Metabolomics reveals effects of rumen-protected glucose on metabolism of dairy cows in early lactation

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Abstract： Early lactation dairy cows are vulnerable to negative energy balance (NEB) due to reduced dry matter intake (DMI) and high energy requirements for lactation. This study mainly revealed the mechanism of different doses of rumen-protected glucose (RPG) to alleviate NEB of the early lactating dairy cows through serum untargeted metabolomics, and explored the effects of different doses of RPG on rumen fermentation, lactation performance, and serum biochemical indices associated with NEB. Thirty-two multiparous Holstein cows in early lactation, blocked by parity, liveweight, and milk yield, were allocated to one of four treatments in a randomized block design. Treatments were: control (CON), low RPG (LRPG), medium RPG (MRPG) and high RPG (HRPG) with 0, 200, 350 and 500 g RPG per cow per day, respectively. Treatments were applied from calving to 35 days postpartum. The results showed that compared with other groups, the MRPG group changed the rumen environment, increased milk protein composition on 35 d, and decreased serum concentrations of β-hydroxybutyric acid (BHBA), non-esterified fatty acid (NEFA), aspartate aminotransferase (AST), and could increase glucose (GLU) concentration in serum. Dietary RPG supplementation affected ruminal pH and some volatile fatty acid (VFA) concentrations. The results of serum metabolomics showed that the metabolites with the largest contribution of the first 30 differences after RPG supplementation were mainly involved in lipid metabolism. The results of this study indicated that adding 350 g RPG to a cow's diet in early lactation could improve energy balance by reducing fat mobilization.

Keywords: Rumen-protected glucose, Negative energy balance, Metabolomics, Rumen fermentation, Production performance, Early lactation