



Tracking stress in the stable

Dummerstorf researchers test biomarkers for long-term stress

Improved animal welfare and optimal husbandry conditions for our farm animals are becoming increasingly important to society. Scientists at the Research Institute for Farm Animal Biology (FBN) in Dummerstorf were successful in their search for gentler, minimally invasive methods to detect long-term stress in farm animals.

In a joint project funded by the Federal Agency for Agriculture and Food (BLE), together with the Friedrich-Loeffler-Institute for Animal Welfare and Husbandry (FLI-ITT) Celle (Lower Saxony), the researchers were able to further develop the determination of glucocorticoid biomarkers for the retrospective detection of long-term stress. The basis is the determination of the stress hormones cortisol in hair samples from cattle and pigs as well as corticosterone in feathers from chickens and turkeys.

"Stress reactions of the organism are essential for survival, but persistently elevated stress hormone levels in farm animals indicate problems in husbandry," explains project leader Dr Winfried Otten from the Institute of Behavioural Physiology at the FBN. Too much heat, too little space, social stress or isolation from conspecifics and boredom - stress in the stable can have many causes. It is not only the animals' well-being that suffers. Chronically stressed animals also cause additional costs, they can become ill more quickly or grow more slowly.

Stress hormones can be measured in blood, saliva, urine or faeces samples to assess stress levels in animals. "The sampling itself can be stressful for the animals and the hormone content in these samples only reflects the stress just before the time of collection. Long-term statements are difficult and only possible on the basis of many samples," Dr Otten describes the basic problem. "Our goal was to further develop stress hormone detection in hair and feathers into a simple and precise method for determining long-term stress in farm animals, similar to what is already used in stress research in humans. During hair and feather growth, there is a continuous and stable storage of hormones and the stress load of the preceding weeks and months could be determined on the basis of a sample."

Therefore, for the first time, the temporal course of cortisol storage in the hair due to stress as well as stress-independent influencing factors were systematically researched in farm animals at the FBN. The veterinarian Dr. Susen Heimbürge did her doctorate within the framework of this project and, to this end, in recent years has investigated not only the influence of various stressors, but also of factors such as hair colour, hair type and age on hair cortisol concentrations in cattle and pigs. "Using an experimental stress model in cattle, we were able to show for the first time that a stress load of several weeks on the animals can be detected by increased cortisol concentrations in different hair types, namely in native and regrown body hair as well as in segments of tail hair," Dr Otten explains the findings. "Depending on the hair length, the stress history of several weeks to several months can thus be read in a sample." As a new result, the scientists were able to show for the first time that individual hair segments in farm animals can be used retrospectively as a kind of calendar of stress exposure.

While the suitability of the method as a stress indicator has already been confirmed in cattle, further studies are still necessary in pigs and poultry, as interferences from soiling of the hair can influence the measurements. In principle, the determination of glucocorticoids in hair and feathers can considerably simplify the measurement of long-term stress in livestock farming in the future, and these physiological biomarkers could therefore also be suitable for use in an animal welfare monitoring system. "In order to improve animal welfare, research into innovative minimally invasive indicators using hair, feathers and even fish scales will continue at the FBN in the future," the scientist announced.

Recent publications in peer-reviewed international journals

Bartels, T.; Berk, J.; Cramer K.; Kanitz, E.; Otten, W. (2021): Research Note: It's not just stress - Fecal contamination of plumage may affect feather corticosterone concentration. *Poultry Sci.*, 100: 101494. <https://doi.org/10.1016/j.psj.2021.101494>

Bartels, T.; Berk, J.; Cramer K.; Kanitz, E.; Otten, W. (2021): Research Note: A sip of stress. Effects of oral corticosterone administration on feather corticosterone concentrations in layer pullets. *Poultry Sci.*, 100: 101361. <https://doi.org/10.1016/j.psj.2021.101361>

Otten, W.; Bartels, T.; Heimbürge, S.; Tuchscherer, A.; Kanitz, E. (2021): The dark side of white hair? Artificial light irradiation reduces cortisol concentrations in white but not black hairs of cattle and pigs. *Animal*, 15(6): 100230. <https://doi.org/10.1016/j.animal.2021.100230>

Otten, W.; Heimbürge, S.; Kanitz, E.; Tuchscherer, A. (2020): It's getting hairy – External contamination may affect the validity of hair cortisol as an indicator of stress in pigs and cattle. *Gen. Comp. Endocrinol.*, 295: 113531. <https://doi.org/10.1016/j.ygcen.2020.113531>

Heimbürge, S.; Kanitz, E.; Tuchscherer, A.; Otten, W. (2020): Is it getting in the hair? – Cortisol concentrations in native, regrown and segmented hairs of cattle and pigs after repeated ACTH administrations. *Gen. Comp. Endocrinol.*, 295: 113534. <https://doi.org/10.1016/j.ygcen.2020.113534>

Heimbürge, S.; Kanitz, E.; Tuchscherer, A.; Otten, W. (2020): Within a hair's breadth – Factors influencing hair cortisol levels in pigs and cattle. *Gen. Comp. Endocrinol.*, 288: 113359. <https://doi.org/10.1016/j.ygcen.2019.113359>

Heimbürge, S.; Kanitz, E.; Otten, W. (2019): The use of hair cortisol for the assessment of stress in animals. *Gen. Comp. Endocrinol.*, 270: 10-17. <https://doi.org/10.1016/j.ygcen.2018.09.016>

Doctorate resulting from the project and successfully defended at the Faculty of Veterinary Medicine at the University of Leipzig

Susen Heimbürge (2021): Hair cortisol concentration in cattle and pigs: Investigation of influencing factors and the potential as an indicator of long-term stress. <https://nbn-resolving.org/urn:nbn:de:bsz:15-qucosa2-752606>

Contact

Public Relations

Isabel Haberkorn

T +49 38208-68 605

E presse@fbn-dummerstorf.de

www.fbn-dummerstorf.de

LinkedIn @forschungsinstitut-nutztierbiologie-fbn

Twitter @FBNDummerstorf

Instagram @forschungsinstitut_fbn