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Effects of protein-free energy supplementation on blood metabolites, insulin and hepatic PEPCK gene expression in growing lambs offered rice straw-based diet

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This study was conducted to investigate the effects of increasing levels of protein-free energy supplementation on blood glucose, urea nitrogen, insulin and gene expression of hepatic phosphoenolpyruvate carboxykinase (PEPCK) in growing lambs offered rice straw-based diet. Thirty-six male Hu lambs (3.5 months old) were divided into four equal groups according to body weight. All animals were fed rice straw *ad libitum* and supplemented with cornstarch at levels of 0 (control), 60, 120, and 180 g/day, respectively, along with 160 g/day of rapeseed meal. The trial lasted for 60 days with the first 15 days for adaptation. Body weight change and feed intake were recorded. Blood samples were taken at different time points after feeding at the end of the trial, and analyzed for blood glucose, total protein, urea nitrogen and insulin. Liver samples were collected and analysed for the mRNA abundance of hepatic PEPCK. Increasing cornstarch showed a low effect on rice straw intake, but increased average daily gain of lambs significantly ($P < 0.05$). Blood glucose tended to increase with starch supplementation, but altered within a narrow range. Blood urea nitrogen was decreased significantly ($P < 0.05$) with increment in supplemental starch. Supplementation of starch at 120 or 180 g/day significantly increased the insulin concentration ($P < 0.05$) compared with the control. The abundance of cytosolic PEPCK (PEPCK-C) mRNA increased 2.47 times and 3.98 times with 60 and 120 g per day of starch supplementation compared with the control, respectively, while the supplementation of 180 g per day of starch showed a low effect on PEPCK-C gene expression ($P > 0.05$). Amounts of mitochondrial PEPCK (PEPCK-M) mRNA were not affected by the supplementation of starch at any level ($P > 0.05$). These results indicate that proper energy supplementation increases the expression of PEPCK-C, and consequently gluconeogenesis and blood glucose increase, while excessive energy may have an inhibitory effect on gluconeogenesis through insulin-involved mechanisms.

Keywords:

cornstarch; glucose; insulin; PEPCK gene; lambs

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