Nutritive Value, Energy Metabolism, Rumen Fermentation and Methane Emission of Fermented Spent Coffee Grounds as a Replacement of Hay in Total Mixed Ration Fed Corriedale Sheep

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The purpose of this study was to determine the fermentation characteristics of total mixed ration (TMR) contained different levels of fermented spent coffee grounds (SCG) and their potential nutritive value for wethers as assessed by feed intake, digestibility, nitrogen balance, and rumen variables. A mixed microbial culture (20 g/kg) was added to SCG and the mixture was incubated in a sealed container (anaerobically) one month at 30°C. Four experiment TMRs were prepared using oat grains, wheat grains (250 g/kg each) and kleingrass hay (*Panicum coloratum* L) 500 g/kg. The hay was replaced by fermented SCG a 0 (control-TMR), 50 (L-TMR), 100 (M-TMR) and 200 g/kg (H-TMR). Four Corriedale wethers (BW 46 ± 7.2 kg) fitted with permanent ruminal fistulae were used in a 4×4 Latin square design experiment (4 experimental periods and 4 diets). The wethers were kept in an individual metabolic cage and fed a basal diet at 55 g of DM/kg according to metabolic body weight ($MBW^{0.75}$). Fermented SCG containing TMR contained relatively high OM, NDF, ADF and GE. Crude protein ranged from 138 g/kg DM in both M-TMR and H-TMR to 139 g/kg DM control-TMR. The voluntary feed intake of TMR contained fermented SCG was not affected with the increase of fermented SCG. Dry matter, OM and NDF digestibility were reduced ($p>0.05$) when increased concentration of fermented SCG compared to the control-TMR. Cellulose ($p = 0.001$) and hemicellulose ($p = 0.015$) digestibility reduced in H-TMR compared to the control-TMR. Nitrogen intake and digestibility decreased ($p>0.05$) with the high level of fermented SCG. The highest GE intake and retained energy were in M-TMR and the lowest were in control-TMR. Nitrogen losses from feces increased and nitrogen losses from urine decreased in TMR contained high level of fermented SCG. pH was similar across all TMR (1.06 to 6.25). Rumen fluid from sheep receiving fermented SCG had lower ammonia-N than the control-TMR. The total volatile fatty acid (tVFA) concentration increased in both L-TMR and M-TMR diets and decreased in H-TMR. However, tVFA concentration increased immediately after feeding, reaching its peak 2 h after feeding the control-TMR, L-TMR and M-TMR and 3 h after feeding H-TMR. The methane emission from control-TMR, H-TMR, L-TMR and M-TMR were 1.45, 1.47, 1.50 and 1.51 (L/d/kg MBW) respectively, although not substantially high. Therefore, the study suggests that fermented SCG is good source of protein and energy for ruminant feed and the suitable hay replacing amount from the TMR by fermented SCG can be 100 g/kg of the DM.

Key Words: Coffee, Energy metabolism, Rumen fermentation, Methane, Sheep