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Research Article

Assessment of an Auricular Thermometer as an Alternative to Rectal Thermometry in Healthy Domesticated Cats

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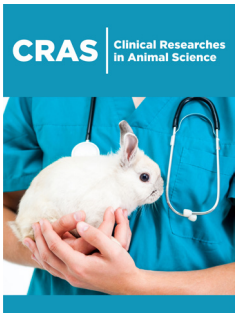

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Abstract

Estimating core body temperature is an important step in veterinary practices to assess animal health. For cats, rectal thermometry is the standard method despite considerable research on low-stress and less invasive alternatives. In 2023, a small study comparing the auricular Pet-Temp Instant Ear Thermometer to rectal temperature was done and a moderate positive correlation was identified (r=0.5, P=0.003). The purpose of our study was to further investigate this auricular thermometer, and the correlation found with a larger sample size of 50 cats. In total, 90% of the rectal and auricular temperatures were different. The statistical difference between the rectal and auricular temperature readings was found to be significant (P=0.0019) with a mean difference of 0.45±0.38 °C. There was a small positive correlation between rectal and auricular temperature (r=0.386, P=0.00567). This means that when in our hands, despite providing similar temperature ranges, this auricular thermometer was significantly different than standard rectal thermometry and may not be ideal for estimating core body temperature in healthy cats in a clinical or research setting.

Keywords: Temperature; Cat; Rectum; Tympanic; Ear; Thermometer

Introduction

Obtaining an accurate body temperature is an important vital assessment in veterinary practices to determine the health of cats [1,2]. In the clinical setting, rectal thermometry is the standard method for estimating body temperatures [3]. This location has been an area on dogs and cats that has been found to provide consistent temperature readings close to the approximate core temperature [4]. The range for normal healthy cat rectal temperatures is 36.7°-39.4 °C (98-103 °F), if it falls out of this range there is cause for concern for the cat's health [5]. However, there are many challenges with performing rectal temperature measurements including increased animal handling time, access, animal stress, and safety concerns [6,7]. Due to these factors, there is a need to find a less stressful and non-invasive process than rectal that reliably obtains an estimate of core temperature [8,9]. Alternatives to rectal thermometry has been an area of ongoing research in veterinary medicine for some time [10]. Potential areas include the axilla, gingiva, medial canthus and tympanic/auricular temperature [6]. Results from these studies are mixed, as is the degree of correlation reported between the temperatures obtained from these locations and rectal [5]. Of the alternative locations, the tympanic or auricular temperature location does not generally require additional restraint or movement and reflection of other tissues (tail, limb, lip etc.) to obtain a measurement. This, along with the increased speed and lower stress to the animals, may explain the commercial development of specialized thermometers for the auricular location [4,8,11,12]. Auricular thermometers have been extensively studied in humans and are commonly used in human medicine as a fast and validated Infrared (IR) screening method, but many find them to not be a clinically acceptable form of getting an accurate body temperature [13-16].

Studies have looked at using similar auricular IR technology in dogs with varying results [17-20]. With there not being a consensus on the accuracy of the auricular location, there is a need for research to investigate if the auricular thermometers being created can be trustworthy in a veterinary clinical setting. An auricular tool called the Pet-Temp Instant Ear Thermometer for Pets (Advanced Monitors Corporation, San Diego, CA) was created and the company states that this is a fast, accurate and easy method to check your pet's temperature [21]. These thermometers have a curved shape that allows them to reach the tympanic membrane where a temperature can be obtained without damaging the ear in the process [22]. There have been difficulties with the widespread use of this tool, one of the reasons is due to the expenses involved with purchasing this specialized device [4]. Studies examining auricular temperatures have had conflicting results [22,23]. A prior study in our laboratory with 30 cats showed a statistically significant difference between the rectal and auricular thermometer readings (p=0.017) and a moderate positive correlation (r=0.52) between rectal and auricular temperatures (p=0.003) [24]. The present study extended these findings using measurements of both auricular and rectal temperatures in 50 healthy cats.

