Alternative Options for Measuring the Body Temperature of Pigs in Order to Relieve Stress and Reduce Environmental Impact

Dávid Köteles[1], Violetta Tóth[1], Wissem Baccouri[1], Róbert Gáspár[2], Edit Mikó[1]

[1]*University of Szeged Faculty of Agriculture, Address – H-6800, Hódmezővásárhely, Andrássy street 15., Hungary*
[2]*Department of Pharmacology and Pharmacotherapy, Albert Szent-Györgyi Medical School, University of Szeged, H-6720 Szeged, Dom ter 12, Hungary*

Abstract
Poultry and pig farming provide two important sources of domestic meat consumption. Pig breeding has not been an economically predictable sector of agriculture, and breeders often suffer financial losses. This has been exacerbated by the COVID-19 pandemic and the current war situation. For this reason, economical production has become even more important, a basic condition that can only appear in the most stress-free environment possible. An essential condition for the production of high-quality food raw materials is the supply of excellent fattening raw materials. However, heat stress during certain stages of pregnancy, especially in the first trimester, can significantly deteriorate the quality of these raw materials. Therefore, the development of alternative contact methods and stress-free temperature measurements will be crucial in the future. This will make the daily lives of workers easier, reduce the time spent measuring temperature, and alleviate stress for pigs. By mitigating stress levels, the potential for disease outbreaks and fatalities can be significantly reduced, thereby directly and indirectly contributing to the reduction of environmental impact and environmental protection.

Keywords: *environment impact, environment protection, heat stress, pig breeding, technology, temperature.*

1. Introduction

Continuous monitoring of the sow's body temperature in the farrowing pen is still a major concern [1]. Pigs require a somewhat steady body temperature for critical and productive functions [2]. Maintaining sow health is critical not just for profit and performance, but also for animal welfare. Fever is one of the first and most noticeable clinical signs of several conditions, including mastitis. Rectal temperature testing in a sow takes roughly 15 seconds on average. As a result, the non-contact method saves time while also decreasing animal discomfort [1] Infrared thermography (IRT) is a potential method for autonomous surveillance of pigs for health screening, as it can be used to quickly evaluate pig health [3].

* Corresponding author: Dávid Köteles, koteles.david@szte.hu

2. Materials and methods

The tests began in September 2022 on a modern industrial pig farm. They work with approximately 1,500 suckling sows and 550 breeding sows, all of which have Danish genetics. The plant's production is capable of producing 90,000 fattening animals per 1 year. We recorded the parameters of 17 suckling sows, which carry a Danish hard finisher in the F1 progeny of Danish Yorkshire x Danish landrace. Preliminary tests were carried out on another 15 pigs of different sexes and age groups (from 2 months to 3 years) with similar basic breeds on a small pig farm with traditional technology. During the study, 15 different parameters were examined, of which the

following were used: rectal temperature, external temperature of the labia, ear temperature, humidity, room temperature, external temperature and groin temperature. The laser thermometer, the thermal camera, the analogue thermometer, and the atmospheric thermometer were calibrated in the preliminary tests. The highest temperature points of the pig's skin were determined with a thermal camera, and after comparing several measuring devices with the same function, we continued to work with the most accurate one. To analyse the data, we used the SPSS statistical program with a multifactor analysis method.

3. Results and discussion

In the following, the research results are presented by means of figures and their associated explanations. According to Antal et al. (1978) [4], the correlation can be divided into four groups loose, representing values less than 0.4; medium, ranging from 0.4 to 0.7; close, ranging from 0.7 to 0.9; and very tight, representing values greater than 0.9.

Humidity is an important factor in livestock breeding, with a relative humidity of around 70% considered optimal. Animals tolerate both heat and cold better when the air humidity is low, and heat release is easier in dry heat. It is important to provide dry bedding (litter) for animals, as they can easily catch a cold in a poorly conductive bed [5].

Figure 1 below shows the relationship between room heat around the sow and humidity around the sow (-0.853**). It is characterized by a strong negative correlation and significance.

