

## REAL CAUSE OF THE FLUCTUATION OF HOLOTRICH CONCENTRATION IN THE RETICULO-RUMEN OF CATTLE

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### Introduction

The concentration of holotrich protozoa in the rumen of cattle begins to increase immediately after feeding, reaches the maximum in a few hours, and then decreases to the prefeeding level (Clarke, 1965). This work aimed to know the real cause of the fluctuation of holotrich concentrations in the rumen of cattle.

### Materials and Methods

Three rumen-fistulated Holstein dry cows, weighing about 650 kg (Cow A and B) or 540 kg (Cow C), were used. The ration consisted of 70 % timothy hay and 30 % flaked maize, and the daily amount was restricted to 1.3 % of body weight, a half of which was given at 09.00 every day.

One day, 250 g polyethyleneglycol was administered into the rumen before the morning feeding, and then fluid within the reticulorumen was taken with the lapse of time from three sites using a plastic tube of 1.8 cm in an inner diameter. When fluid was taken from the front (F), the tube was inserted through the fistula towards the elbow till the end of the tube reached 53-55 cm distant from the fistula. To take fluid from the rear (R), the tube was inserted towards the upper thigh till the end reached 40 cm distant. The lower-middle (LM) was about 45 cm beneath the fistula.

On another day, fluid and solid digesta in the rumen were taken from two cows (B and C). On this occasion, fluid was collected using the tube from the upper-middle (UM), which was about 15 cm beneath the fistula, and solid digesta from the same site using a grasper.

### Results and Discussion

The attachment of holotrich protozoa to fresh plant particles, which was first reported by Orpin and Hall (1977), was confirmed also in this work,

but seems never enough to explain the cause of the increase in holotrich concentrations in fluid, because the beginning of increase and the arrival at the highest value of holotrich numbers at UM occurred 30 min later in solid digesta than in fluid. Further, their numbers per ml fluid was almost twice as high as those per g solid digesta.

A thick holotrich mass was found inside the honeycomb structure of the reticular wall in a cow slaughtered 20 h after the final feeding (Abe et al., 1981), and the holotrich concentration in the rumen was tripled by the administration of glucose into the reticulum (Murphy et al., 1985), suggesting the increase owes to the migration of holotrichs from the reticulum into the rumen.

Figure 1 shows the periodical change in the concentrations of holotrichs and reducing sugars at F, LM and R. The fluctuation of holotrich concentrations at LM and R well corresponded to that of reducing sugar concentrations, suggesting that one factor which causes the migration of holotrichs from the reticulum to the rumen and *vice versa* would be a chemical stimulus from soluble sugars contained in the ingested feed. However, other factors would also be concerned, because the increase in holotrich concentrations at LM and R always preceded that of reducing sugars, and because the exhaustion of soluble sugars in the rumen must be only a trigger of the return to the reticulum.

In this work, the VFA concentration tended to be lower in direction R → F at least a few hours after feeding in all cows. The similar tendency was observed for NH<sub>3</sub>-N concentration in Cow A and Cow B, but not in Cow C, and no definite tendency was detected for pH. These results suggest that the concentration gradient of VFA would be one of the guides for the migration of holotrichs from the rumen to the reticulum. The fluid dilution rate was the highest at F in all cows, suggesting that the lowest VFA level at F owed, at least partially, to the highest dilution rate of fluid at this site which was the nearest to the

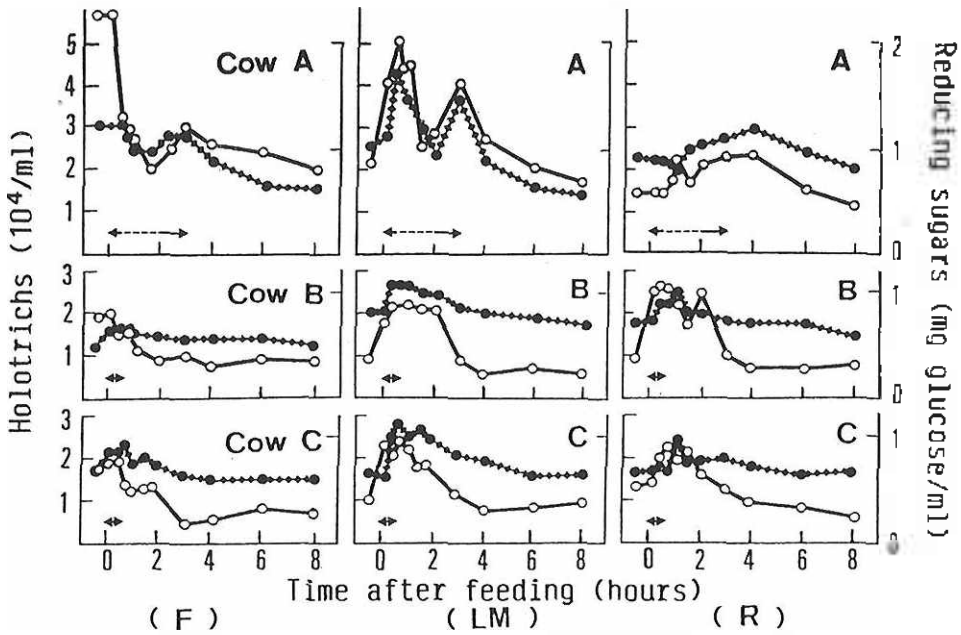


Figure 1. Periodical changes in the concentrations of holotrichs (○) and reducing sugars (●) at the front(F), the lower-middle (LM) and the rear(R) within the reticulo-rumen. The arrows denote the duration of ingesting feed.

reticulo-omasal orifice among the sites examined.

The fluctuation pattern of the holotrich concentration of holotrichs at F immediately before feeding does not necessarily mean their sequestration at this site, because their concentration at F varied little after they began to retire from LM and R. In addition, if they exist in a high density at F for a long time, they must be easily washed out with fluid of the highest dilution rate. Such a prefeeding increase has usually been observed in sheep and goats (Abe et al., 1983). It may provide another evidence indicating that some factor(s) other than soluble sugars would be concerned with their migration from the reticulum into the rumen. (Key Words: Holotrichs, Migration, Reticulo-Rumen)

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