

# **Assessing the effects of addition of plant saponins on the rumen metabolism of dairy goats in peri-partum period by metabonomic approach**

**STSM TITLE: “Assess the saponins effects on rumen metabolism of peri-partum dairy goats, by metabonomic approach”**

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## **Rationale**

One of the goals in dairy farms is to limit nutritional and metabolic disturbances during critical physiological periods. The peri-partum period in goats is particularly hazardous. Indeed, this period corresponds with a time when there are crucial metabolic changes in the animal in response to the challenges of late gestation and early lactation when nutrient requirements are extremely high. The use of dietary plant additives is interesting in that they may be able to improve both the health and welfare of animals and also minimize the negative impact of animal production on the environment. In addition, animal product quality may also be influenced positively. Many biological systems may be affected by plant matrices since they are extremely complex in composition (primary and secondary metabolites). Saponins have received some attention as natural feed additives. The risk of pregnancy toxemia is high in late gestating small ruminants due to the very high foetal glucose requirements. An increase in ruminal propionate concentrations induced by dietary saponins may help alleviate this problem by supplying more precursors for gluconeogenesis without any disadvantage of propylene glycol, the chemical drug usually used. The potential beneficial effect on energy metabolism, on the adaptability of animals, particularly during the crucial peri-partum period, and so on the welfare of animals during this crucial period led us to more investigate.

## **Objectives**

To assess the effect of saponins on rumen of dairy goats during peri-partum period, i.e. during a period of metabolic instability and disrupted welfare by using metabonomic approach.

## **Experimental design**

The trial will be conducted using 24 Alpine and Saanen dairy goats in the peri-partum period.

Goats in gestation will be allocated into 2 balanced groups of 12 goats each according to body weight, lactation number and milk yield, and randomly assigned to the dietary treatments consisting of:

- standard diet
- standard diet with saponins supplement

The experimental design will consist in a period of 7d of standard diet for all goats then 4 weeks with or without saponins supplements. This first period of 5 weeks has to correspond with the period ante-partum. From the delivery, goats from the 2 batches will be fed with standard diet. Both diets will be offered *ad libitum* twice daily with a free access to water, micromineral and vitamin blocks.

Goats will be housed together because of ethically reasons during gestation but will be housed in individual pens during samplings. Rumen liquor will be sampled using an esophageal probe. Blood and rumen liquor will be sampled before and 2 hours just after the distribution of diet. Rumen pH will be measured at the same times for comparison.

Biological fluids (blood, milk and rumen liquor) will be analyzed using  $^1\text{H-NMR}$ . Then, some multidimensional statistical analyses will be performed on data in order to reveal the main metabolites and metabolic pathways involved in this period and the putative effect of saponins on them.

### **Expected results and benefits**

The proposed plan will cover scientific and personal objectives, completing the available information on the use of plant additive on health and performances of goats.

The simultaneous work on goats and the assessment of rumen, blood and milk metabolome by  $^1\text{H-NMR}$  spectroscopy analyses were not possible in the IBNA-Balotesti laboratory. Therefore, this stage will be key, by combining high-throughput metabolic  $^1\text{H NMR}$  fingerprinting and multivariate statistical analyses, to reveal in bio-fluids (plasma, milk, ruminal juice) some specific signatures associated with saponin-induced metabolic deviations.

It will open the possibility of adding value to the experiments running in Romania on fistulated goats / plant secondary metabolites, by enlarging the range of analyses that can be done on the biological fluids (rumen / blood / milk) sampled within these experiments.

Moreover, the use of dietary plant additives is interesting to improve both the health and welfare of animals and also minimize the negative impact of animal production on the environment.

Collected data will be discussed with a group of scientists of recognized expertise in dairy ruminant nutrition and metabolism at the INRA-AgroParisTech Research Unit MoSAR in Paris and will be used to write a report aiming to be presented in the DairyCare Cost Action plenary meetings.

The knowledge gained by the candidate will be valorised within the on-going or planned experiments in Romania, on fistulated goats and on the use plant secondary metabolites as feed additives. Also, it will stimulate the generation of new project ideas and project proposals by the candidate.