7 SUMMARY

Effect of milk and different oral electrolyte solutions on the abomasal luminal pH and the acid-base-status in calves

The aim of this study was to test the effect of suckling milk or different oral electrolyte solutions on abomasal luminal pH and the electrolyte concentration in abomasum of calves. Simultaneously the effect of the administered solutions on the acid-base-parameters of blood was determined.

Eight healthy calves aged 19-38 days were surgically instrumented with an abomasal body cannula. Samples of abomasal content were obtained via the cannula before and after feeding. Abomasal luminal pH was monitored continuously every 15 minutes for four hours. The area under the pH/time-curve (AUC) and the strong ion difference (SID) were also determined. Pre-prandial and 2 hours postprandial, an arterial and venous blood samples were taken for the estimation of the acid-base-status using the Henderson-Hasselbalch-parameters and the Stewart-Variables.

Milk feeding caused an increase of the abomasal luminal pre-prandial pH (mean ± SD) from a basal value of 2,00 ± 0,44 to a peak value of 4,70 ± 0,41 thirty minutes after feeding and a subsequent decrease to 2,43 ± 0,37 (four hours postprandial). The area under the pH/time-curve of milk feeding was 912 ± 75. Feeding electrolyte solutions A and B lacking bicarbonate mixed with milk resulted in a significantly higher alkaline pH of the abomasal fluid. Electrolyte solution A induced an increase of abomasal pH (mean ± SD) from 1,93 ± 0,22 to 5,64 ± 0,23 (AUC=1166 ± 17), OES B caused an increase of pH (mean ± SD) from 2,12 ± 0,57 (fasting) to 5,34 ± 0,31 (AUC=1108 ± 89). After feeding containing bicarbonate electrolyte solutions mixed with water, the abomasal luminal pH showed the largest transient pH-increase (mean ± SD) to 6,58 ± 0,30 (OES C), 6,80 ± 0,30 (OES D) and 6,71 ± 0,17 (OES E). In comparison with milk feeding the mixture of equal parts of milk and OES C and D caused a higher transient pH-value (mean ± SD) of 6,22 ± 0,19 (C-1) and 6,22 ± 0,29 (D-1). The AUC-Values of 1118 ± 45 (OES C), 1159 ± 120 (OES D), 1117 ± 90 (OES E) as well as 1127 ± 45 (OES C-1) and 1062 ± 138 (OES D-1) differed significantly from milk. There were no significant differences between OES with or without bicarbonate.

Strong acid abomasal content in fasting calves has [SID_3] acid values of -61 and -68 mmol/l. After ingestion milk the low [SID_3]-values decreased towards 0 over 1-2 hours. Milk with oral electrolyte solution without bicarbonate induced an increase of the abomasal luminal [SID_3] into the positive range. Comparable values in the literature are lacking.

Both milk and electrolyte solution caused a partially significant alkaline reaction in arterial and venous blood samples of calves. PCO_2 did not change.

In conjunction with the increase of Henderson-Hasselbalch-parameters, pH, $[HCO_3^-]$ and [BE] there was partially significant evidence for increased values of the Stewart-Variable $[SID_3]$ (all OES) as well as decreased $[A_{tot}]$ (OES B, D, E, C-1 and D-1) in blood samples of calves. The simultaneous increase of $[HCO_3^-]$, [BE] and $[SID_3]$ and the decrease of $[A_{tot}]$ were small but significant. These alkaline reactions in blood were caused by the alkaline metabolic changes. The postprandial alkaline tide in venous and arterial blood of calves was significantly higher in the group fed electrolyte solution containing bicarbonate.

The postprandial abomasal luminal pH-values measured after feeding electrolyte solution mixed in water, returned faster to their basic pH-values compared to milk-feeding. This efficient decrease of pH induced a shorter transit time of electrolyte solution in abomasum of calves than milk feeding. Oral electrolyte solution mixed in water reach the small intestine, the place for absorption, earlier than feeding milk.