Effects of soluble protein to insoluble protein ratios in low nitrogen diet on growth performance and nitrogen metabolism of fattening *Hu* sheep

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It is estimated that the annual N_2O emissions from animal production systems and animal wastes are 2.7 Tg N(0.7-4.2), which is equivalent to 30-50% of total agricultural N_2O emissions; NH_3-N emissions are 22-32 Tg, accounting for approximately 50-75% of the total anthropogenic NH_3 emissions, which has resulted in numerous negative human health and environmental impacts (Oenema *et al*. 2005; Bouwman *et al*. 2009). In China, 55-59% of total nitrogen emissions in the past decade (2004-2014) have been emitted into the air, with agricultural and livestock production accounting for the largest (Xian *et al*. 2019). In order to relieve the current status of nitrogen emissions, nitrogen emissions have been reduced by reducing the nitrogen level of diets in livestock production, and it is unclear whether different dietary soluble crude protein (SCP) to insoluble crude protein (ISCP) ratios have an effect on nitrogen excretion, so we hypothesize that modification of dietary SCP to ISCP ratios can increase nitrogen metabolism and utilization in fattening *Hu* sheep.

Thirty-two five-month-old healthy fattening *Hu* sheep with an initial body weight of 39.53±1.18 kg (BW ± SD) were chosen and randomly divided into four treatments: (1) Con (Control): crude protein (CP) 15% base diet based on nutritional requirements, (2) LN(1:3.5): Low nitrogen diet, CP is reduced by 10% based on the control, and SCP:ISCP=1:3.5, (3) LN(1:2.5): Low nitrogen diet, CP is reduced by 10% based on the control, and SCP: ISCP=1:2.5, (4) LN(1:2): Low nitrogen diet, CP is reduced by 10% based on the control, and SCP: ISCP=1:2.

The feed intake and weight gain of each sheep were recorded, and blood samples, fecal samples, and urine samples were collected at day 14 and 28 to determine the nitrogen metabolism. Data were analyzed using PROC MIXED procedure of SAS with diet, period and place as fixed effects. Significance was declared at $p < 0.05$.It showed that the average daily gain (ADG) and feed conversion rate (FCR) of each group ranked: LN (1:2.5)> LN (1:2)> LN (1:3.5)> Con (Fig 1a). At 14d, the serum urea nitrogen content was lower with LN (1:2.5) than Con (*P*<0.05; Fig1b); The CP digestibility was highest at LN (1:2.5), which was higher than Con and LN (1:2) (*P*<0.05; Fig1c). At 28d, compared with Con, the low nitrogen diet treatment groups reduced urea nitrogen in serum (*P*<0.01; Fig1b), of which LN (1:2.5) was the lowest; and compared with other treatment groups, LN (1:2.5) CP digestibility (*P*<0.05; Fig1c) was the highest.

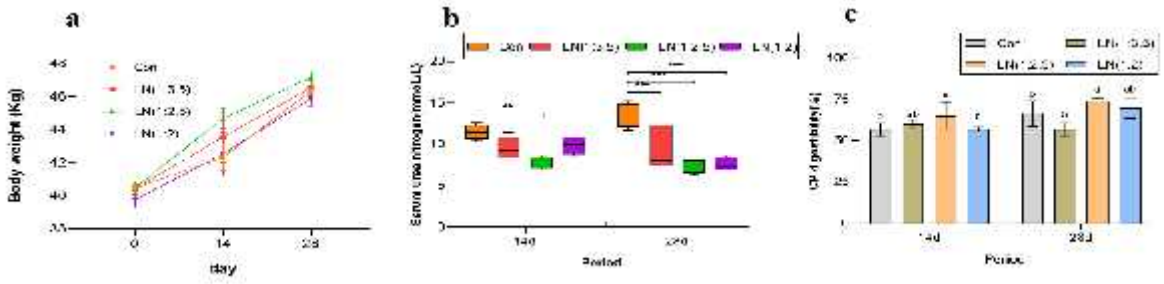

Figure 1. Body weight (a), Serum urea nitrogen content (b) and CP digestibility (c) of fattening *Hu* sheep during the experimental period

The experiment concluded that low nitrogen diets can reduce urea nitrogen levels in the blood without affecting the growth performance of fattening *Hu* sheep, and increase the utilization rate of nutrients, especially nitrogen when the ratio of soluble protein to insoluble protein is 1:2.5.

References

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