Gastric Cryptosporidiosis of Feeder Cattle, Beef Cows, and Dairy Cows

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Cryptosporidiosis of calves is well-recognized by veterinarians and calf raisers as a condition usually associated with diarrhea in the second week of life; other enteropathogens are frequently present at the same time. Recent reviewers have emphasized that the condition is common, widespread, self-limiting, untreatable and zoonotic.[1,2,3] *Cryptosporidium parvum* is the classification given to the organism isolated from calves; apparently it is identical in location of infection (intestines) and form to *C. parvum* originally found in mice in 1912.[4] Just prior to discovery, *C. muris* was found in the gastric glands of mice;[5] this species of the organism generated an oocyst somewhat larger than that of *C. parvum*. *C. muris* has not been reported for over 70 years since the initial discovery. Recently, however, this larger oocyst was seen in the feces of dairy cows (unpublished observations, 1981) and was confirmed morphologically as *Cryptosporidium muris*.[6] The site of generation of the organism was confirmed at necropsy to be the peptic glands, in a 6-week-old holstein calf and at slaughter in 9 feeder steers all of which had shed oocysts of *C. muris* up to the time of death.[7]

The diagnosis of abomasal cryptosporidiosis is made, most definitively, by histology of abomasal folds (Figure 1).[7] However, fecal examination by flotation[8] (Figure 2) or acid-fast staining of fecal smears[9] (Figure 3) will reveal the distinct oocysts of *C. muris* which differ from those of *C. parvum*, the intestinal parasites.

Figure 1. Abomasal glands open to the mucosal surface. *Cryptosporidium muris* forms are lined up along the surface of the gland lumens, most notably the one on the right (Hematoxylin and eosin-stained section).

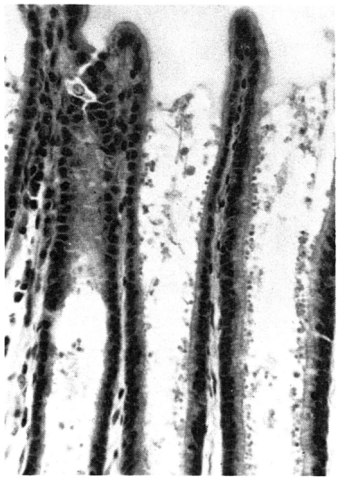


FIGURE 2. Sugar flotation of a mixture of calf and steer feces to compare oocysts of *Cryptosporidium parvum* (small, about 5 microns) from calves and *C. muris* (large and oval).

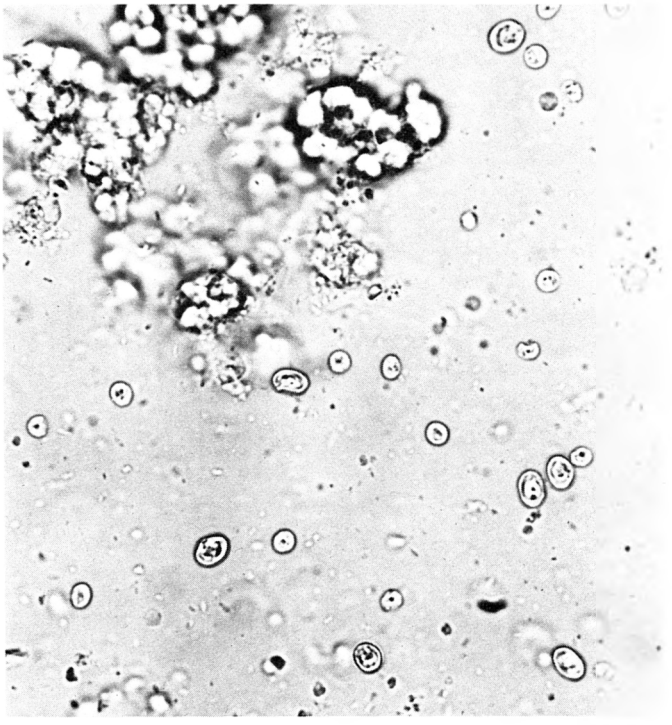
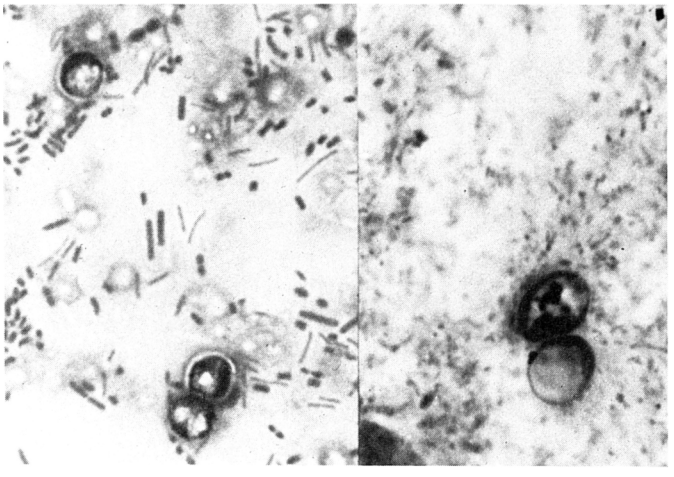


