

# Genetic Insights into Sheep Colostrum: Unraveling the Impact of LTF, PTPRK, and LIFR Polymorphisms on Yield and Quality

Yiyu Sha<sup>1</sup>, Guiqiong Liu<sup>1</sup>, Jianping Ding<sup>2</sup>, Fuqing Hou<sup>3</sup>, Huiguo Yang<sup>4</sup>, Yongbin Liu<sup>5</sup>, and Xunping Jiang<sup>1</sup>

<sup>1</sup>Huazhong Agriculture University Key Laboratory of Agricultural Animal Genetic Breeding and Reproduction of the Ministry of Education

<sup>2</sup>Anxin Sheep Industry Technology Innovation Research InstituteBozhou

<sup>3</sup>National Sheep Industry Technology System Shihezi Comprehensive Experimental Station

<sup>4</sup>Xinjiang Academy of Animal Sciences

<sup>5</sup>Inner Mongolia University

January 15, 2025

## Abstract

Colostrum is a unique channel that contributes to passive immunity transfer and provides nutrients for the growth and newborn lambs development. High yield and quality colostrum are the keys to ensuring the healthy lamb's survival. However, systematic evidence regarding colostrum characteristics, particularly yield and immunoglobulin concentrations, as well as the underlying genetic-molecular mechanisms, remains insufficient. Therefore, this study aims to measure and analyze the dynamic changes in colostrum yield, immunoglobulin concentrations (IgG, IgA, and IgM), and nutrient composition (including fat, protein, lactose, total solids, non-fat solids, and urea) in sheep, while also identifying genes associated with colostrum characteristics to provide insights for improving the yield and quality of sheep colostrum and for developing efficient lactating sheep breeds. It was found that colostrum production increased significantly with time and total colostrum production could reach  $3.489 \pm 0.075$  Kg in the first 3 days after delivery. At the same time, the highest concentrations of IgG (108.014 mg/mL), IgA (4.139 mg/mL), and IgM (0.447 mg/mL) in colostrum were observed during delivery, and they decreased rapidly at 12 hours and finally stabilized. The contents of fat, protein, lactose, total solids, non-fat solids, and urea decreased after delivery, while the lactose content showed an increasing pattern. In addition, whole genome resequencing analysis revealed six single nucleotide polymorphism (SNP) sites in the *LTF* gene (rs422619216), *PTPRK* gene (rs429528738), and *LIFR* gene rs408968100, rs162154352, rs161149074, and rs411119461). Variations at these loci are significantly associated with colostrum production and immunoglobulin content, serving as important molecular genetic markers for colostrum traits. Notably, these variations also influence the hydrophilicity and three-dimensional structure of the corresponding proteins. *LTF*, *PTPRK*, and *LIFR* genes are important candidate genes for colostrum yield and immunoglobulin concentration, providing robust evidence to support sheep selection and breeding programs.

## Hosted file

Genetic Insights into Sheep Colostrum Unraveling the Impact of LTF, PTPRK, and LIFR Polymorphisms on Yield and Quality available at <https://authorea.com/users/880947/articles/1259971-genetic-insights-into-sheep-colostrum-unraveling-the-impact-of-ltf-ptprk-and-lifr-polymorphisms-on-yield-and-quality>