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不同粗饲料组合全混合日粮对泌乳奶牛瘤胃液微生物蛋白浓度24h变化和小肠微生物蛋白流量的影响

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Different Roughage Combinations in Total Mixed Rations: Effects on Microbial Protein Concentration Variation in Rumen Fluid in 24 Hours and Its Flow in Small Intestine of Lactating Cows

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摘要 本试验研究了不同粗饲料组合全混合日粮(TMR)对荷斯坦泌乳奶牛瘤胃液微生物蛋白(MCP)浓度24 h变化和嘌呤衍生物(PD)法测定小肠MCP流量的影响。选用5头体重(543±45) kg、年龄4岁、泌乳期和日均产奶量相近、安装有大口径瘤胃瘘管的奶牛作为试验动物。采用5×5拉丁方设计,TMR精粗比为61:39,共包括5个粗饲料组合,分别为100%玉米秸(TMR1)、50%玉米秸+50%玉米秸黄贮(TMR2)、50%玉米秸黄贮+50%全株玉米青贮(TMR3)、50%羊草+50%全株玉米青贮(TMR4)以及34%羊草+33%全株玉米青贮+33%苜蓿(TMR5)。结果表明:每隔2 h采集的不同时间点瘤胃液测定的MCP浓度差异不显著($P>0.05$)。不同TMR间瘤胃液MCP浓度存在显著差异($P<0.05$),TMR3瘤胃液MCP浓度值最高(1.217 mg/mL),显著高于TMR1和TMR5($P<0.05$),但与TMR2和TMR4相比差异不显著($P>0.05$)。TMR1至TMR5尿中尿囊素、尿酸、嘌呤衍生物(PD)排出量及由此估计的流入小肠的微生物氮(MN)和MCP合成量依次升高,差异逐渐达到显著水平($P<0.05$),5个处理尿囊素占PD排出量的83%~92%,尿酸排出量占PD排出量的8%~17%,且尿囊素($y=50.44x+35.58, R^2=0.733$)、尿酸($y=27.22x-28.77, R^2=0.734$)和PD排出量($y=77.67x+6.811, R^2=0.734$)均与TMR非纤维性碳水化合物/中性洗涤纤维(NFC/NDF)存在线性正相关关系。由此得出,饲喂羊草、全株青贮和苜蓿为TMR粗饲料的奶牛尿中PD排出量及由此估计的流入小肠的MCP合成量均高于其他各TMR。

关键词: 粗饲料组合 泌乳奶牛 嘌呤衍生物 微生物蛋白

Abstract: This experiment was conducted to study the effects of different roughage combinations in total mixed ration (TMR) on microbial protein (MCP) concentration variation in rumen fluid in 24 hours and its flow in small intestine of lactating cows by the purine derivative (PD) method. Five 4-year-old Holstein cows with an average body weight of (543±45) kg, similar lactation period and average daily milk yield, fitted with permanent ruminal fistulas, were used in a 5×5 Latin square design. Roughage combinations in five TMRs (concentrate:forage= 61:39) were as follows: 100% corn stover (TMR1), 50% corn stover+50% ensiled corn stover (TMR2), 50% ensiled corn stover+50% Chinese wildrye hay (TMR3), 50% Chinese wildrye hay+50% whole corn silage (TMR4), and 34% Chinese wildrye hay+33% whole corn silage+33% alfalfa hay (TMR5). The results showed as follows: MCP concentration in rumen fluid did not significantly differ among different time points (sampled every 2 hours) ($P>0.05$), but significantly differ among different TMRs ($P<0.05$). The highest MCP concentration (1.217 mg/mL) occurred in TMR3, and it was significantly higher than that of TMR1 and TMR5 ($P<0.05$), but was not significantly different from that of TMR2 and TMR4 ($P>0.05$). Allantoin, uric acid and PD outputs in urine and microbial nitrogen (MN) and MCP amount flowed into small intestine gradually increased from TMR1 to TMR5, and the difference finally reached a significant level ($P<0.05$). Allantoin and uric acid outputs in PD output ranged from 83% to 92% and 8% to 17%, respectively. Allantoin ($y=50.44x+35.58, R^2=0.733$), uric acid ($y=27.22x-28.77, R^2=0.734$) and PD outputs ($y=77.67x+6.811, R^2=0.734$) were linearly correlated with NFC/NDF in the TMRs. Consequently, PD output in urine and MCP amount flowed into small intestine in the TMR with a roughage combination of Chinese wildrye hay, whole corn silage and alfalfa hay are higher than those in the other TMRs.

Keywords: roughage combination, lactating cows, purine derivative, microbial protein

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