

Using Omics to Understand Seasonal Weight Loss in Dairy Goats: An overview of Project GOATOMICS major achievements

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Seasonal weight loss (SWL) is a limiting factor to animal production. Understanding SWL adaptation molecular mechanisms is of high importance in animal selection. We studied the effect of SWL, on the mammary gland secretory tissue proteome, metabolome and metabolome in 2 dairy goat breeds from the Canary Islands with different levels of tolerance to SWL: Majorera (tolerant) and Palmera (susceptible) in the framework of project GOATOMICS. Herein we present the main achievements of the project.

Goats from both breeds were divided into two groups (n =5): control (constant weight) and underfed (15% liveweight reduction). At day 22, mammary gland biopsies were extracted and proteomics (Label-Free), metabolomics (NMR) and transcriptomics (NGS) profiles were obtained. Proteomics component: 1010 proteins were identified, 96 were significantly different among groups. SWL lead to an increase of apoptosis and stress processes in both breeds. Both breeds showed a decrease in the number of protein, carbohydrates and fat-biosynthesis proteins. When both breeds were compared after SWL, Majorera breed showed higher expression of immune system related proteins. In contrast, Palmera breed showed higher expression of proteins related to apoptosis, ketone bodies formation (fat liver) and protein metabolic processes. Metabolomics component: 47 different compounds were identified in the aqueous fraction of mammary gland extracts. Lactose, glutamate, glycine, lactate and glucose were found to be the most abundant. Statistical evaluation using Principal Component Analysis (PCA) and Partial Least Squares (PLS) revealed differences between control and underfed animals, although no differences between breeds were observed. Transcriptomics component: Results showed that a concerted reprogramming of genes expression occurs as result of the stress imposed, irrespective to the breed. Also suggesting a different behavior of both breeds in response to SWL. Moreover, an enrichment analysis of the differentially expressed genes provided some insight into what biological processes are related with the response to SWL during lactation. Finally, a validation of the RNA-Seq assay using RT-qPCR was performed on candidate genes differentially expressed: Glycerol kinase (GK) and Adrenoreceptor beta 2 (ADRB2). Conclusion: The two goat breeds have a different metabolic response to SWL, highlighting differences particularly related to the immune system and apoptosis.

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