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Fatty acids have impact on calf performance

THE role of volatile fatty acids has been established in developing rumen papillae and function in the order of butyric acid, followed by propionic acid, followed by acetic acid (Warner, 1991).

That was based on studies done in the 1950s, of which Sander et al. (1959) is a good example.

During a Cornell Animal Science Alumni gathering at the 1995 American Dairy Science Assn. annual meeting, I had the opportunity to meet and visit with one of those authors: H.N. Harrison, who was working in biomedical research. I learned from him that butyric acid was also found to have positive effects on intestinal tissue and was being used in post-operative recovery in humans after intestinal surgery.

Butyric acid seems to have been used more in pigs and poultry for its various beneficial aspects, and of course, it is present in bovine milk fat.

Most milk replacers in the U.S. use lard or some tallow as a fat source. Could butyric acid have a beneficial effect if added to a milk replacer? That was part of the thrust of a study done jointly by The Ohio State University and Provimi researchers (Esselburn et al., 2013).

Holstein calves that were two to three days of age — 24 males and 24 females in trial 1 and 48 males in trial 2 — were sourced from one dairy and transported to the Provimi research site in Ohio.

Calves were started on a whey-based milk replacer with 27% protein and 17% fat mixed at 15% solids and fed twice daily to provide 1.45 lb. of dry milk replacer. After the first day, calves were blocked by sex (only in trial 1) and randomly assigned to treatments.

The three treatments were: (1) the control milk replacer that used only animal fat, (2) animal fat supplemented with a proprietary blend of butyrate,

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medium-chain fatty acids and linolenic acid (FA-S) and (3) dried whole milk selected to have 27% protein and 33% fat (MF). A texturized 20% protein calf starter was provided free choice along with water.

Trial 1 was conducted during August and September, while trial 2 was done during October and November. On the last three days before weaning, only the morning feeding of milk replacer was done, and weaning was completed on day 42.

However, the trials continued another 14 days. It was important to evaluate through 14 days postweaning to determine if there were any carryover effects. This is also important in field practice as it assists in the weaning transition process before moving calves into their first grouping (*Feedstuffs*, Jan. 11, 2011). Calves were housed in individual 4 ft. x 8 ft. pens in a sidewall-

1. Fat, ME and fatty acid composition of calf starter and experimental milk replacers

	Treatment			
Item	Control	FA-S	MF	Starter
Fat, %	17.9	17.6	33.4	5.1
ME, Mcal/lb.	2.18	2.18	2.54	1.50
Fatty acid, %				
C4	0.04	0.46	0.42	0.02
C6	< 0.01	< 0.01	0.62	< 0.01
C8	< 0.01	0.01	2.90	< 0.01
C10	< 0.01	0.07	0.17	< 0.01
C12	0.03	0.51	0.17	0.02
C14	0.02	0.19	0.73	0.01
C16:0	4.08	3.76	8.74	0.31
C16:1	0.48	0.46	0.49	0.11
C18:0	2.22	1.97	3.93	0.16
C18:1	7.89	7.29	9.66	1.06
C18:2	1.54	1.42	3.86	1.71
C18:3	0.06	0.18	0.34	0.07
C18:2/C8:3	25.2	7.9	11.5	25.2

2. Performance of calves in trial 1

	Treatment			Std. error
Item	Control	FA-S	MF	of means
Initial bodyweight, lb.	90.7	88.1	89.8	2.2
Preweaning daily gain, lb.	0.99	1.15	1.10	0.04
Postweaning daily gain, lb.	1.54	1.76	1.67	0.09
Milk replacer intake, lb./day	1.39	1.39	1.39	—
Starter intake, lb./day				
Preweaning	0.53	0.55	0.48	0.06
Postweaning	4.18	4.23	4.12	0.23
Overall	1.45	1.48	1.39	0.10
ME intake, Mcal/day				
Preweaning	3.84	3.85	4.27	0.46
Postweaning	6.26	6.34	6.16	0.28
Overall	4.45	4.48	4.74	0.31
Hip width change, in.				
Preweaning	6.35	7.62	7.37	0.50
Postweaning	4.06	5.08	5.08	0.42
Overall	10.41	12.70	12.45	0.55

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curtained barn with no added heat. The bedding used was long straw.

Clearly, the MF treatment had more fat and a greater metabolizable energy (ME) content than the control or FA-S treatments (Table 1). It also had considerably more butyric (C6), caprylic (C8), capric (C10), myristic (C14), palmitic (C16:0), stearic (C18:0), linoleic (C18:2) and linolenic (C18:3) acids than the other two treatments.

However, FA-S had more propionic (C4), C10, lauric (C12), C14 and C18:3 acids than the control. Butyric acid was similar between the control and FA-S treatments, with both being less than 0.01% detection.

Butyric acid was about 10 times greater, the sum of medium-chain fatty acids (C10, C12 and C14) was 14-20 times greater and C18:3 was three to five times greater in the FA-S and MF treatments than in the control treatment. Linoleic acid (C18:2) was minimal in the FA-S and control treatments but was about 2.5 times greater in MF than in control and FA-S treatments.

Starter intake, ME intake and daily gain during both the preweaning and postweaning periods did not differ among treatments (Table 2). Fatty acid intakes of C4, C10, C12, C14, C18:2 and C18:3 were greater ($P < 0.001$) for both the FA-S and MF treatments compared to the control treatment, except that C18:2 was similar for the control and FA-S.

However, serum albumin, urea nitrogen and glucose concentrations were greater ($P < 0.01$ or 0.05) for FA-S and MF versus control calves. Serum amylase concentrations were greater ($P < 0.02$) for calves fed FA-S versus the control.

Tail skin temperatures were lower ($P < 0.01$) for calves fed FA-S versus the control but higher ($P < 0.01$) for MF versus control calves. The overall hip width change was greater ($P < 0.01$) for calves fed either FA-S or MF compared to those fed the control treatment. Preweaning abnormal fecal days were lower ($P < 0.02$ or $P < 0.04$) for FA-S versus control calves, but not for MF versus control calves.

Differences among treatments were similar in trial 2 versus trial 1 calves but tended to be greater for starter intake, daily gain and hip width change. This was most likely due to using only male calves in trial 2 and because the weather in October/November would be cooler than in August/September.

The Bottom Line

Supplementing animal fat in a milk replacer with some fatty acids was compared to a control milk replacer with animal fat and dried whole milk, which contained milk fat. Intakes of most fatty acids were greater for calves fed milk fat and supplemented animal fat versus the control animal fat.

Starter intake, overall ME intake and daily gains were similar among treatments. However, the preweaning hip width change was greater and abnormal fecal days and tail skin temperatures were lower for the calves fed supplemented animal fat versus the control animal fat.

References

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