Material and Methods

Animals

All research methods were approved by the Institutional Animal Care and Use Committee at the University of Wisconsin La Crosse (protocol 5-21) and were conducted on animals at the Coulee Region Humane Society (Onalaska, Wisconsin) with the shelter's consent. Rectal and auricular temperatures were taken of 50 healthy cats with demographic data shown in Table 1. Cats were evaluated by an in-house veterinary team daily and support staff throughout the day. Animal cages were marked to indicate possible health concern. This project was supervised by a licensed veterinarian, any cat with a cage concern or one demonstrating any sign of illness, stress or injury was excluded from study. All cats had been altered (22 spayed, 28 neutered), ranged in age from 5 weeks to 8 years (mean 25.86±28.67 months) with their body mass ranging from 1.56-7.47kg (mean 3.45-1.23kg). All cats were designated as domestic short-hair (46) of medium-hair (4). No domestic-long-hair cats and those without hair were available for inclusion.

Table 1: Demographic information.

Sex (Altered)	Age (Months)	Body mass (kg)	Breed
Male (n=28)	25.86±28.67	3.45±1.23	Domestic short hair (n=46)
Female (n=22)			Domestic medium-hair (n=4)

Thermometry

The Pet-Temp Instant Ear Thermometer for Pets (Advanced Monitors Corporation, San Diego, CA) was used for the auricular temperatures and the Well & Good Digital Rectal Thermometer (International Pet Supplies, San Diego, CA) for the rectal temperatures. Cats were lightly restrained as previously described [6]. Researchers have shown how to use both thermometers, properly and consistently by a veterinarian in non-study animals prior to the study. Once correctly placed, the activation button on each device was pushed and the measurement was complete when the thermometer beeped, usually within 5 seconds. The ear chosen was random based on presentation and restraint of the cat. Auricular and rectal temperatures were both taken inside at room temperature (22.18±0.64 °C), within three minutes of having the cat out of the kennel. The cats were held briefly by examiners in a safe and standardized fashion while another examiner performed the thermography. They were held due to the lack of an exam table or surface to rest on. On the days that data was collected, the person holding the cat would alternate while the person taking the auricular and rectal temperatures remained the same. Each temperature, auricular and rectal, was recorded once; the auricular temperature was taken, and the data was recorded then the rectal temperature was taken. If a potentially non-diagnostic reading was obtained, a temperature outside of the normal cat range of 36.7°-39.4 °C (98-103 °F), the tool was replaced, the measurement was repeated, and the value was recorded when it was within the normal range. In all instances, these potentially erroneous or inaccurate values that were remeasured were obtained from auricular thermometry. Ultimately, one reference range value was obtained with each device for all cats. Name, age, sex, weight, and breed information were recorded as well.

Statistics

Statistical analyses were performed using a statistical software package (Sigma Stat, San Jose, CA, USA). Normal distribution of both auricular and rectal temperature was confirmed using a Shapiro-Wilk normality test, Analysis was run to compare the consistency and correlation of the auricular thermometer to the rectal thermometer. A paired t-test was run to test variation in the means between both techniques and a Pearson Product Moment Correlation test was run to determine the correlation between the auricular and rectal temperatures taken from the cats. In both instances a 95 percent confidence level was used to identify significance. Unless otherwise reported, data is presented as mean values ± standard deviation.

Result

Difference between rectal and auricular temperatures

Results from the cat rectal and auricular thermometry are depicted in Figure 1. The average rectal and auricular temperatures were 38.14±0.43 °C and 37.90±0.53 °C. A paired t-test was done with the rectal and auricular thermometer readings. The results were t=3.287 with 49 degrees of freedom, a 95 percent confidence interval for difference of means of 0.205 to 0.851 and two-tailed P value=0.0019. This indicated a significant difference despite some overlap rectal and auricular values. The difference in values between rectal and auricular temperature ranged from 0 to 2.6 °C (mean difference 0.454±0.38 °C). The rectal temperature was higher than the auricular temperature of 29/50 readings, the

auricular temperature was higher 16/50 readings and both values were the same in 5/50 readings.

