

Evaluation of rumen transfaunation after surgical correction of left-sided displacement of the abomasum in cows

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Objective—To evaluate rumen transfaunation after surgical correction of left-sided displacement of the abomasum (LDA) in cows.

Design—Prospective clinical trial.

Animals—20 multiparous cows with LDA.

Procedures—Cows with LDA were treated surgically (day 0). On days 0 (immediately after surgery) and 1, 10 cows each received 10 L of rumen fluid (transfaunated group) or 10 L of water (control group) via a stomach tube. Postoperative dietary dry-matter intake and milk yield of each cow were recorded daily for 5 days, beginning immediately after surgery. Blood and rumen fluid samples were collected prior to surgery and on days 1, 3, and 5 after surgery. Serum nonesterified fatty acid and β -hydroxybutyrate concentrations were measured. Volatile fatty acid and ammonia concentrations and pH of rumen fluid were determined. Urine specimens were collected and tested for ketones at 8 AM and 4 PM. Cows with ketonuria were treated with 50% dextrose solution administered IV at the time ketonuria was first detected. Cows with ketonuria were treated twice daily until ketonuria resolved.

Results—All cows survived and completed their lactation. Daily and cumulative dry-matter intake and milk yield of cows in the transfaunated group were significantly greater than those of cows in the control group. Cows in the transfaunated group had significantly lower serum concentrations of β -hydroxybutyrate and significantly lower acetate-to-propionate ratios in rumen fluid on day 1 after surgery, compared with cows in the control group. Cows that received transfaunation required a significantly lower total volume of dextrose administered IV than control cows.

Conclusions and Clinical Relevance—Benefits of rumen transfaunation of cows after surgical correction of LDA included a lesser degree of ketonuria, greater feed intake, and higher milk yield, compared with nontransfaunated cows. (*J Am Vet Med Assoc* 2004;225:915–920)

Treatment of cattle with left-sided displacement of the abomasum (LDA) involves surgical repair of the malposition and correction of metabolic disturbances.¹ Results of previous studies reveal that cattle

with LDA respond favorably to surgical treatment; however, substantial economic losses as a result of delayed or decreased peak milk production, metabolic disturbances, and increased culling rates are encountered.^{2,3} Ancillary medical treatments for LDA include administration of electrolyte solutions, calcium salts, sodium propionate, propylene glycol, and prokinetics. Metabolic disorders in inappetent cows include abnormal rumen fermentation, low energy intake, ketonemia, low blood and rumen concentrations of **volatile fatty acids (VFAs)**, increased fat mobilization, and high serum concentrations of **nonesterified fatty acids (NEFAs)**.^{4,7} Correction of metabolic disorders in cows with surgically corrected LDA could result in an increase in milk production and shortened recovery times.

At least 1 lay publication has advocated administration of rumen fluid to sick cows.⁵ The procedure (transfaunation) has also been recommended for cows with acidosis-related rumen stasis.⁶ Theoretically, transfaunation of cows convalescing after surgical correction of LDA could shorten recovery time and enhance postoperative energy production. The VFAs in rumen fluid could provide a source of metabolizable energy for anorectic and ketotic cows. A decrease in serum ketone concentration could be expected to result in greater appetite and milk yield in the postoperative period. The efficacy of transfaunation as a treatment for cows after surgical correction of LDA, however, is unproven. The purpose of the study reported here was to evaluate rumen transfaunation after surgical correction of LDA in cattle.

Materials and Methods

During the last 20 years, the **Veterinary Medical Teaching Hospital (VMTH)**, School of Veterinary Medicine, University of California, Davis, has provided consultations for 2 large dry-lot dairy farms that share a common nutrition program and purchase feed from the same sources. The dairy farms have similar facility designs and common milking management. During the previous decade, the annual number of cases of LDA at each dairy farm ranged from 10 to 30. The uniformity of cases of LDA and the similarities of management allowed us to conduct a prospective randomized clinical study to evaluate the potential benefits of rumen transfaunation in cows after surgical correction of LDA.

