APPEARANCE AND DYNAMICS OF RUMEN MOTILITY IN NEWBORN CALVES

Y. KOSTOV and V. ALEXANDROVA
University of Forestry, Faculty of Veterinary Medicine, BG - 1756 Sofia, Bulgaria

Abstract


The appearance and dynamics of rumen motility in newborn calves were studied by means of radiotelemetry. Rumen contractions were registered right after birth. Their amplitude was growing gradually and that was observed best in the first month after birth.

Key words: rumen motility, telemetry

Introduction

The study of rumen motility of ruminants in the first days after birth is of primary importance since this is the period when animals uptake milk only and digestion takes place in the abomasum. Hence the question: is there any forestomach motility when they are not engaged in food digestion and if not, what processes would take place in case of milk infiltration into them due to orifice reflex disorder.

According to Church (1975), the studies of a number of authors have revealed that rumen motility in calves can be measured in the second week after birth, which is related to intake of solid feed.

Material and Methods

Investigations were carried out on 12 Black-and-White calves from the 1st to the 60th day after birth. The recordings of rumen contractions were made by a telemetric system of our own construction (Kostov and Bodourov, 1977). The transmitter, located on the animal, consisted of a photoelectric transformer and carrier and subcarrier frequency generators. The photoelectric transformer was placed in an aneroid blood pressure monitor device that transformed the mechanical oscillations of a small balloon into an electric signal and the pressure gauge served for pressure visualization. The balloon was connected to a thin-wall probe, placed in the calf’s rumen through one of its nostrils with surface anesthesia. The other end of the probe was attached to the transformer. The collector part of the telemetric system was composed of a receiver, decoder and recording device.

Total rumen motility (units) was evaluated based on several indexes such as contraction frequency for 5 minutes (f), contraction duration (t) and amplitude (a), the latter presented with the following formula from their average values:

\[ A = f \times t \times a \]

Data were processed by variation statistics.
Results

Data for the separate periods of the investigation are given on Table 1. They showed the existence of rumen motility up to the 5th day after birth, total motility being 229.67 ± 24.16 units. It marked a statistically significant growth in the period after the 10th day, reaching 374.00 ± 37.50 units, P ≤ 0.01. The highest values of this index were recorded in the period within 20th-30th day, followed by reduction and stabilization.

The frequency of rumen contractions up to the 5th day after birth was 4.33 ± 0.23 min⁻¹. It increased gradually to reach the mathematically significant values of 5.40 ± 0.26 min⁻¹, Dd" 0.01 after the 10th day and 6.04 ± 0.24 min⁻¹, Dd" 0.01 after the 20th day. The values of this index went down after those periods.

The dynamics of rumen contraction duration was similar (1 - contraction), reaching the highest values after day 20th – 10.95 ± 0.30 s, Dd" 0.01.

Contraction amplitude increased insignificantly until day 20th, followed by a significant rise up to 10.83 ± 0.75 mmHg, Dd" 0.01 and was close to those values in the subsequent periods. Figure 1 shows the motility of a newborn calf’s rumen after the 20th minute. Line 1 of the figure shows rumen contractions with amplitude of up to 7 mm Hg. Their duration was about 10 s. Their shape immediately after birth was atypical and very much resembled convulsive movements. Some of the contractions were combined with artifacts from the calf’s tenesmi. The readings show curves resulting from calf’s mooing. Line 2 of the figure shows a record made during artificial nutrition of the calf. Contraction frequency and their amplitude increased. Parallel to rumen contractions, a number of sharp-peak curves of different amplitude were registered, resulting from calf’s tenesmi and mooing.

Calf rumen motility in different periods of the investigation is shown on Figure 2. Line 1 of the figure shows rumen contractions on the 3rd day after birth. They had a sharp-peak shape and amplitude of 7 mm Hg. Close to the 20th day after birth (line 2), rumen contractions were well shaped with amplitude of the first contraction up to 12 mmHg. The readings showed a second contraction with amplitude of 8 mm Hg. It was characteristic of the second reticulorumen cycle and connected to gas eructation from the dorsal rumen sac. The recordings made during the remaining periods were similar with insignificant reduction of contraction amplitude in this animal.

The dynamics of rumen contractions in cases of

Table 1

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Age</th>
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<tbody>
<tr>
<td></td>
<td>Up to 5 days</td>
</tr>
<tr>
<td>Number of animals, n</td>
<td>12</td>
</tr>
<tr>
<td>Total motility, unit</td>
<td>229.67</td>
</tr>
<tr>
<td></td>
<td>±24.16</td>
</tr>
<tr>
<td>Frequency of rumen contractions, min⁻¹</td>
<td>4.33</td>
</tr>
<tr>
<td></td>
<td>±0.23</td>
</tr>
<tr>
<td>Duration of rumen contractions, s</td>
<td>8.37</td>
</tr>
<tr>
<td></td>
<td>±0.37</td>
</tr>
<tr>
<td>Amplitude of rumen contractions, mm Hg</td>
<td>6.25</td>
</tr>
<tr>
<td></td>
<td>±0.70</td>
</tr>
</tbody>
</table>

*P ≤ 0.01
disorder of the gastrointestinal tract was intriguing. In such cases their frequency and amplitude decreased. This can be well seen on the recordings on Figure 3. Line 1 of the figure shows a recording of a clinically healthy calf on the 2nd day after birth. Contractions were well shaped and their amplitude reached a value of 7 mm Hg. An additional artifact can be seen on one of the contractions, provoked by calf mooing. Line 2 of the figure shows a recording made on a calf with gastrointestinal disorder, showing a decrease of contraction frequency and amplitude, the latter being within the limits of 4 mm Hg.
Discussion

Regardless of the fact that there is not enough data in literature on postnatal calf rumen motility, we shall try to interpret the results from a physiological point of view.

We have expected the existence of immediate postnatal rumen motility. Perhaps, this is predetermined phylogenetically, given the feeding habits and behavior of wild ruminant animals. The contractions of abomasum would not be possible unless they were coordinated with the other sections of the complex stomach of ruminants. This is determined by the digestion centers, located in different sections of the central nervous system. The motility of forestomachs leads to their fast further development from anatomical and functional point of view.

The indexes of total motility increased significantly towards the 10th day after birth, which was also related to the uptake of hay and feedstuffs. It was not only primary but also secondary reticulorumen cycle contractions that were registered towards the 20th day after birth.

Coming close to the second month, the indexes of rumen activity decreased insignificantly, probably due to the schedule of calf nutrition.

Conclusion

Rumen contractions were recorded in calves immediately after birth. Their amplitude was about 5 mm Hg, gradually growing to reach 12 mm Hg towards the 15-20th day. At the same time, a second contraction of the reticulo-rumen cycle appeared.

A formula was used to calculate total motility, which increased significantly after the 10th day after birth as a result of greater contraction frequency and duration.

References


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