

EFFECT OF UNFAUNATION ON PLASMA FREE AMINO ACIDS, GASTRIN AND INSULIN, AND DUODENAL NITROGEN FLOW IN RUMINANTS

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Introduction

Though many studies have demonstrated the role of ciliate protozoa on rumen fermentation, their contribution to the overall nutrition of ruminants remains obscure (see Veira, 1986). In a previous work, we showed that the absence of protozoa increases concentrations of plasma gastrin and insulin (Itabashi et al., 1983). Grovum (1981) reported that intravenous injection of gastrin suppressed food intake of sheep and we confirmed this using growing cattle (unpublished). However, the reason for higher plasma gastrin in unfaunated animals is still unknown. In this paper, therefore, we studied further the effects of unfaunation on plasma free amino acids, gastrin and insulin, and duodenal N flow.

Materials and Methods

Trial 1. Six male Japanese Saanen goats weighing an average 35 kg were used. Half of them were faunated with a large mixed ciliate population and the others were unfaunated. They were reared individually indoors with an ambient temperature of 25 °C, and fed daily 1,000 g Orchardgrass hay or 800 g the same hay plus 500 g concentrate at 09:00 h for 3 weeks. Minerals and water were given freely. On days 21, blood samples were taken until 6 h after feeding. Plasma gastrin and insulin were measured by radioimmunoassay.

TABLE 1. EFFECT OF UNFAUNATION ON NITROGEN FLOW TO DUODENUM IN STEERS.

protozoa	(+)	(-)
N intake (g/day)	70.5	70.5
N flow to duodenum (g/day)	73.0*	82.1
(% of N intake)	103.5*	116.4
Protein-N flow to duodenum (g/day)	40.2	42.2
(% of N intake)	57.1	59.8

*Significantly different ($P < 0.05$).

Trial 2. Six faunated and six unfaunated Holstein steers weighing an average 135 kg, each fitted with a simple duodenal cannula, were used. They were given daily 3 kg a total mixed ration in two equal portions at 09:00 and 21:00 h for 3 weeks. The diet consisted of 30 % chopped Timothy hay, 35 % barley, 14.5 % alfalfa hay cube, 12 % soybean meal, 7.2 % beet pulp on a DM basis. The CP and TDN contents were 17 % and 72 %, respectively. On days 20, duodenal contents and blood were sampled every 2 h for 10 h. The following day rumen contents were sampled at 0 and 4 h after feeding. Duodenal contents were homogenized, and its protein N was determined by TCA method. Separation of peptides and free amino acids in TCA-soluble fraction was done by Cu-Sephadex method. Daily N passage to the intestine was determined by the lighin ratio technique. The others were the same as in *Trial 1*.

Results and Discussion

Trial 1. Effects of unfaunation on plasma gastrin and insulin are shown in figure 1. A maximum level of gastrin was reached 1-2 h after feeding in all goats, being markedly higher in hay plus concentrate diet than in hay diet. The absence of protozoa increased plasma gastrin and also free essential amino acids levels considerably, which confirmed our previous observations (Itabashi et al., 1983). On the other hand, plasma insulin tended to be higher in faunated compared to unfaunated, which disagreed with previous results. This is in part explained by higher plasma glucose level of faunated goat in the present study.

Trial 2. Plasma free amino acids level showed similar change to *Trial 1*, favouring higher in unfaunated. Concentrations of ammonia-N and individual free amino acids in rumen fluid were markedly higher in faunated, suggesting more proteolytic activity took place in the faunated rumen. The higher N degradability in faunated seems likely to be due to protozoal proteolysis.

Amounts of duodenal total-N (mg/g) and

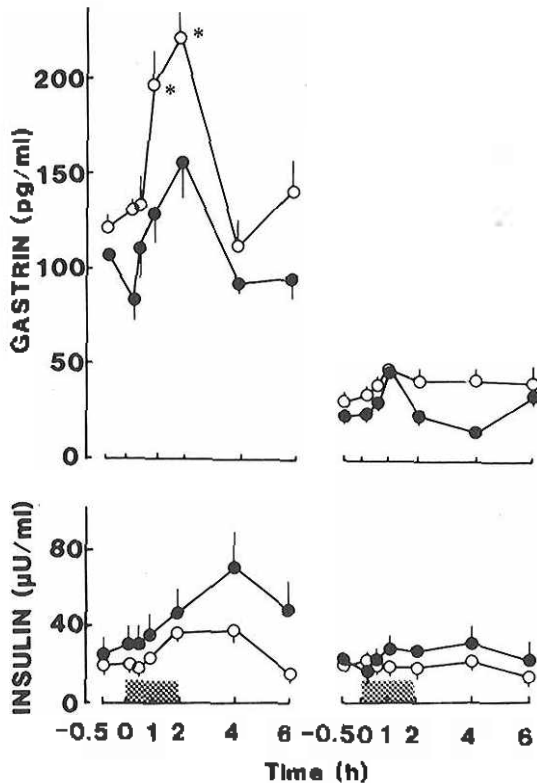


Figure 1. Effect of unfaunation on plasma gastrin and insulin concentrations in goats fed hay plus concentrate (left) and hay (right) (—●—; faunated, —○—; unfaunated). Vertical bars indicate S.E. of mean. Hatched area denote eating time. *Significantly different ($P < 0.05$).

protein-N in total duodenal-N (%) averaged 2.04 and 54.5 for faunated, 2.03 and 50.7 for unfaunated, respectively. Table 1 shows N flow to the duodenum. N flow (g/day) exceeded by 3.5 % for faunated and 16.4 % for unfaunated over the N intake, being significantly different. This result agreed with previous study (Ushida et al., 1986). This could explain the difference in plasma amino acids level between the faunated and unfaunated animals. Of the duodenal NPN fraction, 95 % was composed of acid soluble peptides. One example of HPLC chromatogram of peptides is shown in figure 2. There was a trend toward higher concentration of the peptides in unfaunated compared to faunated steers. VanBruchem and Van't Klooster(1980) showed that there is a close

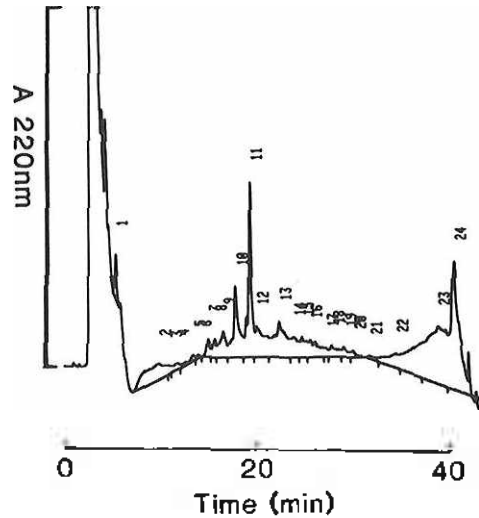


Figure 2. Reversed-phase HPLC of acid soluble peptides in duodenal contents of steer (unfaunated).

relation between gastric secretion of acid and the amount of protein digested in the intestine. Therefore, the higher gastrin levels in unfaunated animals are likely related to the increased duodenal flow and absorption of amino acids.

(Key Words: Protozoa, Gastrin, Duodenal Peptides)

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