Cattle—Twenty Holstein cows, ranging in parity from second to fifth, with a diagnosis of LDA comprised the study group. Heifers were excluded because they had been fed a different transition ration and may not have been typical of the other affected cattle. Cows originated from 1 of the 2 dry-lot dairy farms, and each herd consisted of approximately 800 lactating cows. The dairy farms were located in the

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northern region of the Sacramento valley in California. The cows were housed in sheltered free stalls and had access to an approximately 0.5-hectare dry-lot corral; water was available ad libitum. Feed for each farm was purchased from the same source and fed to cattle in clean, sheltered mangers. Free-stall care, milking, mastitis control, and manure removal systems on the 2 dairy farms were similar.

Cows in the study group were kept with other cows in the high lactation string and were fed a **total mixed ration** (TMR; Tables 1 and 2). Herdsmen examined the cows in the string at least twice daily and transported inappetent cows or cows with agalactia to the VMTH within 4 hours.

Surgical treatment—On arrival at the VMTH, cows were prospectively and randomly assigned to control or transfaunated groups. Left-sided displacement of the abomasum was diagnosed in each cow and surgically corrected within 4 hours. Preoperatively, all cows were treated with 2 L of 7.2% saline and 0.5 L of 50% dextrose solutions administered IV. Left-sided displacement of the abomasum was cor-

Table 1—Composition of the total mixed ration fed to cows in a study that evaluated rumen transfaunation after surgical correction of left-sided displacement of the abomasum.

Ration component	Dry matter (kg)	% of diet
Corn silage	3.82	15.2
Alfalfa hay	5.73	22.8
Brewers grain (wet)	1.37	5.5
Cottonseed with lint	2.72	10.9
Barley grain	2.37	9.5
Corn grain	2.07	8.3
Canola meal	2.17	8.7
Hominy corn	1.84	7.3
Beet pulp with molasses	1.67	6.7
Soybean meal 44%	0.40	1.6
Liquid fat	0.23	0.9
Calcium carbonate	0.15	0.6
Sodium carbonate	0.14	0.5
Limestone	0.09	0.4
Potassium bicarbonate	0.09	0.4
Wheat flour middling	0.07	0.3
Salt	0.05	0.2
Monocalcium phosphate	0.03	0.1
Magnesium oxide	0.04	0.1

Table 2—Predicted daily nutrient intakes of total mixed ration fed to cows in a study that evaluated rumen transfaunation after surgical correction of left-sided displacement of the abomasum.

Nutrient	Amount
Dry matter (kg)	28.1
NEL (MCal/kg)	0.7
Crude protein (kg)	4.4
DIP (kg)	2.8
UIP (kg)	1.6
SolP (%)	3.9
EE (kg)	1.7
Ash (kg)	1.9
NDF (kg)	9.1
ENDF (%)	15.1
ADF (kg)	5.4
NFC (kg)	5.6
Calcium (kg)	0.2
Phosphorus (kg)	0.1

NEL = Net energy of lactation. UIP = Undegraded intake protein. DIP = Degraded intake protein. SolP = Soluble protein. EE = Ether extract. NDF = Neutral detergent fiber. ENDF = Effective neutral detergent fiber. ADF = Acid detergent fiber. NFC = Nonfiber carbohydrate.

Amounts were calculated on a dry-matter basis.

rected by use of an omentopexy technique,⁹ and surgeries were performed by the VMTH veterinary staff. Ceftiofur (2 mg/kg, [0.9 mg/lb], IM) was administered intraoperatively, then once daily for 3 days.

Transfaunation procedure—Two nonlactating Holstein cows with rumen fistulae served as rumen fluid (transfaunate) donors. To stabilize rumen conditions, donor cows were fed a mixed forage diet consisting of alfalfa and oat hay (50:50 ratio) for 3 weeks prior to the beginning of the study and daily thereafter until the last transfaunation procedure was performed. The transfaunate (10 L) was collected from 5 randomly selected locations in the rumen by use of a perforated polyvinyl chloride pipe 5 cm in diameter and 1 m long. Rumen fluid that filtered into the pipe through the perforations was evacuated via a stomach tube^b and was administered to cows assigned to the transfaunated group within 20 minutes of collection. Prior to the beginning of the study, but after equilibration to the forage diet, the concentrations of VFAs in rumen fluid of donor cows were measured.

Cows assigned to the transfaunated group received 10 L of rumen fluid, and cows assigned to the control group received 10 L of lukewarm tap water via a stomach tube on day 0 immediately after surgery and on day 1 after surgery.

