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A molecular and genetic analysis of milk production and quality in goats of the Murciano-Granadina breed



Human population increases at a fast pace making necessary to devise more efficient strategies to ensure an adequate food supply. In this study, researchers investigate the molecular basis of goat lactation and the genetic determinism of milk yield and composition in Murciano-Granadina goats. The results obtained could lead to the future design of genomic tools to help specialists to discern and select individuals with the highest genetic value in order to increase the production efficiency of goat farms.

The work presented in the article Analyzing the Genomic and Transcriptomic Architecture of Milk Traits in Murciano-Granadina Goats was born from a collaborative project of the Spanish State Program for R + D + i Oriented to the Challenges of Society (Food security, Sustainable agriculture, Bioeconomy etc.), called Capramur, between the Centre for Research in Agricultural Genomics, the University of Córdoba and the National Association of the Murciano-Granadina goat breed (Caprigran).

One of the primary objectives of the project was to better understand the molecular basis of goat lactation, a physiological process that determines the synthesis of the milk components. With the collaboration of the Servei de Granges i Camps Experimentals de la UAB, mammary gland biopsies were obtained from Murciano-Granadina goats and their expression profiles were compared at the beginning and at the end of lactation and during the dry period (phase of the production cycle in which the goat ceases producing milk). Our

results evidenced that the drying phase implies a very strong decrease in the biosynthetic activity of the mammary gland as well as the activation of genes that induce the involution and remodeling of the mammary gland tissue. On the other hand, during the dry period, an increased expression of genes related to the immune system was also observed, a feature which could have a protective effect on the mammary gland.

Another objective of the Capramur project was to investigate the genetic basis of milk yield and composition traits. To do this, Caprigran technicians in collaboration with the University of Córdoba measured these phenotypes in 1036 goats of the Murciano-Granadina breed, and subsequently their association with 50,000 genetic markers genotyped in the goat population under study was investigated. By doing so, we identified a region of the goat chromosome 6 that presented a very significant association with the protein content of milk. This region contains the genes for caseins, which are the majority milk proteins. We have also identified 23 additional genomic regions that show significant associations with dairy traits. The achievement of this objective constitutes a first step towards finding the specific genetic variants that affect the protein content of milk, a character that largely determines cheese yield.

One of the most important challenges our society faces is being able to produce enough food to feed a constantly growing population. In this context, it is very important to increase the efficiency of animal production, so that it is fully sustainable and allows more food to be generated with fewer animals. In our project we have identified a set of genes that are crucial for the establishment of lactation and therefore have an important effect on milk production. On the other hand, we have identified several regions of the genome associated with dairy traits. The integration of these sources of molecular information could allow, in the future, to design genomic tools that help us to select Murciano-Granadina goats in a more efficient and precise way, accelerating genetic progress so that goat breeding becomes more productive, sustainable and economically profitable.

Marcel Amills¹, Dailu Guan¹, Javier Fernández², Amparo Martínez³

¹Centre for Research in Agricultural Genomics, Universitat Autònoma de Barcelona.

²Caprigran.

³Universidad de Córdoba.

marcel.amills@cragenomica.es ; dailu.guan@cragenomica.es ; j.fernandez@caprigran.com ; ib2mamaa@uco.es

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