

Description of the research topic

General information

Institute: National Research Institute of Animal Production.

Research topic: Analysis of the microRNA profile in mammary secretory tissue and blood leukocytes of dairy goats with severe or mild CAE compared to SRLV-uninfected goats.

Scientific discipline: Animal Science and Fisheries.

Name of potential supervisor: dr hab. inż. Klaudia Pawlina-Tyszko, prof. NRIAP.

Background information

The doctoral scholarship is financed by the National Science Centre (NCN) from the OPUS project titled "Omics and pathophysiological analyses of udder secretory tissue and blood leukocytes from dairy goats with severe or mild CAE vs. SRLV uninfected goats" (project number: 2025/59/B/NZ9/00800). Principal Investigator: Prof. Emilia Bagnicka, PhD, DSc (Institute of Genetics and Animal Biotechnology of the Polish Academy of Sciences).

The research will focus on microRNA profiling in dairy goats naturally infected with small ruminant lentiviruses (SRLV), which cause caprine arthritis-encephalitis (CAE). The study will involve three groups of animals: seronegative and clinically healthy goats (SRLV-SN), seropositive goats with a mild course of CAE (SRLV-SPM), and seropositive goats with a severe course of the disease, characterized by emaciation and/or advanced lameness (SRLV-SPE). The key biological materials will be blood leukocytes and mammary gland secretory cells, representing the systemic and local mammary immune responses, respectively. The research hypothesis posits that pathophysiological mechanisms differ depending on disease severity, resulting in distinct response on molecular level, including signatures of regulatory non-coding sequences such as microRNAs. The aim of the doctoral research is to identify microRNAs associated with the severity of SRLV infection and to determine their potential role in regulating immunity, mammary pathology, and CAE progression.

The main question to be addressed in the project

The doctoral research will address the question of whether SRLV infection and the clinical severity of CAE are associated with specific changes in the microRNA profile of dairy goats. The first objective is to determine whether goats with severe disease progression exhibit a stronger or qualitatively different miRNA response compared to those with a mild course

of the disease and uninfected animals. A second question concerns the differences between blood leukocytes and mammary gland secretory cells - that is, between the systemic and local responses. A further aim is to determine whether the altered miRNAs regulate genes associated with antiviral response, inflammation, udder function, tissue remodeling, and production traits. Moreover, associations between the miRNA profile and viral load, SRLV genotype/subtype, and clinical signs of CAE will be investigated. Finally, the potential of selected miRNAs as markers of disease progression will be evaluated.

Information on the methods/description of work

The study will involve 45 dairy goats from at least five herds, divided into three groups: SRLV-SN, SRLV-SPM, and SRLV-SPE, with 15 animals in each group. Animals will be selected following a clinical examination and the exclusion of significant confounding factors, such as other infections or hoof diseases. Following euthanasia, blood samples and mammary gland secretory cells will be collected for microRNA analysis. Total RNA will be isolated, assessed for quality and quantity, and subsequently used to prepare microRNA libraries using a dedicated kit. The microRNA profile will be determined using Next-Generation Sequencing (NGS) technology. Bioinformatic analysis will encompass microRNA sequence identification, differential expression analysis, target gene prediction, and functional pathway enrichment. Ten selected miRNAs will be validated via RT-qPCR, and the results will be statistically correlated with the clinical group, viral load, and SRLV genotype.

Additional information

The candidate should hold a degree in biology, biotechnology, bioinformatics, or related natural sciences. Basic knowledge of molecular biology and genetics is required. Laboratory experience, particularly with techniques such as nucleic acid isolation and PCR/qPCR, is highly desirable. The candidate should demonstrate independence, teamwork skills, good work organization, and reliability. Proficiency in English at a level sufficient to consult scientific literature and prepare publications is also expected.

Doctoral scholarship: approx. 5800 PLN monthly gross before mid-term evaluation (first 2 years) and approx. 7200 PLN monthly gross after mid-term evaluation (last 2 years) is funded by the National Science Centre (NCN).

Place/name of potential collaborators

The doctoral research will be conducted under the supervision of dr hab. inż. Klaudia Pawlina-Tyszko, prof. NRIAP; a specialist in molecular biology with a particular focus on small non-coding RNAs.

As the doctoral project is part of a larger study titled " Omics and pathophysiological analyses of udder secretory tissue and blood leukocytes from dairy goats with severe or mild CAE vs. SRLV uninfected goats " the research, data analysis, and manuscript preparation will be carried out in collaboration with other project partners (the Institute of Genetics and Animal Biotechnology of the Polish Academy of Sciences and the Warsaw University of Life Sciences).

References

Dawar P., Maravi P., Singh S., Jyoti, Umar P. K., Maravi S. Caprine arthritis-encephalitis: A holistic review of disease etiology, diagnosis, and control measures. *International Journal of Veterinary Sciences and Animal Husbandry*. 2024;9(5):324-328.

Urbańska, D. M., Jarczak, J., Czopowicz, M., Kaba, J., Horbańczuk, K. & Bagnicka, E. (2022). miRNA expression patterns in blood leukocytes and milk somatic cells of goats infected with small ruminant lentivirus (SRLV). *Scientific Reports*, 12(1), 13239.

Bagnicka E., Kawecka-Grochocka E., Pawlina-Tyszko K., Zalewska M., Kapusta A., Kościuczek E., Marczak S. & Ząbek T. MicroRNA expression profile in bovine mammary gland parenchyma infected by coagulase-positive or coagulase-negative staphylococci. *Vet Res*. 2021 Mar 6;52(1):41. doi: [10.1186/s13567-021-00912-2](https://doi.org/10.1186/s13567-021-00912-2). PMID: 33676576; PMCID: PMC7937231.