

# Lower Dietary Crude Protein May Increase Glucose Utilization in Ruminant Intestinal Mucosa

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Glucose is a nutrient limiting productivity of lactating dairy cows. Substantial amount of glucose is utilized by the mammary gland in high producing cows. Although the synthesis in the liver is the primary source of glucose in ruminants, in cows fed a high grain diet, a part of dietary starch escapes ruminal fermentation and is absorbed in the small intestine as glucose. The glucose absorbed in the intestine can contribute up to 30% of total body glucose flux in dairy cows. In some studies, enhanced glucose supply to the duodenum increased milk and milk lactose yield. However, glucose is extensively utilized by the duodenal mucosa, thus reducing its availability for milk production. *In vitro* study showed that glucose is used to detoxify ammonia N by the ruminant duodenal mucosa. Therefore, we hypothesized that glucose utilization in duodenal mucosa would be greater and its net absorption would be lower for animals fed a high crude protein (CP) diet.

The objective of this research was to evaluate the effects of ammonia load on glucose metabolism of ruminant gut tissues. Growing female lambs were fed either high (17.5%) or low (11.9%) CP diet for three weeks prior to slaughter. Duodenal mucosal cells (DMC) were isolated immediately after slaughter and incubated for 90 min with [2-<sup>13</sup>C] glucose (3 mM). Ammonia-N concentration in the duodenal digesta fluid was higher for lambs fed a high CP diet (16.4 vs.  $9.1 \pm 0.9$  mM;  $P < 0.01$ ). Contrary to our expectation, glucose utilization was greater for DMC isolated from lambs fed a low CP diet compared to those fed a high CP diet (15.0 vs.  $8.7 \pm 1.6$  nmol /  $10^6$  cells / 90 min;  $P < 0.05$ ). The activity of Hexokinase, an important enzyme responsible for glucose metabolism in cells, was higher (1.22 vs. 1.04 mUnit/mg protein;  $P < 0.05$ ) in the duodenal mucosal cells isolated from sheep fed a low CP diet.

**Implications.** Ruminant animals fed a low CP diet may use more glucose in the duodenal mucosa, indicating that glucose availability for milk production is likely decreased. Physiological reasons for greater glucose utilization for animals fed a low CP diet warrants further investigation. In addition, it is of interest to determine whether glucose utilization by gut mucosal cells can be further decreased by feeding CP far beyond dietary requirement.