FIGURE 3. Acid-fast smear of *C. parvum* in calf feces (left, smaller) and *C. muris* in steer feces (right). Counterstain is methylene blue. Both photographs were taken at the same magnification.



In order to survey large populations of cattle economically, the acid-fast smear technique should be used. The diagnosis can be made on a 3 mm dot of fecal material 87% as efficiently as with fecal flotation (Table 1) and as many as 40 to 90 fecal samples can be placed on one standard glass slide (Figure 4). In this way moist fecal material in pens (Figure 5) can be surveyed without disturbing the cattle. If large numbers of identified animals are to be sampled then a system needs to be organized in order to identify individual samples on a slide as to source animal. Positive control fecal material, acid-fast stained smears and unstained smears are available from Black Cat Lab, Rte 6 Box 6589, Nampa, Idaho 83651 (no telephone).

TABLE I. Comparison of fecal flotation (F) and acid-fast fecal smear (A) for detection of *Cryptosporidium muris* oocysts in steer feces (4 trials, 40 samples each trial; samples were taken from fresh manure piles in pens where 1 or 2 of 6 steers were known shedders).

Method	Trial number					Total		
	1	2	3	4				
A	12	12	8	7	=	39		
						—	=	86.6%
B	14	13	10	8	=	45		

FIGURE 4. Standard acid-fast stained glass slide with 40 fecal smears. Counterstain was methylene blue. As many as 90 fecal dots (5 rows of 18) can be applied to one slide.

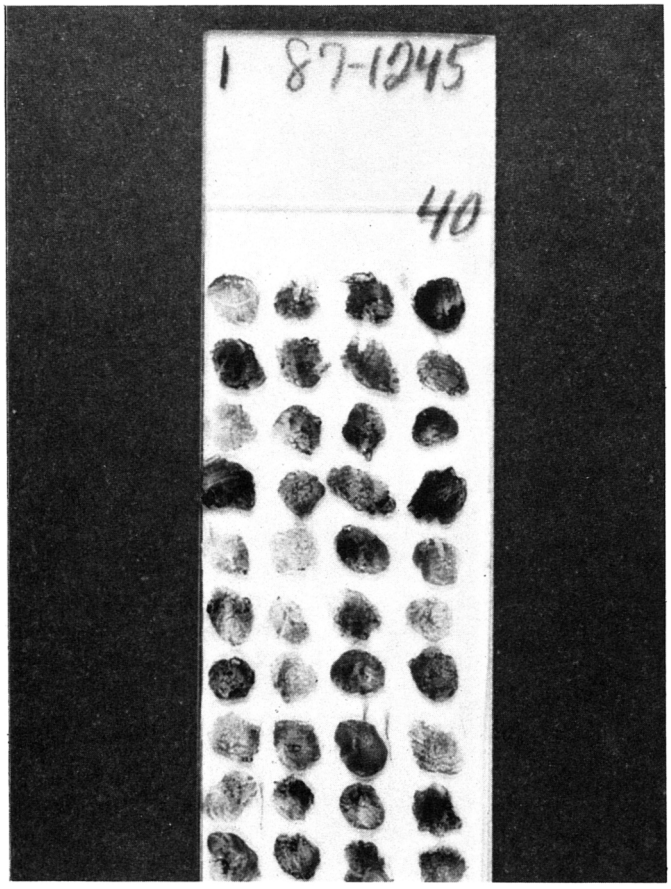


FIGURE 5. Penetration of a fresh manure pile with a wood applicator stick. The **end** of the stick applied to the slide provides sufficient material to make the diagnosis (see text for details).

