Assessing the effects of forage:concentrate ratio on the rumen indicators and lactational performances of dairy goats

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Rationale

High yielding ruminants at early lactation have inevitably a negative energy balance which is mitigated by using diets with high percentage of concentrate, leading to acute or subacute rumen acidosis. Rumen acidosis modifies the animal's behavior and health status compromising animal welfare, as well as milk production and composition.
Goats are more tolerant to high concentrate diets than cows but few is known on the interactions of concentrate:forage ratio and the key indicators of rumen function (i.e., temperature and pH) and milk production which will be investigated in this research.
On the other hand, there is an ethical concern on the use of fistulated animals (i.e., rumen cannulated goats) for nutrition research. The use of rumen sensors, applied orally, may be and alternative of interest currently affordable. Most commonly used sensors are pH and temperature, but osmolarity, pressure, Redox potential, ammonia, etc. sensors are also available.

Objectives

To asses the validity of rumen sensors for monitoring the main indicators of rumen function (pH and temperature) in comparison to direct measures done by using cannulated animals.

Experimental design

The trial will be conducted using 8 ruminally canulated dairy Alpina goats at early lactation to which a wireless rumen sensor for rumen temperature and pH will be applied (Kahne Limited, Auckland, New Zealand).
Goats will be allocated into 2 balanced groups of 4 goats each according to BW, lactation number and milk yield, and randomly assigned to the dietary treatments consisting of:

- Low concentrate diet: 30% concentrate and 70% forage
- High concentrate diet: 70% concentrate and 30% forage

The experimental design will consist in a crossover 2 × 2 (2 periods × 2 diets) with periods of 24 d each (14 d of adaptation to the diet and 10 d of measurements) in which the diets will be alternatively fed. Both diets will isonitrogenous, varying in energy content and will be offered ad libitum twice daily with a free access to micromineral and vitamin blocks. Water will be offered at intervals during the first 8 after feeding.
Goats will be housed in individual pens equipped with weighing feeders and video cameras throughout the trial and milked twice in the pens. Rumen pH and temperature will be monitored at 2-h interval during 2 d at the end of each experimental period through the rumen cannulas and using the rumen sensors (at 15 min interval). Rumen liquor will be sampled through the cannula or using an esophageal probe at the same times for comparison.

Expected results and benefits

The proposed plan will cover scientific and personal objectives, completing the available information on the use of biosensors working by telemetry and the skills acquired by the candidate during hers PhD.
Direct measurement of rumen pH and temperature were not possible in the UAB laboratory, were hers Thesis was done, because the lack of fistulated animals. Therefore, this stage will be key for learning how to manipulate cannulated goats and to interface the conventional methodology with the new biosensor technology.
Collected data will be discussed with a group of scientists of knew excellence at the INRA-MoSAR unit in Paris and will be used to write a report aiming to be presented in the DairyCare Cost Action plenary meetings.