Postoperative monitoring—After surgery, cows were housed at the VMTH in individual straw-bedded stalls and examined twice daily for 5 days. The cows were fed a TMR of the high production string (obtained from one of the cooperating dairy farms) ad libitum. Any feed not consumed was removed and weighed twice daily. Urine specimens were collected twice daily (8 AM and 4 PM) and tested for ketones by use of a commercial test strip.^c Cows with ketonuria were treated with 250 mL of 50% dextrose solution administered IV every 12 hours until ketonuria resolved. All cows were milked twice daily at 7 AM and 6 PM. Dietary dry-matter intake and milk yield were recorded daily.

Rumen fluid was collected from cows in the transfaunated and control groups prior to surgery and on days 1 (24 hours after surgery or 10 hours after the first feeding), 3, and 5 after surgery. One liter of rumen fluid was collected from each cow by use of an orogastric probe.¹⁰ The first 100 mL of fluid collected was discarded because it was likely contaminated with saliva. The pH of the rumen fluid was determined within 20 minutes of collection by use of a combination electrode.^d Duplicate 10-mL aliquots of rumen fluid were acidified via addition of 2 mL of 25% metaphosphoric acid and centrifuged at 2,500 × g for 20 minutes. The supernatant was stored at -20°C until measurements of VFAs and ammonia concentrations were performed.

Duplicate (10 mL) blood samples were collected from the coccygeal vein into evacuated tubes prior to surgery and on days 1, 3, and 5 after surgery. Serum samples were aliquoted and stored at -20°C until measurements of β-hydroxybutyrate (BHB) and NEFA concentrations were performed.

Analytic methods—All measurements (except for feed weights) were performed without knowledge of group assignment. Concentrations of VFAs in rumen fluid samples were measured via gas chromatography by use of a modification of a published procedure.^{11,12} The gas chromatograph was fitted with a 3 m × 0.25-mm capillary column (free fatty acid phase; nitroterephthalic acid modified polyethylene glycol).^f One microliter of rumen fluid was injected automatically^g into a standard straight-through liner packed with a small plug of phosphoric acid-treated glass wool. The column temperature, initially set at 100°C, was programmed to increase 4°C/min until a final temperature of 140°C was reached. The total run time was 30 minutes. Injector and detector temperatures were set at 220° and 230°C, respective-

ly. The carrier gas (H₂) head pressure was set at 17.1 psi, and the split vent flow was 100 mL/min.

The concentration of ammonia in the rumen fluid was measured by use of a urease-catalyzed indophenol method.¹³ Serum BHB concentration was measured by use of a D(-)-β-hydroxybutyric dehydrogenase reduction-oxidation assay.¹⁴ Serum NEFA concentration was analyzed by use of a commercial assay kit.^h

Statistical analyses—Statistical analyses of continuous data were performed by use of ANOVA with repeated measures or a Student *t* test. Differences in glucose volume administered were determined by use of the Student *t* test. The rates of decline of serum BHB concentrations were evaluated by use of a Cox regression model and survival analysis.ⁱ A value of *P* < 0.05 was considered significant.

Results

Eight cows (4 transfaunated and 4 control) originated from 1 farm, and 12 cows (6 transfaunated and 6

control) originated from the other farm. Beginning on day 2 after surgery until day 5, cows in the transfaunated group had significantly greater daily dry-matter consumption than cows in the control group (Table 3). Cumulative 5-day dry-matter intakes for the transfaunated and control cows were 593 and 410 kg, respectively, and these values were significantly different. Cows within each group also had a significantly greater dry-matter intake on days 2 through 5 than on the corresponding day 1. The cumulative 5-day milk yields of cows in the transfaunated and control groups were 782 and 515 kg, respectively; these cumulative yields were significantly different. Transfaunated cows had significantly greater daily milk yield than control cows on days 2, 3, 4, and 5 (Table 4).

Day after surgery	Tr (n = 10)	Con (10)	Difference in DMI
1	4.8 ± 3.1	3.9 ± 2.8	9.1
2	10.4 ± 3.4 ^{ab}	6.9 ± 4.2 ^b	34.3
3	12.2 ± 2.8 ^{ab}	8.0 ± 5.0 ^b	42.0
4	15.0 ± 4.3 ^{ab}	10.4 ± 5.9 ^b	45.8
5	16.9 ± 5.0 ^{ab}	11.7 ± 5.9 ^b	51.6
Total	—	—	182.8

^aSignificantly (*P* < 0.05) different than control group.
^bSignificantly (*P* < 0.05) different than corresponding day 1 value.
— = Not applicable

Table 4—Mean ± SD daily milk yield (kg) and difference in total daily milk yield between groups, in cows that received transfaunated and in cows that received water via a stomach tube after surgical correction of left-sided displacement of the abomasum.