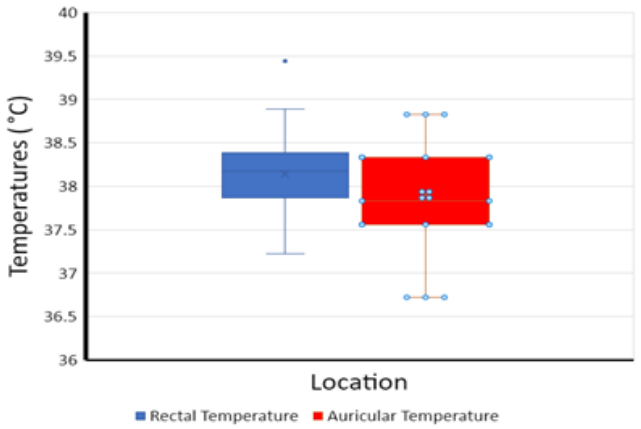

Figure 1: Range of cat temperature values between rectal and auricular locations.

Correlation between rectal and auricular temperatures

In addition, a Pearson Product Moment Correlation was done to analyze with a correlation significance value α=0.05, these results are in Figure 2. This correlation analysis had a correlation coefficient of r=0.386 and a P=0.0057 which signifies a small positive correlation between rectal and auricular temperature values. A Bland-Altman plot was generated to illustrate the distribution and differences between the means from each location (Figure 3).

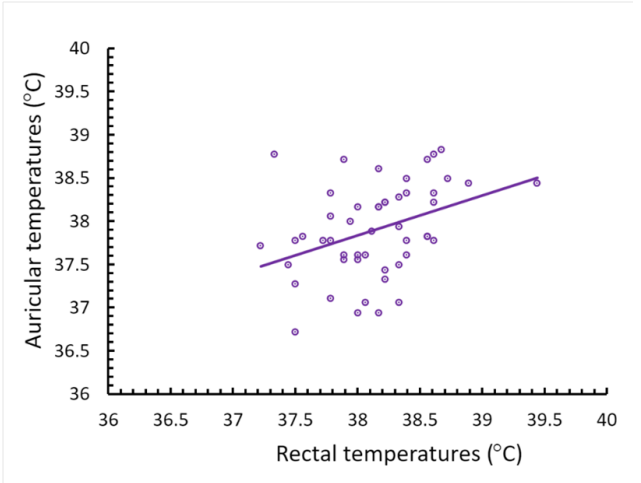

Figure 2: Relationship in temperature values between rectal and auricular locations.

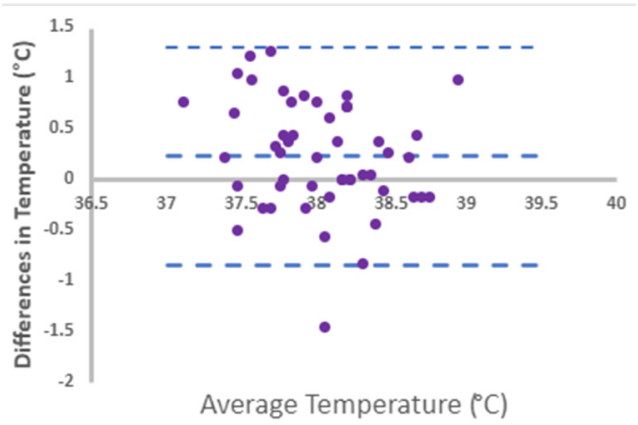

Figure 3: Bland-Altman plot indicating differences based on temperature averages between rectal and auricular locations.