Picture 1. Detection of the hottest points on the pig's skin (my recording with a Flir one pro thermal camera

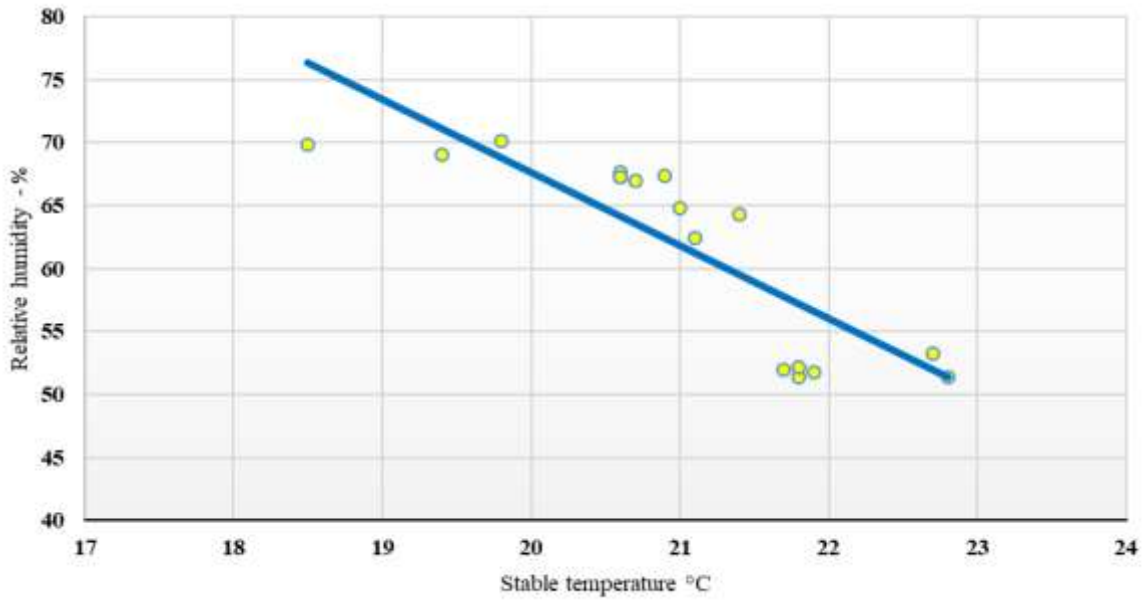

Figure 1. The relationship between room temperature and humidity

Figure 2 shows that in the case of similar areas covered with less pig hair, the temperature is relatively high and approaches the value of the internal temperature. It is characterized by narrow importance significance.

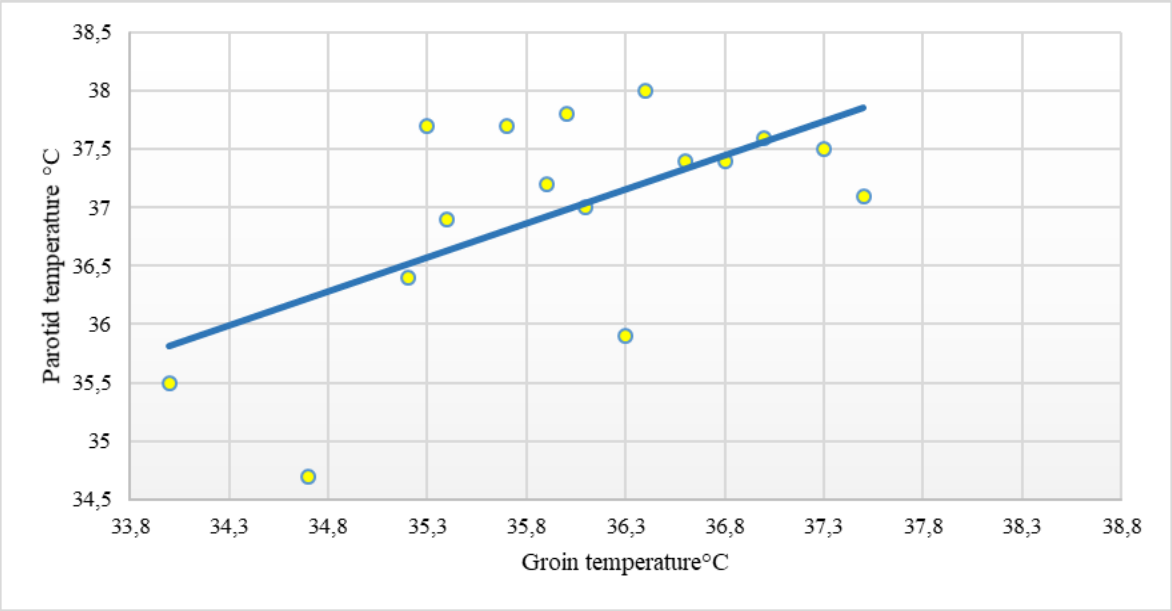

Figure 2. The connection between the auricle and the groin

The temperature relationship between the ear and the labia (Figure 3) is 0.726* (**Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level).

