Genome Editing in Cows to produce Hypoallergenic Milk

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Statement of problem:

Worldwide, cow's milk is a food ingredient massively consumed due to its high nutritional value. However, it also constitutes one of the foods that most frequently causes allergies. Cow's milk allergy is a common condition among infants and children that severely impairs the absorption and utilization of nutrients from dairy products. Beta-lactoglobulin is the main allergen found in bovine milk, and between 2% and 3% of children under three develop allergy symptoms.

Different treatment methods have been applied on milk to reduce allergenicity, including heating, high pressure and enzymatic hydrolysis. However, such treatments entail damages on the structure and function of other proteins, to the detriment of the nutritional quality of milk.

Technology Readiness Level:

Medium-High. We generated the constructs required to edit this gene. The procedure was performed on embryos and the embryos were transferred to the recipient animals. We obtained calves that feature the genetic modification in some of their cells (mosaic). Now we must generate a knockout animal, by way of crossbreeding.

We have recently implemented an enhanced genome editing protocol that enabled to generate fifteen new edited and transferred embryos, whose birth we are expecting.

Technology proposal:

The ultimate purpose of this development is to obtain beta-lactoglobulin gene knockout animals that may produce hypoallergenic milk, suitable for all types of consumers.

Researchers from EEA Balcarce and Universidad de San Martín have adopted genome-editing techniques to silence the beta-lactoglobulin gene in bovine cattle successfully. This unprecedented effort applied the genome editing technique on this gene in bovine cattle for the first time in the world.

Development requirements (testing, scale-up production, investment, etc.):

After generating a cow with all body cells edited to block the synthesis of beta-lactoglobulin, we must evaluate the quality of the milk produced and its hypoallergenicity.

Simultaneously, we must fulfill the regulatory requirements to assess the marketability of the hypoallergenic milk and transfer the technology to an adopter capable of making this product available to the target population.