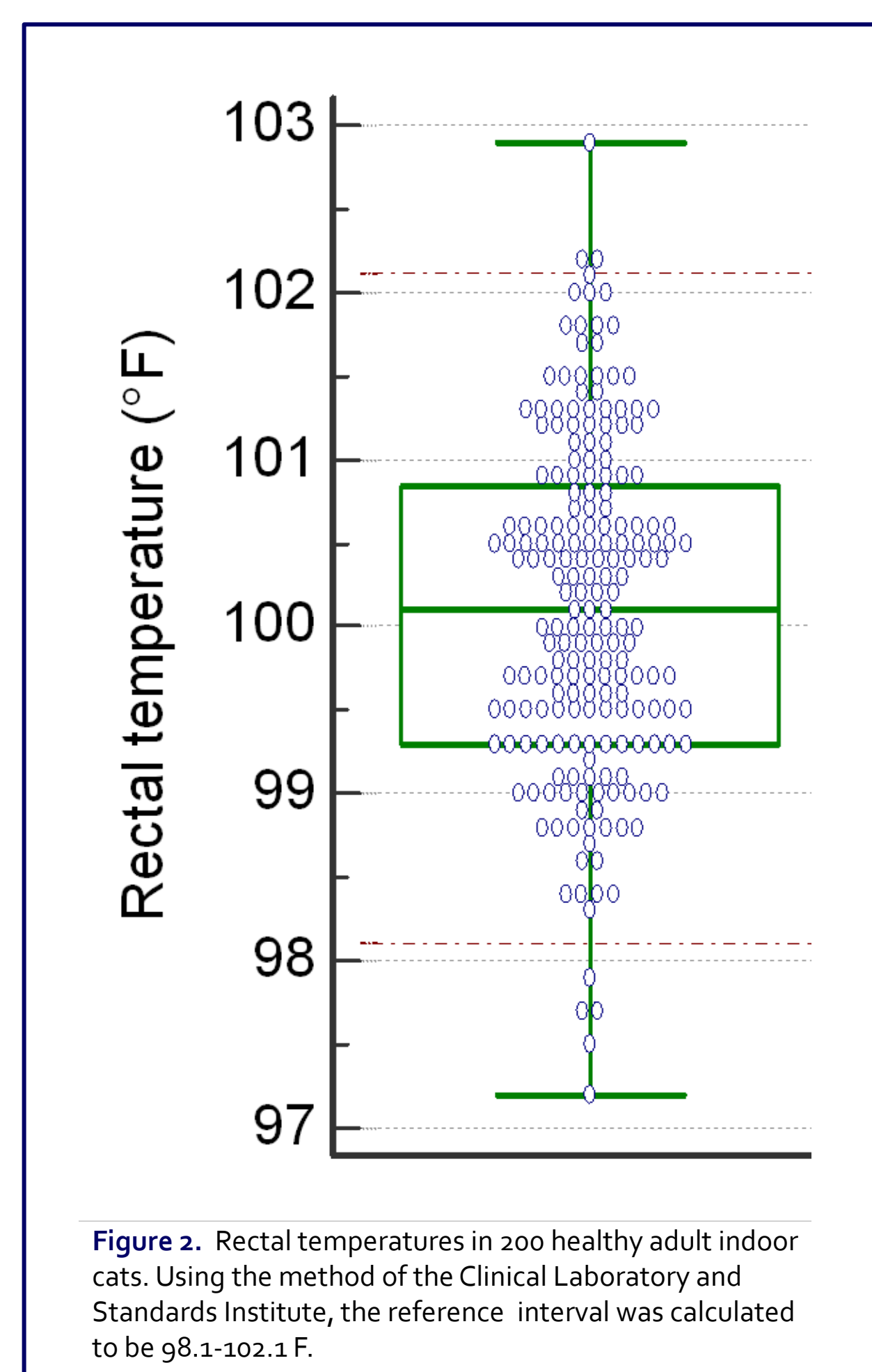


Figure 2. Rectal temperatures in 200 healthy adult indoor cats. Using the method of the Clinical Laboratory and Standards Institute, the reference interval was calculated to be 98.1-102.1 F.

