Nutrición de rumiantes para afrontar el escenario actual de inestabilidad: INSEctos y ReSiliencia en Ovejas lecheras (INSERSO)

Ruminant nutrition to face the current scenario of instability: insects and resilience in dairy ewes (INSERSO)

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Resumen

Livestock farming is currently facing a scenario of great instability and uncertainty as a result of climate change, high prices of diet ingredients, global population growth and competition for resources. In addition, consumers are increasingly demanding healthier products, and socially and environmentally sustainable animal production systems. In this scenario, research in ruminant nutrition must be a key player in the transitions necessary to address major global challenges and build solutions. Thus, our proposal aims to search for alternative feeds for dairy ewes that reduce feed-food-fuel competition, make animals more resilient to external challenges (arising, among others, from climate hazards), and contribute to achieving a milk with a healthier lipid profile, to meet consumers demand.

To this general goal, we propose to investigate the dietary use of oil and chitosans from the insect *Tenebrio molitor* (mealworm), produced locally and authorised in Europe, as well as a source of n-3 polyunsaturated fatty acids (n-3 PUFA).

Two main specific objectives are proposed, with several sub-objectives each. The first one (1) is to decipher the effects of the inclusion of *T. molitor* oil and chitosans in sheep diet

on the digestive utilisation, with special attention to rumen fermentation and microbiota, the ruminal biohydrogenation of fatty acids and the subsequent milk lipid composition (looking for a healthier profile for consumers), and the animal performance, feed efficiency and health status (to ensure that the insect consumption has no negative consequences). In addition, we expect to identify new ruminal enzymes related to lipid metabolism with applications in the biotechnological industry. The second objective (2) is to elucidate the effect of the incorporation in the diet of *T. molitor* chitosans and n-3 PUFA on the resilience of dairy sheep in response to an inflammatory challenge of the mammary gland (as an experimental model of infectious challenges). Within this objective, we intend to explore and measure resilience indicator traits (such as animal performance and digestive parameters, immune parameters and milk and plasma metabolome), to investigate possible trade-offs between resilience, immune competence and production traits, and to search for biomarkers for phenotyping animal resilience in dairy sheep (for future selective breeding).

To meet all these objectives, 3 experimental trials are proposed. First, an *in vivo* trial with lactating ewes to examine the dietary use of *T. molitor* oil (Trial 1), followed by an *in vivo/in situ/in vitro* trial with cannulated ewes to investigate further the processes occurring in the rumen (Trial 1.1). Then, another *in vivo* trial with lactating ewes (Trial 2) to study the effects of incorporating *T. molitor* chitosans and n-3 PUFA into the diet on the resilience, in terms of response to and recovery from an intramammary inflammatory challenge with *Escherichia coli* lipopolysaccharides. This Trial 2 (namely, the insect chitosans part) will also address the first objective.

This proposal comes as a continuation of several previous projects (e.g., from the Plan Estatal R&D and H2020 programmes), and involves the participation of researchers from the IGM (CSIC-ULE), the Univ. of Torino (Italy) and the INRAe (France).

We expect the project to have not only a major scientific impact but also a high technical interest for the agri-food sector.