Importance of Phosphorus Supplementation in Improving Fermentability, Microbial Protein Synthesis and Degradability of Ammoniated Rice Straw

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ABSTRACT

Rumen microbes need minerals for supporting its growth and activity in fermenting and digesting feeds. However, the supply of minerals should match the amount of energy that is available for microbial growth and protein synthesis, and for fermentation. An experiment is carried out to study the importance of phosphorous (P) supplementation in rations containing ammoniated rice straw (RS) and concentrate on its fermentability, microbial protein synthesis and degradability. The *in vitro* experiment was carried out following the first stage of Tilley and Terry method. The treatments consisting of four diets were A = 50% ammoniated rice straw (RS) + 50% concentrate (control), B = A + P supplement at 0.2%, C = A + P supplement at 0.4%, and D = A + P supplement at 0.6%. Completely randomized design was used as the experimental design with differences among treatment means were examined using Duncan multiple range test. Variables measured were ammonia (NH_3) and volatile fatty acid (VFA) concentrations, total bacterial and cellulolytic bacterial population, cellulolytic enzyme activity, as fermentability indicators and microbial protein synthesis, as well as degradability indicators including dry matter (DM), organic matter (OM), neutral detergent fibre (NDF), acid detergent fibre (ADF) and cellulose. The results indicate that P supplementation at the levels of 0.2, 0.4 and 0.6% reduced ammonia concentration ($P<0.05$) and increased VFA concentration ($P<0.05$), but did not affect other variables. Degradabilities of DM, OM, NDF, ADF and cellulose were increased by P supplementation ($P< 0.05$). It is concluded that P supplementation is important for improving fermentability and degradability of rations containing ammoniated RS and concentrate. The improvement occurred through the increase in cellulolytic bacterial population, cellulolytic enzyme activity, total VFA concentration, and degradabilities of DM, OM, and fibrous fraction. The best level of P supplementation is 0.4% (DM basis).

Key words: ammoniated rice straw, phosphorous, fermentability, microbial protein synthesis, degradability

INTRODUCTION

The presence of microbes in the rumen has enabled ruminants to eat fibrous diets such as grasses, agricultural and agriculture industrial byproducts. Rice straw (RS) is one of fibrous feed that is usually used to substitute or to replace grasses; the use of RS becomes important when the availability of grasses is limited during summer. However, the animal production has not reached its optimum level when RS is given to the animals. This is due to limitations in nutrient content and digestibility of RS.

The use of RS can be improved by treatments such as physical (grinding), chemical (alkali or ammoniation) and biological (treatment with microbes producing fibrous degrading enzymes) treatments. Among these treatments, ammoniation with urea is the best chemical treatment. This is because the treatment was simple and easy with low cost, the treatment has also enabled to loose the lignocellulose bonds which increased fibre degradation by rumen microbes (Leng, 1981). The use of urea-ammoniated RS as animal feed has increased body weight gain and milk production, feed intake, dry matter (DM) and organic matter (OM) digestibilities (Promma *et al*., 1985; van Soest, 2006; Sundstol, 1991). However, the use of urea-ammoniated RS could not be used up to 100% level as this level has slowed down animal