Abstract

The possibilities in thermal imaging interest farmers. As the herd size rises, useful tools to monitor animal welfare are needed. The aim of Kuvaa Nautaa – thermal imaging in cattle health care project (KuNa, 2018–2021) was to find out whether thermal imaging can be used as a tool for monitoring cattle health. In addition, the project investigated what kind of thermal imager is suitable for imaging cattle. Guidelines for monitoring hoof health and milk fever using thermal imaging were created based on the research conducted during this project.

Results of our research revealed that traditional methods of diagnosing mastitis work better in monitoring udder health than thermal imaging. Similarly, the parturition is not possible to predict based on changes in the surface temperature of the cow. Instead, thermal imaging can be used for detecting milk fever and monitoring hoof health. According to our results, the surface temperature of the cow decreases significantly in all cases after calving, but a larger decrease is associated with a decrease in serum calcium concentration, and thus with subclinical or clinical milk fever. Thermal imaging could also be used in the hoof health assessment, as at least severe hoof diseases raise the surface temperature of the coronary band.

Based on the results we created guidelines for the use of thermography in monitoring hoof health and the risk of milk fever. In the case of the hooves, the maximum temperature of the coronary band is measured using thermal imager and then compared with the temperature predicted by our model. To make the comparison easy we created a web-based calculator (Sorkkalaskuri) that compares the measured temperature with model prediction taking into account also ambient temperature and whether front or rear foot is scanned. When the measured coronary band temperature is higher than 2 ˚C compared to our model prediction, the calculator suggests checking the hoof. To monitor milk fever using thermography, the maximum surface temperature of the pelvic and thigh area of the cow is measured from behind. If the maximum surface temperature of the area is below +33 ˚C, the cow is at risk of developing milk fever. However, interpretative guidelines are tools for decision-making; the treatment decision should never be based solely on thermal imaging.

Cattle thermography places special demands on the thermal-imaging camera. The thermal imager used in the cowshed needs to be durable and able to operate in cold conditions. When reviewing the technical properties of thermal imagers, it is worth paying attention to the infrared resolution (IR resolution). High enough IR resolution enables finding also small-scale temperature differences. Additionally, thermal imager should have a practical measuring tool that enables finding the maximum temperature easily.

Thermal imaging is a tool with great potential for monitoring the welfare of cattle. However, various challenges need to be addressed before the method can be widely used. The thermal imaging guidelines developed at Kuvaa Nautaa project are based on manually made infrared measurements, but the results of the project serve also future development needs. Before the method can be automated, further research is needed. In the meantime, the guidelines developed in the Kuvaa Nautaa project will help taking and interpreting on-farm thermal images.

Keywords: thermal imaging, thermography, cattle, animal welfare, animal husbandry, udder health, hoof health, calving, milk fever, livestock production, guidelines