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Effect of Carbohydrate and Nitrogen Sources on Feed Intake, Nitrogen Balance, and Performance of Sheep

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Abstract

The study aimed to evaluate the effect of different carbohydrate and nitrogen (N) supplements on feed intake, nutrient utilisation, and performance of sheep. Twelve male Dorper sheep with a body weight (BW) of 23 kg (standard deviation (SD) 2.20) were used. The experimental design was a 4 × 3 Youden square which consisted of four experimental diets and three 21-d-experimental periods (14 d adaptation and 7 d sample collection). Two carbohydrate sources (whey permeate, corn) and two N sources (protected urea, unprotected urea), which differed in their rate and extent of degradation in the rumen, were combined, resulting in four diets:

1) rapidly degradable carbohydrate with rapidly degradable N source (whey permeate-unprotected urea), 2) slowly degradable carbohydrate and slowly degradable N source (corn-protected urea), 3) rapidly degradable carbohydrate with slowly degradable N source (whey permeate-protected urea), and 4) slowly degradable carbohydrate with rapidly degradable N source (corn-unprotected urea).

Dry matter (DM) intake ($p = 0.75$), apparent total tract digestibility of DM ($p = 0.89$), and daily BW gain ($p = 0.98$) were not affected by dietary treatment. Mean daily DM intake (g/kg BW^{0.75}), total tract DM digestibility (%), and daily BW gain (g/kg BW^{0.75}) were 60.4 (SD 3.45), 60.1 (SD 3.17), and 2.0 (SD 6.34), respectively. However, N intake (g/d), urinary and fecal N excretions (% of N intake) and, to some extent, N retention (% of N intake), were affected by carbohydrate source, regardless of N source. Urinary N excretion was significantly reduced ($P < 0.01$), fecal N excretion was higher, and N retention had a tendency ($p = 0.09$) to increase when sheep were fed a rapidly degradable carbohydrate (whey permeate) compared with corn, regardless of N sources. This implies that sheep receiving whey-permeate-based diets utilised N more efficiently than those sheep receiving diets containing corn. Moreover, the decrease in N excretion with whey permeate may be of ecological significance by potentially reducing the excretion of N into the environment.

Keywords: Carbohydrate, nitrogen metabolism, protected urea, protein, sheep, whey permeate