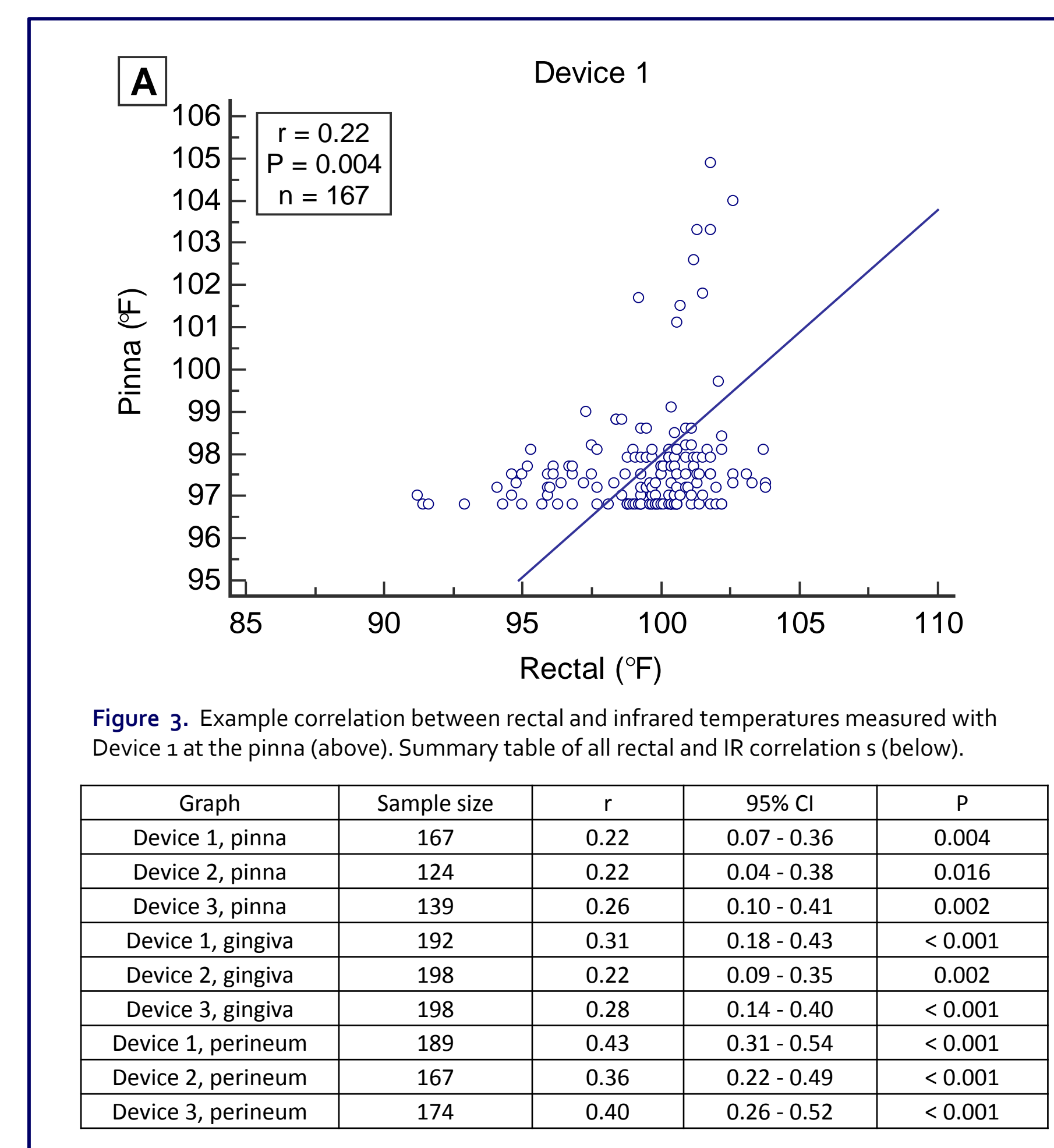


Figure 3. Example correlation between rectal and infrared temperatures measured with Device 1 at the pinna (above). Summary table of all rectal and IR correlations (below).

