12. Alterations in rumen bacteria community and metabolome characteristics of dairy cows in response to different dietary energy sources

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The current study was conducted to investigate the effects of one lipogenic and two glucogenic diets differing in processing conditions on the rumen metabolism in terms of ruminal microbial communities and their metabolic functioning.
Six rumen cannulated Holstein Frisian dairy cows were randomly allocated into two 3 × 3 latin squares. Three periods with 21 days per period were included. The three diets which were chemically similar and isoenergetic included a lipogenic diet (L) with sugar beet pulp and alfalfa silage as main energy sources and two glucogenic diets with corn silage and corn (C) or steam-flaked corn (S) as energy sources. The ruminal bacterial community was determined through 16S rRNA sequencing and the rumen metabolomics information was conducted by liquid chromatography-tandem mass spectrometry.
Compared to the diet C and S, the diet L resulted in significantly lower ruminal concentrations of lactic acid and ammonia-nitrogen (NH_3-N), higher proportions of propionate, isobutyrate, isovalerate, and higher proportions of acetate and butyrate. As for the bacterial community at the genus level, the diet L had significantly higher relative abundances of *Prevotella_1, Prevotellaceae_Ga6A1_group, Ruminococcus_1, Eubacterium_coprostanoligenes_group, Ruminiclostridium_6, Ruminococcaceae_UCG-013,* and *Tyzzerella_3*, but lower relative abundances of *Ruminococcus_2, CAG-352, Ruminococcaceae_UCG-005, Papillibacter, Lachnobacterium,* and *Selenomonas*, and tended to lower relative abundances of *Prevotella_7* and *Prevotellaceae_YAB2003_group*, compared to the diet C and S. A total of 188 influenced metabolites were obtained based on VIP > 1 and $P < 0.05$, among which 10 out of 11 metabolites in the subclass of amino acids, peptides, and analogues and 2 out of 16 metabolites in the subclass of triterpenoids were significantly higher in the diet C and S than that in diet L.
The present study showed the two glucogenic diets lead to higher ruminal production of lactic acid and propionate and improve the protein digestion thereby resulting in an increased availability of amino acids and NH_3-N compared to the lipogenic diet. The typical amylolytic or cellulolytic bacteria were not observed highly abundant in the diets higher in starch or NDF, respectively. This suggests the presence of new starch-fermenting and cellulose-fermenting ruminal bacteria that need to be confirmed and classified, which also leads to new perspectives for the exploration of alternative species of the ruminal amylolytic and cellulolytic bacteria.

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