This result can be a good measurement factor in the future, because the top, which is close to the brain, produces a good value and reflects the temperature fluctuation of the animal well-being.

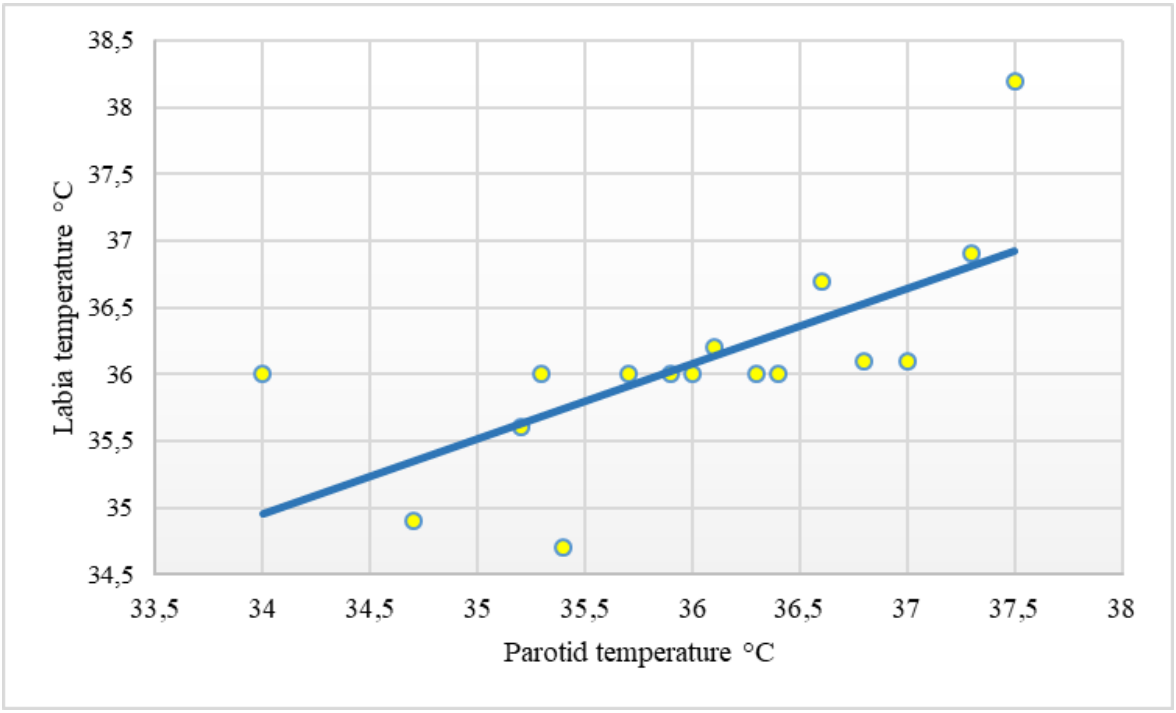

Figure 3. Temperature relationship between ear and labia

Rectal section/labia: 0.622*

The two areas are relatively close to each other, so they should have similar values. But the area of the udder is more blood-rich, and the circulatory blood network is higher, so it will represent a slightly higher value. The regressive representation of this is shown in Figure 4.