Discussion

In human medicine, several alternatives to rectal thermometry are used to estimate core body temperature [6]. There is, however, no widely accepted alternative in cat medicine. Clinical and public interest in alternatives may be responsible for the commercial development of possible alternatives [7]. The Pet-Temp Instant Ear Thermometer for Pets is one of those alternatives, with detailed instructions on how the device can provide reliable temperature readings in canine and cat pets [21]. This device uses an infrared sensor that must be appropriately positioned for an accurate reading to occur [21]. We often had to repeat measurements when we got values that fell out of the normal healthy cat's temperature range. The incorrect value could've been due to an error in the placement of the thermometer so we would reposition the thermometer each time to ensure this wasn't the case. All values included in this study fell within this range. In the end, even with adjusting to get values that fell in the normal temperature range, our values differed significantly with a small positive correlation. In 2023, our laboratory conducted a similar study in 30 cats and the results were used as preliminary data for this study [24]. In that study, she used a different rectal thermometer for comparisons against the same auricular thermometer in cats. She had similar results to this study. She identified a significant difference between her rectal values and the auricular thermometer (p=0.017), and she found a small (although slightly higher) positive correlation (r=0.52, p=0.003) [16]. It is interesting to note that within her dataset rectal values were more frequently lower than the auricular values and, in our study, the rectal values were more frequently higher than the auricular values. Consequently, some of these results may reflect inaccuracy or variation in the part of the rectal thermometer used and not the auricular thermometer. On the other hand, it may be showing the inaccuracies of this auricular thermometer. Neither thermometer allows user calibration, in either case there was not a strong agreement, nor a standard variation between the two measures.

The average difference between measurements in this study was 0.454±0.38 °C. Despite that being less than a 1% difference

in value, a 1°C difference in body temperature may be an early indicator of a systemic issue [11]. Animal thermometry is perhaps of more clinical value in cases of pyrexia, hypothermia and hyperthermia than in normal healthy animals [1]. Healthy animals were used in this study. Most diagnostic tools are developed with calibration points with the greatest accuracy within a set reference interval. Accuracy can then diminish further from that range that testing occurs, for that reason we focused on healthy animals. It remains to be seen if there is an improved correlation with this thermometer when values are outside of normal references ranges. Some have found the reliability of other auricular thermometers when used on dogs and humans worsens when the temperature falls out of the normal healthy range [13,25]. Even when there is a strong correlation found like in the study done by Banitalebi and Bangstad with fever in children, a low specificity was found which indicated that the use of the auricular IR thermometer could lead to some fevers being missed [25]. One limitation of our study was the inability to perform repeated measurements. The stress that can result from prolonged restraint and repeated rectal probing could compromise animal welfare and artificially elevate body temperatures [2]. For that reason, we standardized measurements and minimized handling. We cannot eliminate the possibility that some of the differences we identified were because temperature readings did not occur concurrently. Technology is in a constant state of flux and there is considerable interest in alternatives to cat rectal thermometry [6,7]. The significant difference and lack of correlation we found between this auricular thermometer and the rectal thermometer that we used does not indicate that no auricular/tympanic thermometry can ever be a suitable alternative.

Conclusion

Based on the small correlation, need for repeated measurements and significant difference between the tested auricular thermometer and our rectal thermometer, in our hands, we cannot at this time recommend using this auricular thermometer for research or clinical cat veterinary applications as an alternative to rectal thermometry.

Author Contributions

Conceptualization, C.G.; funding acquisition, C.G.; investigation, C.G., L.M., and A.K.; resources, C.B; supervision, C.B. visualization, C.G.; Writing-original draft, C.G.; Writing-review and editing, C.G., C.B.; Formal analysis, C.G., C.B. Project Administration, C.G.

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Institutional Review Board Statement

The animal study protocol was approved by the Institutional Animal Care and Use Committee (protocol 5-21, approved October 2021).

Data Availability Statement

The temperature data collected can be given upon request.

Acknowledgment

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Informed Consent Statement

All animals used in this study were owned by the Coulee Region Humane Society who consented to their use in this research.

