Developmental Processes of Omasal Motility in Calves

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Abstract. Developmental processes of omasal motility under normal feeding condition were studied. Two male Holstein calves were rumenfistulated at an early age. Intraluminal pressure changes in the reticulum, and the omasal canal and body were recorded simultaneously on kymographic paper at regular intervals beginning at 2 or 3 weeks of age.

Cyclic contractions of the omasal canal which coincided with those of the reticulum were first observed at 4-6 weeks of age. Contractions of the omasal body began to be recognized at 8 weeks of age. When the contraction of the omasal body was first observed, it showed a slow and irregular pattern. With the advance in age, it increased slowly in frequency and became more periodic. Then such a contraction of the omasal body as could be seen generally between diphasic contractions of the reticulum in adult cattle was first observed at 29-32 weeks of age.

A few reports have been made on omasal motility, but few on the development of omasal motility in young ruminants. The author [2] has previously studied the developmental process of reticulo-ruminal motility in calves by the intraluminal pressure recording method and recognized five apparent grades in its process. So it was possible that there might be some other developmental processes of omasal motility.

In their studies on omasal motility with five cows and five calves Stevens et al. [7] found that occasionally there was a contraction of the omasal body covering two or more contraction cycles of the reticulo-rumen in addition to a contraction which was correlated with each reticulo-ruminal cycle. Their finding suggests that there may be some developmental processes of omasal motility in calves.

In the present paper the developmental processes of omasal motility in calves under normal feeding condition are reported.

Materials and Methods

Animals and diets: Two male Holstein calves (Nos. 49 and 52) were used. They had been separated from their dams immediately after birth. A large rumen fistula, 10 cm diameter, was set in them at 3 days of age by the method of Sasaki [6]. A plug consisting of plastic plates and foam rubber was fitted into this fistula. The calves became available at 2 or 3 weeks of age for recording changes in intraluminal pressure of the omasum and reticulum. They were given whole milk at a level of 10% of body weight per day within a limit of 6 kg. They were weaned at 8 weeks of age. In addition, they were allowed to have hay and grain ad libitum.

Pressure recording methods: Pressure changes in the omasal canal, omasal body and reticulum were transmitted by an air balloon connected, or by a pressure tube, to a tambour and a water manometer and recorded simultaneously on a kymograph. Thin rubber balloons were used. They were inserted into the stomach through the fistula. Balloons inserted into the omasal canal and omasal body changed from 1.0 to 2.0 cm and from 2.0 to 4.0 cm, respectively, in diameter in accordance with the
advance in age. A balloon inserted into the reticulum was always 5.0 cm in diameter.

The insertion of a balloon into a certain portion to be explored in the stomach was conducted by hand through the fistula after the plug was taken off. The pressure tubes used were wrapped with fine wire which had been enclosed in a polyethylene tube. This procedure was helpful for directing each balloon to its proper place. The omasum was located by palpation with the forefinger to place each balloon in the desired part before the balloon was inserted. The position of each balloon was found by inflating and deflating. After all the balloons were placed in their position, another plug with three holes was fixed to the fistula and three pressure tubes were fitted tightly to the plug through the holes. The length of the pressure tube in the stomach was adjusted for the position of the balloon. At the end of the experiment, the position of the balloons were reaffirmed by palpation.

Kymographic recording was started at 1 PM, or 4 hours after suckling time in the morning, in order to eliminate the effect of abomasal filling. The trial for each calf was carried out at intervals of a week or more.

Results

The results obtained from calf No. 49 are shown in Figs. 1-10.

Fig. 1. Omasal motility at 3 weeks of age

Reticulum

Omasal canal

Omasal body

Time (1 min)

Fig. 2. Omasal motility at 4 weeks of age

Reticulum

Omasal canal

Omasal body

Time (1 min)

Fig. 3. Omasal motility at 6 weeks of age

Reticulum

Omasal canal

Omasal body

Time (1 min)

Fig. 4. Omasal motility at 8 weeks of age

Reticulum

Omasal canal

Omasal body

Time (1 min)

Fig. 5. Omasal motility at 13 weeks of age

Reticulum

Omasal body

Time (1 min)

Fig. 6. Omasal motility at 17 weeks of age

Reticulum

Omasal body

Time (1 min)
Cyclic contractions of the omasal canal which coincided with the contractions of the reticulum were first recorded at 4 weeks of age. Contraction of the omasal body were gradually recognized from 8 weeks of age. When the contraction of the omasal body was first recorded, it showed a very slow and irregular pattern. With the advance in age, it increased gradually in frequency and became more periodic. Then such a contraction of the omasal body as could be seen generally between diphasic contractions of the reticulum in adult animals was first recognized at 32 weeks of age. At this age contractions of the omasal body which coincided with the secondary contractions of the omasal canal were also recorded.

The results obtained from the two experimental calves are summarized in Table 1. There was no great difference in the developmental process of omasal motility between the two calves.

Discussion

Cyclic contractions of the omasal canal began to be recorded at 4–6 weeks of age, whereas contractions of the omasal body showed a very slow developmental process. The finding that contractions of the omasal canal are observed at an early age in calves seems to indicate that the contractions of the omasal canal may be essential for the transference of ingesta from the reticulum even in calves.

Experiments by Godfrey [4], Becker et al. [3], and Asai and Sasaki [1] showed that the anatomical development of the omasum was slower than that of the reticulo-rumen in calves at an early age. In this regard, Warner et al. [9] and Omori et al. [5] reported that dry feed was required to accelerate the anatomical development of the omasum. Then Tamate et al. [8] demonstrated that the increase in size of laminae was more
Table 1. Summarized developmental processes of omasal motility in calves

<table>
<thead>
<tr>
<th>Calf No.</th>
<th>49</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in weeks</td>
<td>Contraction of omasal canal</td>
<td>Contraction of omasal body</td>
</tr>
<tr>
<td>2</td>
<td>Not detected</td>
<td>Not detected</td>
</tr>
<tr>
<td>3</td>
<td>Not detected</td>
<td>Not detected</td>
</tr>
<tr>
<td>4</td>
<td>Detected</td>
<td>Not detected</td>
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<td>5</td>
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<td>6</td>
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<tr>
<td>8</td>
<td>Detected</td>
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<td>9</td>
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</tr>
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</table>

Remarkable in calves fed roughage ad libitum in addition to milk than in calves fed milk alone. Since no anatomical examination was conducted in the present studies, it was impossible to find any relationship between the anatomical development and the development of motility in the omasum. On the other hand, Stevens et al. [7] suggested that the contractions of the omasal body which might or might not occur in each reticulo-omasal cycle might initiated an accumulation of ingesta among the laminae. Further studies on the relationship between the kind of feedstuff and the development of omasal motility would be necessary.

References