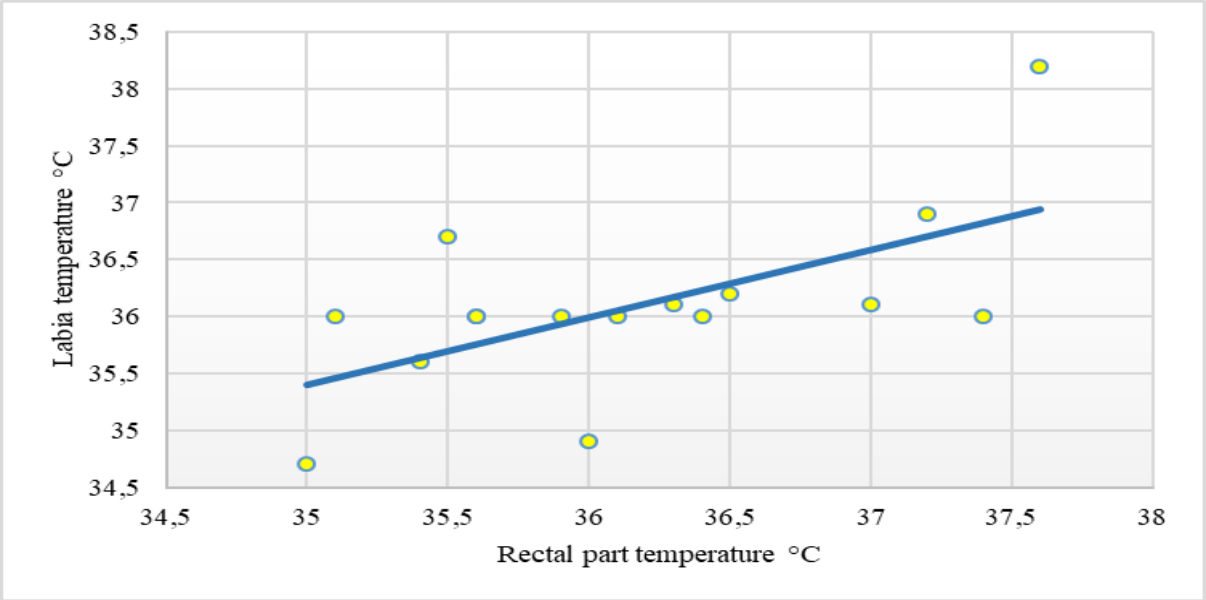

Figure 4. The relationship between the rectal section and the labia

4. Conclusions

Our initial tests produced promising results. From our research, it can be established, among other things, that if the temperature around the pig is higher, the air will be drier. The sensation of heat is stronger at higher humidity than at lower humidity. Thus, the lower temperature combined with a higher humidity is favorable for the sow's body, which provides a favorable feeling of comfort, which helps economic production and improves the animal's well-being. Our hypothesis is that if we provide the animal's body with exactly that macro-environment, the environmental load will be much smaller, and we can alleviate it.

Summary

Continuous monitoring of the sow's body temperature in the farrowing chamber is important for both profit and performance, as well as animal welfare. Rectal temperature testing in a sow takes roughly 15 seconds on average. Humidity is an important factor in livestock breeding, with a relative humidity of around 70% considered optimal. Figure 2 shows that in the case of similar areas covered with less pig hair, the temperature is relatively high and approaches the value of the internal temperature.

Our initial tests produced promising results, which suggest that if the temperature around the pig is higher, the air will be drier and the sensation of heat is stronger at higher humidity than at lower humidity.

Acknowledgements

Supported By The ÚNKP-22-3-SZTE-420 New National Excellence Program Of The Ministry For Culture And Innovation From The Source Of The National Research, Development And Innovation Fund.

References

1. Schmidt, M., Lahrmann, K. H., Ammon, C., Berg, W., Schön, P., & Hoffmann, G. (2013). Assessment of body temperature in sows by two infrared thermography methods at various body surface locations. *Journal of swine health and production*, *21*(4), pp. 203-209.

2. Andersen H.M.L. – Jørgensen E. – Dybkjær L.- Jørgensen B. (2008): The ear skin temperature as an indicator of the thermal comfort of pigs, Applied

Animal Behaviour Science, Volume 113, Issues 1–3, pp. 43-56,
3. Soerensen, D. D. - Clausen, S. - Mercer, J. B., - Pedersen, L. J. (2014): Determining the emissivity of pig skin for accurate infrared thermography. Computers and Electronics in Agriculture, 109, pp. 52-58.
4. Antal A. – Bogdan E. – Paschke H. (1978): Biometric and population genetic calculations in animal breeding, Mezőgzda publisher, Budapest pp. 47
5. Szabó F. (2015) Environmental factors in animal husbandry. in Szabó F. at al. (2015): General animal husbandry, Mezőgazda publishing house, Budapest pp.179.