EXOCRINE PANCREATIC FUNCTION IN CALVES FED LIQUID OR SOLID FOOD

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Introduction

The comprehensive long-term studies on the exocrine pancreas in calves were undertaken by many researches. Some results showed delayed response to food stimulation. Other authors, however, observed increase of the secretion during and just after feeding (McCormick and Stewart, 1966 and Ternouth et al., 1975). Present experiment was undertaken to check calf pancreatic exocrine function in first few weeks of life in regard to food changes from milk to dry concentrate and the response to GI hormones during this period.

Materials and Methods

Eight newborn Friesian male calves about 30 kg bodyweight (b.w) were used. On the 2nd day of life, calves were separated from their mothers and placed in single cages. Next day, catheterisation of pancreatic duct and jugular vein and cannulation of jejunum about 10 cm beyond the end of duodenum were performed. Twelve hours after operation and between collections the pancreatic catheter was connected to the jejunal cannula. Standard feeding regime was chosen to obtain fully post-preruminant calves in the age of 6 weeks (table 1). Collections of pancreatic juice started at 07.30 and 90 min later the morning meal was given: milk or milk replacer mixed with grain concentrate for 5 min and grain concentrate for 10-15 min. Three hours after feeding secretin (0.5 U/kg b.w., Sigma, USA) + CCK-8 (0.16μg/kg b.w., Sigma, USA) were adminstered i.v. in bolus injection. Volume of pancreatic juice, protein content (Lovry et al., 1951) and trypsin activity (Erlanger et al., 1961) were measured.

TABLE 1. THE COMPOSITION OF THE DAILY RATIONS

Age (days)	Cow milk (l)	Milk replacer+water (kg and l)	Grain concentrate (kg)
04-10	6	–	–
19-22	–	0.7+7	0.3
33-42	–	0.3+3	0.9
43-50	–	–	1.0

All rations were divided in two equal portions given at 09.00 and 20.00. Milk replacer and grain concentrate were supplemented with 2% of vitamins + microelements. 0-42 d milk period, 43-50 d post-preruminant period. Hay and water were presented ad libitum.

Results and Discussion

Secretion of pancreatic juice before feeding was stable regardless to the age and type of feeding (table 2). Change of food from milk or milk replacer to grain concentrate increased "interdigestive" enzyme production. There are great daily

TABLE 2. CHANGES OF PANCREATIC JUICE SECRETION IN CALVES DURING THE FIRST FEW WEEKS OF LIFE

Day of life	Volume ($ml*h^{-1}*kg^{-1}$ b.w.)	Protein secretion ($mg*h^{-1}*kg^{-1}$ b.w.)	Trypsin secretion ($U*h^{-1}*kg^{-1}$ b.w.)
10	0.44±0.19	2.3±1.2[a]	25.5±20.0[a]
22	0.49±0.23	1.2±0.7	9.6±92
35	0.48+0.26	0.9±0.4[b]	4.5±3.2[b]
50	0.41±0.23	1.7±1.3	15.0±12.2

Mean ± S.D. a, b – the difference statistically signficant

variations in the juice volume and trypsin secretion in calves fed with milk or milk replacer. Significant increase of both parameters observed during drinking was then followed by decrease in the juice volume. When liquid food was replaced by solid concentrate, both juice volume and enzyme secretion did not vary markedly during the day. In all cases (liquid food as well as concentrate) the i.v. administration of secretin + CCK-8 produced a significant rise in the juice volume and trypsin secretion (tables 3 and 4).

Present study strongly confirms developmental and functional specifity of the ruminal exocrine pancreas function in the preruminant period. All measured parameters (juice outflow, protein outflow and trypsin output) were equal during both basal and short post-prandial period what earlier postulated Ternouth et al. (1975). It should be pointed out that the change of food from cow milk to milk replacer + concentrate diminished the enzyme secretion. The highest secretion rate was noted during the period of liquid food consumption – this probably involves parasympathetic suckling axis. This phenomenon does not appear when vagal function is excluded by cold blockade (Zabielski, in preparation).

Present findings support the hypothesis that parasympathetic system in ruminants plays a predominant role in pancreatic regulation mainly as vagal reflexes. Stimulation with CCK-8 + secretin significantly increased pancreatic secretion. The mechanism of this stimulation in preruminant animals does not differ from that of monogastric ones where it is observed an increase of stimulatory effect of GI hormones during the development.

(**Key Words**: Calf, Exocrine Pancreas, Development)

TABLE 3. CHANGES (%) OF PANCREATIC JUICE VOLUME AFFECTED BY FEEDING AND HORMONES TREATMENT (Mean + S.D.)

Day of life	Before feeding	During feeding	1.5 h after feeding	3 h after feeding	After secretin + CCK treatment
10	100	240±113	94±22	75±23	246±86
22	100	237±45	71±24	68±21	242±45
35	100	259+49	63+8	74±16	240±48
50	100	106±18	93±44	81±21	245±81

TABLE 4. CHANGES (%) OF TRYPSIN SECRETION AFFECTED BY FEEDING AND HORMONES TREATMENT (Mean ± S.D.)

Day of life	Before feeding	During feeding	1.5 h after feeding	3 h after feeding	After secretin + CCK treatment
10	100	549±394	161±58	130±55	662±340
22	100	939±318	256±198	194±152	843±508
35	100	625±209	147±33	114±55	1086±659
50	100	103+39	85±28	72±15	505±378

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