References

1. Flood J (2009) The diagnostic approach to fever of unknown origin in cats. Compend Contin Educ Vet 31(1): 26-31.
2. Quimby JM, Smith ML, Lunn KF (2011) Evaluation of the effects of hospital visit stress on physiologic parameters in the cat. J Feline Med Surg 13(10): 733-737.
3. Greer RJ, Cohn LA, Dodam JR, Wagner-Mann CC, Mann FA (2007) Comparison of three methods of temperature measurement in hypothermic, euthermic and hyperthermic dogs. J Am Vet Med Assoc 230(12): 1841-1848.
4. Hymczak H, Gołąb A, Mendrala K, Plicner D, Darocha T, et al. (2021) Core temperature measurement principles of correct measurement, problems and complications. International Journal of Environmental Research and Public Health 18(20): 10606.
5. Levy JK, Nutt KR, Tucker SJ (2015) Reference interval for rectal temperature in healthy confined adult cats. J Feline Med Surg 17(11): 950-952.
6. Kahng E, Brundage C (2019) Comparing alternatives to canine rectal thermometry at the axillary, auricular and ocular locations. Open Vet J 9(4): 301-308.
7. Beyer O, Lueck A, Brundage C (2023) Comparison of axillary versus rectal temperature timing in canine and feline patients. Vet Sci 10(7): 475.
8. Kunkle GA, Nicklin CF, Sullivan-Tamboe DL (2004) Comparison of body temperature in cats using a veterinary infrared thermometer and a digital rectal thermometer. J Am Anim Hosp Assoc 40(1): 42-46.
9. Lloyd JKF (2017) Minimizing stress for patients in the veterinary hospital: Why it is important and what can be done about it. Vet Sci 4(2): 22.
10. Southward ES, Mann FA, Dodam JR, Wagner-Mann CC (2006) A Comparison of auricular, rectal and pulmonary artery thermometry in dogs with anesthesia-induced hypothermia. J Vet Emergen Crit Care 16(3): 172-175.
11. Scalia B, Alberghina D, Panzera M (2017) Influence of low stress handling during clinical visit on physiological and behavioral indicators in adult dogs: A preliminary study. Pet Behav Sci 4: 20-22.
12. Gomart SB, Allerton FJW, Gommeren K (2014) Accuracy of different temperature reading techniques and associated stress response in hospitalized dogs. J Vet Emerg Crit Care 24(3): 279-285.
13. Chamberlain JM, Terndrup TT, Alexander DT, Silverstone FA, Wolf-Klein G, et al. (1995) Determination of normal ear temperature with an infrared emission detection thermometer. Ann Emergency Med 25(1): 15-20.
14. Terndrup TE, Allegra JR (1989) A Comparison of oral, rectal and tympanic membrane-derived temperature changes after ingestion of liquids and smoking. Am J Emerg Med 7(2): 150-154.

15. Niven DJ, Gaudet JE, Laupland KB, Mrklas KJ, Roberts DJ, et al. (2015) Accuracy of peripheral thermometers for estimating temperature: A systematic review and meta-analysis. Ann Intern Med 163(10): 768-777.

16. Mogensen CB, Wittenhoff L, Fruerhøj G, Hansen S (2018) Forehead or ear temperature measurement cannot replace rectal measurements, except for screening purposes. BMC Pediatr 18(1): 15.

17. Zanghi BM (2016) Eye and ear temperature using infrared thermography are related to rectal temperature in dogs at rest or with exercise. Front Vet Sci 3: 111.

18. Cichocki B, Dugat D, Payton M (2017) Agreement of axillary and auricular temperature with rectal temperature in systemically healthy dogs undergoing surgery. J Am Anim Hosp Assoc 53(6): 291-296.

19. Sousa MG, Carareto R, Pereira-Junior VA, Aquino MC (2013) Agreement between auricular and rectal measurements of body temperature in healthy cats. J Feline Med Surg 15(4): 275-279.

20. https://www.admon.com/pet-temp-instant-thermometer/

21. Konietschke U, Kruse BD, Muller R, Stockhaus C, Hartmann K, et al. (2014) Comparison of auricular and rectal temperature measurement in normothermic, hypothermic, and hyperthermic dogs. Tierarztl Prax Ausg K Kleintiere Heimtiere 42(1): 9-13.

22. McBrearty AR, Lamb V (2003) Comparison of rectal, tympanic membrane and axillary temperature measurement methods in dogs. Vet Rec 173(21): 524.

23. Olivia Beyer OB (2023) Initial thermometry study pilot data, University of Wisconsin La Crosse, La Crosse, Wisconsin, USA.

24. Smith R, Mastrocco A, Prittie J, Weltman J (2023) Comparison of aural and rectal temperature in dogs presenting to an emergency room. Vet Med (Auckl) 14: 125-131.

25. Banitalebi H, Bangstad HJ (2002) Measurement of fever in children is infrared tympanic thermometry reliable? Tidsskr Nor Laegeforen 122(28): 2700-2701.