Day after surgery	Tr (n = 10)	Con (10)	Difference in milk yield
1	5.7 ± 4.9	4.2 ± 3.8	6.6
2	28.5 ± 10 ^{ab}	18 ± 11.4 ^b	47.7
3	38.0 ± 6.9 ^{ab}	25.9 ± 15.1 ^b	54.8
4	46.8 ± 10.1 ^{ab}	27.7 ± 17.9 ^b	86.8
5	53.2 ± 16.4 ^{ab}	37.45 ± 19.5 ^b	71.6
Total	—	—	268

Difference in milk yield was calculated by subtracting total daily milk yield in control cows from total daily milk yield in transfaunated cows. See Table 3 for remainder of key.

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The pH values of preoperative rumen fluid samples were 5 to 6 (n = 4 cows), 6 to 7 (10), and 7 to 8 (6). No significant differences in the pH of rumen fluid between control and transfaunated cows at any time (Table 5), or within the same cow during the preoperative and any postoperative period, or between cows originating from the 2 farms were detected. No significant differences in total or individual VFA concentrations in rumen fluid between control and transfaunated groups were detected at any time; however, the concentration of total VFAs increased significantly over the preoperative concentration in both groups during the postoperative period because of significant increases in concentrations of acetate, butyrate, and propionate after surgery. The acetate-to-propionate ratio in rumen fluid was significantly lower in transfaunated cows than in control cows on day 1 after surgery. Ratios were also lower in transfaunated cows on days 3 and 5; however, these differences were not significant (*P* = 0.07). In both groups, the acetate-to-propionate ratios on days 3 and 5 were significantly lower than corresponding preoperative values. The acetate-to-propionate ratio in transfaunated cows was also lower on day 1 than the corresponding preoperative value.

Preoperative concentration of ammonia in the rumen fluid of transfaunated cows was significantly greater than on days 1, 3, and 5 after surgery; however, there were no significant differences between groups at any time (Table 6).

The preoperative serum concentrations of BHB in transfaunated and control groups were not significantly different; however, on day 1 after surgery, the serum concentration of BHB was significantly lower in the transfaunated group than in the control group (Table 7).

Table 5—Rumen fluid characteristics (mean ± SD) of cows in a Tr group and cows in a Con group before and after surgical correction of left-sided displacement of the abomasum.

Day	Total VFAs (mEq/L)		pH		Ac:Pr ratio	
	Tr (n = 10)	Con (10)	Tr	Con	Tr	Con
Preoperative	46.1 ± 20.5	41.9 ± 21.3	6.6 ± 0.5	6.6 ± 0.7	4.3 ± 1.0	4.3 ± 0.7
1	56.0 ± 19.0 ^b	64.5 ± 25.9 ^b	6.8 ± 0.3	6.8 ± 0.4	3.7 ± 0.4 ^{ab}	4.3 ± 1.1
3	80.4 ± 17.7 ^b	71.7 ± 28.6 ^b	6.8 ± 0.1	6.8 ± 0.3	3.5 ± 0.4 ^b	3.9 ± 1.0 ^b
5	89.9 ± 15.4 ^b	86.9 ± 31.0 ^b	6.8 ± 0.3	6.7 ± 0.4	3.3 ± 0.4 ^b	3.5 ± 0.9 ^b

^aSignificantly (*P* < 0.05) different than Con group. ^bSignificantly (*P* < 0.05) different than corresponding preoperative value.
VFA = Volatile fatty acids. Ac:Pr = Rumen acetate-to-propionate ratio.

Table 6—Mean \pm SD concentration of ammonia (mg/dL) in rumen fluid of cows in a Tr group and cows in a Con group before and after surgical correction of left-sided displacement of the abomasum.