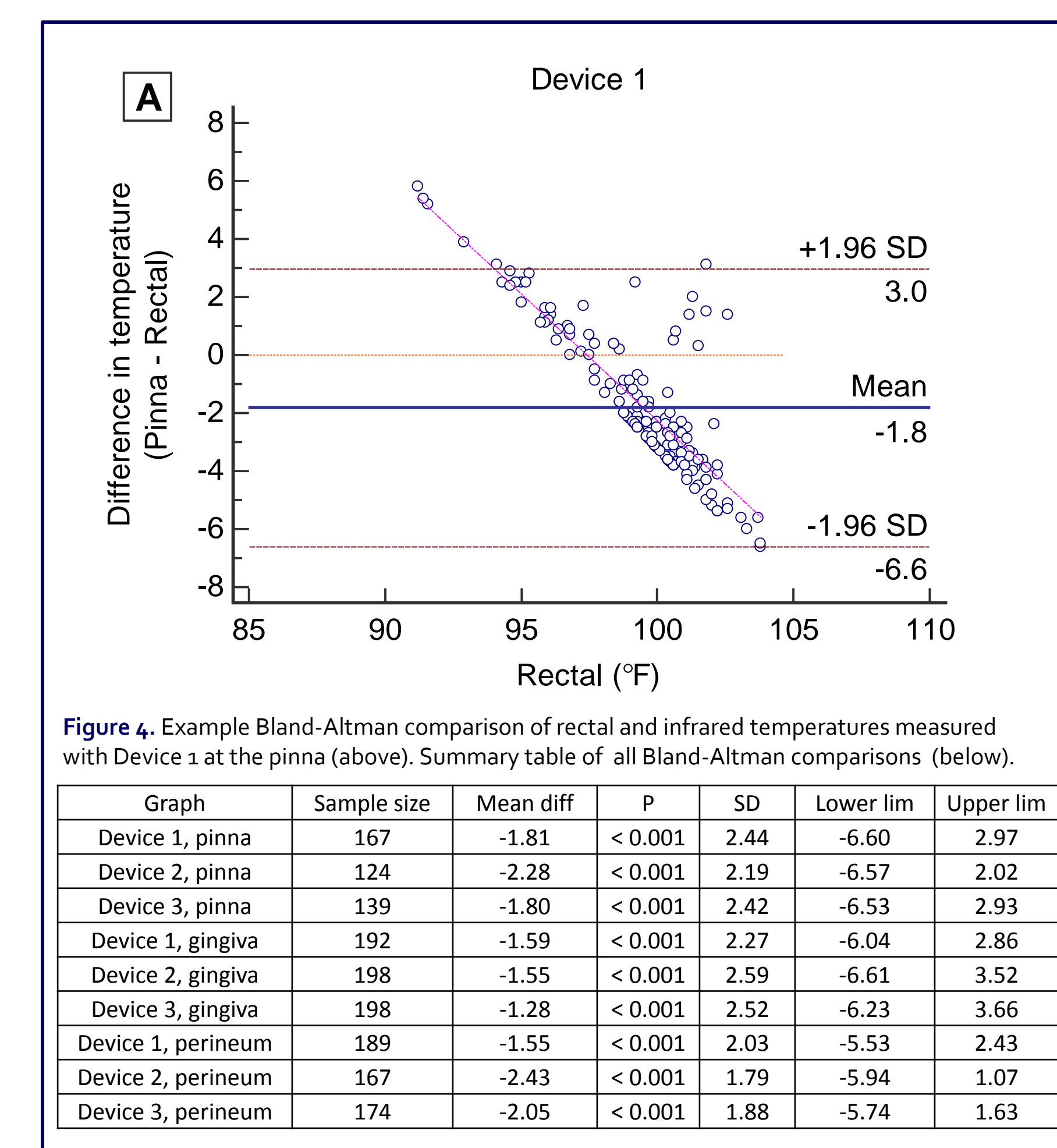
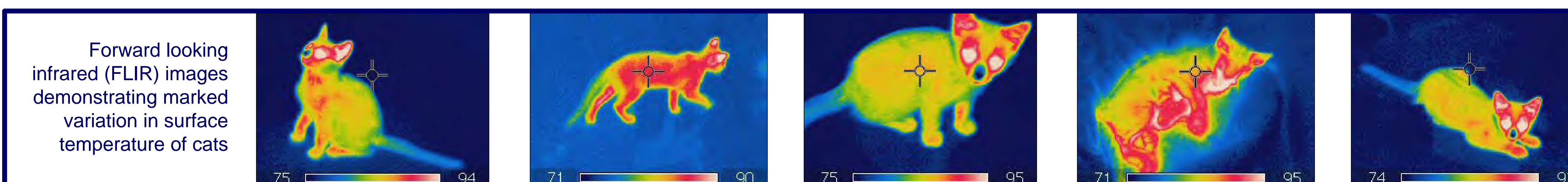


Figure 4. Example Bland-Altman comparison of rectal and infrared temperatures measured with Device 1 at the pinna (above). Summary table of all Bland-Altman comparisons (below).



Forward looking infrared (FLIR) images demonstrating marked variation in surface temperature of cats

RESULTS

- The 3 IRT devices that correlated best with rectal thermometry and selected for in-depth evaluation were the **Data-Therm IR** model JXB-182 (Jinxinbao Electronic Co.), the **TempIR** model RC003 (Raycom Electron Technology Limited), and the **FeverWatchers** (OxveTech).



- The 3 anatomical sites that correlated best with rectal thermometry and selected for in-depth evaluation were the pinna, the gingiva, and the perineal area, all of which lack fur (**Figure 1**)
- The reference interval for rectal temperature in healthy adult cats confined indoors is 98.1-102.1 °F (**Figure 2**)
- IRT measured with all 3 devices and all 3 anatomical sites was only weakly correlated with rectal temperature ($r=22-40$). (**Figure 3**)
- Bland-Altman analysis revealed poor agreement between IRT and rectal thermometry. IRT measurements were most commonly lower than rectal measurements in a portion of the cases. The mean IRT measurement ranged from 1.3-2.4 °F below the mean rectal measurements. IRT measurements tended to exceed rectal measurements in hypothermic cats and to fall below rectal measurements in normothermic and hyperthermic cats. (**Figure 4**)

CONCLUSIONS

- The temperature reference interval for healthy adult cats confined indoors is 98.1-102.1 °F, which is lower than commonly reported ranges.
- Infrared thermometry is inadequate for clinical use in cats.

ACKNOWLEDGEMENTS

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