Details on the efficient acid-fast smear technique, up to 90 specimens per slide, are as follows:

1. Label the frosted end of a clean glass slide approximately as to pen number.
2. Using a wood applicator stick, penetrate fresh (up to day-old) manure piles with a rapid repetitive wrist motion (like a wood pecker assaulting a tree) in order to thoroughly moisten the **end** of the stick.
3. Apply the end of the stick to the slide leaving a 3mm dot. Fifteen to 18 dots will fit in one row (5 rows per slide). The dots will usually have thick and thin areas, and perhaps some excess excreta.
4. After drying **lightly** scrape the excess excreta from the smears using the edge of another slide. Carry-over of oocysts from dot to dot has not been recognized as a problem.
5. Briefly heat-fix (3, one-half second passes through a full flame) and apply the AFB stain procedure. Acid-fast stain (AFB Kit) is convenient for veterinary practitioners to use and is available from Volu-Sol Medical Industries, 700 Sunset Road, Henderson, Nevada 89015 (702) 565-1383.
6. Coverglass the dried slide using a drop of oil or permanent mounting medium and peruse the dots at 250X (100X for the experienced eye) for typical oval red structures. Practice with known positive specimens will be necessary in order to differentiate oocysts of *C. muris* from other acid-fast structures that have a somewhat similar appearance.

The significance of *Cryptosporidium muris* infection in the abomasum of cattle is unknown. The infection occurs in production animals, is persistent and causes damage to gastric mucosa as evidenced by enlargement of the abomasum, thickening of abomasal folds, and histologically by increased depth of glands with dilation and atrophy of some gland cells.

Plasma pepsinogen concentration often is above normal (unpublished observations). Detrimental effects on the weight gains in 4 steers were apparent (Table II) but affected steers in some other feeding trials performed as well as pen-mates.

TABLE II. Average daily gain (ADG in pounds) of steers on 3 feeding regimes (Pens) compared to ADG of penmate steers with *Cryptosporidium muris* infection of the abomasum (8 steers per pen).

Pen #	*ADG	Steer #	ADG
1	3.49	14	2.91
		110	2.40
2	3.07	50	1.76
3	3.34	91	2.23

*ADG of pen of 8 included the ADG of the affected members of the pen. Steer # = steers shedding oocysts of *Cryptosporidium muris* over the entire 4 months feeding period.

To date I have not recognized any clinical signs associated with abomasal cryptosporidiosis. A few of the dairy cows with the infection seemed at time to have more watery stool than pen-mates but that was not a consistent finding. Other points that need to be made are as follows:

1. *C. muris* infection results in oocyst shedding for at least 4 months.
2. Pen-mates of infected steers have not begun to shed oocysts during prolonged exposure.
3. Four percent of slaughtered beef and dairy cows at one establishment had oocysts detectable by the acid-fast fecal smear technique (1000 samples examined).
4. Abomasal cryptosporidiosis was produced in only one of 18 calves exposed 2 hours pre-colostrally to millions of fresh oocysts. The infection was confirmed by histologic examination of abomasal biopsies. Oocysts shedding declined and ceased over a period of several months (unpublished observations).
5. Natural infections with *C. muris*-like organisms have been found in calves as young as 2 weeks but the history of the infections in older animals is unknown.

References

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A pheromonal function for the perineal skin glands in the cow

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Two cows with synchronised oestrous cycles were housed with a Friesian bull. During the midcycle period of the cows, one cow was given an intradermal injection of adrenaline in the perineal region. This caused local sweat gland discharge. The other cow was treated with water. The number and types of bull-to-cow behaviours were recorded before, during and after the day of treatment. This was repeated at three-weekly intervals for a total of four times. On the day of treatment the bull directed a greater proportion of olfactory behaviours towards the adrenaline-treated cow than the other cow ($P<0.05$). There was no difference between the cows before or after the day of treatment. The above experiments were repeated with a Hereford bull who showed the same response as the Friesian for the first two but not the last two experiments. The increased proportion of bull olfactory behaviours elicited by an increased perineal skin gland discharge, adds support to our hypothesis that the perineal skin glands are the source of an oestrous pheromone in the cow.

Use of a high frequency transducer with real time B-mode ultrasound scanning to identify early pregnancy in cows

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The reproductive tracts of 22 Friesian dairy cows were examined from seven to 35 days after insemination using a real time B-mode ultrasound scanner with a 7·5 MHz transducer. The earliest detection of pregnancy was at nine days when a vesicle was imaged within the lumen of the uterine horn. The early conceptus was seen at day 13 within the vesicle and these structures were followed ultrasonically until day 35. There was a sudden enlargement of the vesicle at day 19 and a heart beat was detected in the embryo at day 22. The allantois was imaged at day 23 and the amnion by day 29. The embryonic outline was clearly defined by day 33 when the body cavities could be discerned. This ability to determine pregnancy at an early stage should prove to be a useful technique in investigating the problems associated with early embryonic death in cattle.