Day	Tr (n = 10)	Con (10)
Preoperative	21.5 \pm 15.1	14.6 \pm 7.5
1	9.9 \pm 3.9 ^a	13.4 \pm 5.7
3	10.7 \pm 2.8 ^a	9.6 \pm 4.3 ^a
5	11.5 \pm 3.4 ^a	10.8 \pm 5.3

^aSignificantly ($P < 0.05$) different than corresponding preoperative value.

Table 7—Mean \pm SD serum concentrations of β -hydroxybutyrate (BHB) and nonesterified fatty acids (NEFA) of cows in a Tr group and cows in a Con group before and after surgical correction of left-sided displacement of the abomasum.

Day	BHB (mg/dL)		NEFAs (mEq/L)	
	Tr (n = 10)	Con (10)	Tr	Con
Preoperative	32.0 \pm 18.9	40.8 \pm 18.7	1.6 \pm 0.5	1.9 \pm 0.7
1	18.5 \pm 11.3 ^{a,b}	36.5 \pm 21.1	1.0 \pm 0.4 ^b	1.0 \pm 0.4 ^b
3	15.7 \pm 12.3 ^b	29.0 \pm 25.0 ^b	0.7 \pm 0.4 ^b	0.9 \pm 0.5 ^b
5	14.7 \pm 15.3 ^b	28.3 \pm 23.3 ^b	0.6 \pm 0.4 ^b	0.9 \pm 0.6 ^b

^aSignificantly ($P < 0.05$) different than controls. ^bSignificantly ($P < 0.05$) different than corresponding preoperative value.

The transfaunated cows also had lower serum concentrations of BHB than control cows on days 3 and 5; however, these differences were not significant. Survival analysis revealed that serum concentration of BHB in transfaunated cows decreased to 9.4 mg/dL, a concentration within the reference range, during a period 0.29 times as long as in control cows.

The mean preoperative serum concentrations of NEFAs were 1.9 and 1.6 mEq of NEFAs/L in controls and transfaunated cows, respectively (Table 7). No significant differences in serum NEFA concentrations between the 2 groups were found at any time; however, cows in both groups had significantly lower serum concentrations of NEFAs on all days after surgery, compared with preoperative values.

Transfaunated cows were treated with 5,000 mL of 50% dextrose solution administered IV, whereas control cows were treated with 10,500 mL; these values were significantly different.

After equilibration and prior to first transfaunation, rumen fluid from donor cows contained 67.3 and 59.8 mEq of acetate/L, 19.8 and 18.0 mEq of propionate/L, and 20.5 and 9.8 mEq of butyrate/L, respectively.

Discussion

Administration of rumen fluid to cows convalescing after surgical correction of LDA had beneficial effects. Cows that received rumen fluid had significantly greater dry-matter intakes, significantly greater cumulative and daily milk yields, significantly lower day 1 acetate-to-propionate ratios in rumen fluid, and significantly lower day 1 serum BHB concentrations and required a lower total volume of dextrose administered IV than control cows.

The mean day 1 dry-matter intakes of transfaunated and control cows were 4.8 kg and 3.9 kg, respectively, which were less than half of the 12.5 to 13-kg requirement for cows weighing 500 to 600 kg (1,100 to

