

Interactions Among Rumen Fermentation Characteristics, the Microbiota, and Host Gene Expression in Response to Ambient Temperature Fluctuations in Tibetan Sheep

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Abstract

As an important ruminant on the Qinghai-Tibet Plateau, Tibetan sheep can maintain their population reproduction rate in the harsh high-altitude environment of low temperature and low oxygen, which is related to their special adaptations to the plateau. Microbes (known as “second genomes”) play an important role in the host adaptations. However, there have been no reports on the effects of the interactions among rumen fermentation, the microbiota, and host gene expression on the adaptation of Tibetan sheep to high altitude. In this study, rumen fermentation characteristics, the microbiota, and rumen epithelial gene expression of Tibetan sheep in various months were analyzed. The results show that the rumen fermentation characteristics of Tibetan sheep differed in different months. The total SCFA, acetate, propionate, and butyrate concentrations were highest in Oct and lowest in Jun. The CL activity was highest in Feb, while the ACX activity was highest in Apr. In addition, the diversity and abundance of rumen microbes differed in different months. Bacteroidetes (53.4%) and Firmicutes (27.4%) were the dominant phyla. *Prevotella_1* and *Rikenellaceae_RC9_gut_group* were the dominant genera. The abundance of *Prevotella_1* was highest in Jun (27.8%) and lowest in Dec (17.8%). In addition, the expression of *CLAUDIN4* and *ZO1* was significantly higher in Apr than in Aug and Dec, while the expression of *SGLT1* was highest in Aug. Correlation analysis showed that there were interactions among rumen fermentation characteristics, the microbiota, and host gene expression, and the host adjusted the rumen fermentation and microbiota structure according to changes in ambient temperature, to adapt to the plateau environment.

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