1,320 lb) and producing 10 kg of milk daily; these intakes were comparable to those reported in cows with moderate to severe hepatic lipidosis.^{15,16} The mean dry-matter intakes for transfaunated and control cows on day 5 were 16.9 and 11.7 kg, respectively. On the basis of 0.7 MCal/kg of dry matter, calculations of energy intake resulted in 49.5 and 34.4 MJ (11.8 and 8.2 MCal) of net energy of lactation (NEL) for transfaunated and control cows, respectively. The daily energy requirement of a comparably sized lactating cow with an 18-kg daily milk yield is approximately 96 MJ (23 MCal),¹⁵ which would indicate that on day 5, daily energy deficits were approximately 46 and 61 MJ for transfaunated and control cows, respectively; therefore, the respective NEL deficits for transfaunated and control cows were approximately 48% and 64% of requirements, respectively. The difference between these percentages (16%) represented the lesser degree of energy deficit in the transfaunated cows. The estimated dry-matter content of the TMR was 68%, and the cumulative 5-day dry-matter intakes were 593 and 410 kg for transfaunated and control cows, respectively. Therefore, the cumulative dry-matter intake in the transfaunated cows was 183 kg greater than in control cows. On the basis of an NEL content of 0.7 MCal/kg in the TMR, there was a calculated difference of 535 MJ (128 MCal) in cumulative energy intakes between the 2 groups. Assuming that 2.7 MJ (0.64 MCal) were required to produce 1.0 kg of milk with 3% fat content¹⁷ and that all of the energy intake was available for lactation, the higher feed intake in transfaunated cows should have resulted in a maximum of 198 (535 divided by 2.7) kg of additional milk output. The measured cumulative milk yields of control and transfaunated cows were 515 and 782 kg, respectively, or a difference of 268 kg. Therefore, during the 5-day observation period, the transfaunated cows produced 70 kg more milk than could have been predicted from their extra dry-matter intake. Reasons for the disparity between theoretical and actual milk yield could include type I error in the observed data in combination with compositional differences in the milk of the 2 groups. Possible reasons for type I data error may include the low numbers of cattle in each group and the lack of stratification of cows by milk yield and parity prior to the study. Milk composition was not measured in our study; however, any treatment that decreased serum NEFA concentration may have decreased milk fat content and lowered energy requirements for each kilogram of milk yield. We would have expected a greater difference in rumen VFA concentration between transfaunated and control cows if the extra milk yield was the result of increased rumen fermentative efficiency and would have anticipated a greater degree of ketosis in transfaunated cows if the increase in milk yield was the result of extra fat mobilization. The reasons for persistence of higher milk yield after 2 transfaunations are not known.

Preoperative rumen fluid pH \leq 5.7 in 4 cows differed from the typical higher pH that develops when feed is withheld from clinically normal cattle.⁷ These 4 cows may have had rumen acidosis prior to surgery. Another 6 cows had rumen fluid pH values ranging

from 7 to 8; this suggests that, preoperatively, distinct populations of cattle with LDA, categorized on the basis of rumen pH, exist. The relationship between rumen fluid pH and initiation of LDA could not be determined because of the low numbers of cows in our study. The lack of significant differences in rumen fluid pH after surgery between transfaunated and control cows was probably the result of factors that included sampling time of cows with varying degrees of anorexia, pH variation in preoperative samples, and potential errors made as a result of the use of the orogastric probe sampling technique. Some of the cows consumed feed immediately after surgery, whereas others were inappetent for several days. Because rumen fluid was first collected 24 hours after surgery or 10 hours after the first feeding, appetite differences could have contributed to the variability of rumen fluid pH values. Because rumen fluid pH may remain low for as long as 24 hours after feeding concentrate,¹⁸ cows that consumed TMR immediately after surgery would have had a low rumen fluid pH when sampled 10 hours later. In contrast, rumen fluid pH of anorectic cows would have been stable at the time of sampling. The pH could also have been influenced by salivary contamination of rumen fluid samples. We attempted to minimize salivary buffering by discarding the first 100 mL of rumen fluid collected and by passing the orogastric probe rapidly and without use of a speculum. The heavy bronze collecting tip of the orogastric probe probably settled to the bottom of the reticulum as soon as it entered the cardia.¹⁹ Results of a previous study²⁰ revealed that rumen fluid collected via an orogastric probe had higher pH than the pH concomitantly measured by use of an indwelling electrode. The difference in mean pH by use of the 2 methods, however, was only 0.37 with a 95% confidence interval that spanned 0.44 pH units. Although insufficient to explain the differences among the preoperative pH values of the cows in our study, the sampling technique could have contributed to pH variability both within and between groups. These inconsistencies combined with the marked variability of day 1 rumen fluid pH among cows could explain some of the variability in our data.

Rumen fluid VFA concentrations of cows in our study were similar to those of nonfed cattle in which total VFA concentrations were below the lower limit of the reference range for as long as 5 days after refeeding.⁷ The relatively low concentrations of VFAs in rumen fluid prior to surgery and on days 1 and 3 after surgery were considered to be partly the result of rapid VFA absorption⁶ combined with prolonged low production that was related to anorexia and rumen acidosis in some of the cows. On the basis of single measurements of rumen fluid VFA concentrations of donor cows, 20 L of transfaunate supplied approximately 2,000 mEq of VFAs. When diluted in an approximately 200-L rumen volume, the transfaunate would have increased the VFAs of the recipient cows by 10 mEq of VFAs/L.²¹ Administration of 20 L of rumen fluid, therefore, could not be expected to replenish the depleted VFAs of cattle with LDA. Prior to transfaunation on day 1, rumen fluid specimens of recipient cows contained only 56 mEq of VFAs/L, which is considerably less than

the concentrations reported in grain-fed cattle (147 to 156 mEq of VFAs/L)²² and in our roughage-fed donor cows (107 and 87 mEq of VFAs/L). The rumen fluid concentration of VFA in donor cows was measured only at the beginning of the study, and VFA concentrations could have changed as a result of repeated collection of 10 L of rumen fluid; however, the donors were alternated throughout the study. Assuming a 200-L rumen volume, the daily VFA production rates in roughage-fed cattle would be expected to range from 33,000 to 56,300 mEq.^{23,24} Transfaunation-related losses of VFAs, therefore, ranged from 3.5% to 6% of the total daily VFA synthesis. Our study was conducted over a 12-month period, which favored post-transfaunation regeneration and steady state of VFAs in donor cows.

The direct relationship between rumen fluid acetate-to-propionate ratios and pH was not observed in the rumen fluid of either group of cows.²⁴ Prior to transfaunation on day 1, the significantly lower rumen fluid acetate-to-propionate ratio in transfaunated cows, compared with control cows, was thought to possibly be related to higher feed consumption in that group; however, there was no significant difference in DM intake between groups on day 1. The higher preoperative serum BHB and NEFA concentrations, compared with postoperative concentrations in both groups, were consistent with previous reports^{4,5,7,25,26,27} of cattle with LDA, cattle undergoing feed restriction, or cattle that had primary acetonemia. The lower serum concentration of BHB in the transfaunated cows, compared with control cows, on day 1 could have been related to a difference in treatment with glucose or to the effects of transfaunation. The optimal dose and frequency of transfaunation were not determined in our study.

^aRumen cannula provides "good bug therapy". *Dairy Manag* 1999;12.

^bCarter J, University of California, Davis, Calif: Personal communication, 1999.

^cBili-Labstix, Bayer Inc, Tarrytown, NY.

^dCorning 3 in 1 Combi electrode, Corning Inc, Acton, Mass.

^eGLC Model 5890, Hewlett-Packard, Avondale, Pa.

^fOV 351, J&W Scientific, Folsom, Calif.

^gHewlett Packard 7673 Autoinjector, Hewlett Packard, Avondale, Pa.

^hNEFA-C enzymatic kit, Wako Chemicals USA Inc, Richmond, Va.

ⁱSPSS statistical software, SPSS Inc, Chicago, Illl.

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Selected abstract for JAVMA readers from the American Journal of Veterinary Research

Spatial dispersal of porcine reproductive and respiratory syndrome virus-contaminated flies after contact with experimentally infected pigs

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Objective—To determine whether flies can acquire porcine reproductive and respiratory syndrome virus (PRRSV) and disperse the virus throughout a designated area.

Animals—60 four-month-old pigs.

Procedure—On day 0, 28 of 60 pigs were inoculated with PRRSV MN 30-100 (index variant). On the same day, 100,000 pupae of ochre-eyed houseflies and 100,000 pupae of red-eyed (wild-type) houseflies were placed in the swine facility for a release-recapture study. Flies were recaptured at 2 locations within the swine facility, 6 locations immediately outside the facility, and 30 locations 0.4, 0.8, 1.3, 1.7, 1.9, and 2.3 km from the facility. Traps were emptied on days 2, 7, 8, 10, and 14. Samples derived from flies were tested by use of a polymerase chain reaction assay, virus DNA was sequenced, and viruses were tested for infectivity by means of a swine bioassay.

Results—PRRSV RNA homologous to the index PRRSV was detected in trapped flies collected inside and immediately outside the facility and from 9 of 48 samples collected at 0.4 km, 8 of 24 samples collected at 0.8 km, 5 of 24 samples collected at 1.3 km, and 3 of 84 samples collected at > 1.7 km from the facility. Two samples collected at 0.8 km contained genetically diverse variants of PRRSV. Swine bioassays revealed the virus in flies was infectious.

Conclusions and Clinical Relevance—Flies appeared to become contaminated with PRRSV from infected pigs and transported the virus \geq 1.7 km. Fly-born transmission may explain how PRRSV is seasonally transported between farms. (*Am J Vet Res* 2004;65:1284-1292)



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