EFFECTS OF CHLORTETRACYCLINE IN CALF STARTER AND MILK

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SUMMARY

The dairyman may use commercial milk replacers or feeds containing antibiotic or may add antibiotic separately to milk or other feeds used in calf raising. This experiment was to determine the effects of feeding 50 mg per day of antibiotic in milk, 25 mg per pound of starter, or these concentrations in both milk and starter. Thirty calves were reared to 16 wk on each of the three treatments and compared to a control group of 30 calves not fed antibiotic. During the first 8 wk, the calves fed antibiotic in the milk grew significantly faster and ate significantly more feed than those in the control and starter-supplemented groups. Those receiving antibiotic in the starter alone gained significantly more than the controls, and those fed antibiotic in both milk and starter gained slightly more than those with antibiotic only from milk. Antibiotic feeding did not reduce calf mortality or significantly prevent diarrhea. From 8 to 16 wk antibiotic feeding in starter produced slightly greater weight gains and feed consumption, but the differences were not significant statistically. These results indicate that the most effective method of feeding calves antibiotic is in milk and, that after weaning, the effects of antibiotic feeding are of small importance.

The benefits to be derived from feeding antibiotic to calves were reviewed in 1955 by Lassiter (5), and have been reported since by many others (3, 4, 6, 8-11). Thomas et al. (10), in a large-scale test with Holstein and Jersey calves in two herds, confirmed that the greatest effect of antibiotic feeding was increasing growth and feed consumption in the first four months. They noted that their untreated calves required more treatments for scours than those fed antibiotic. In many of the earlier experiments the antibiotic had been administered by capsule or fed only in the milk. Guanya et al. (2) and Mochrie et al. (7) found that adding 4.5 to 9.0 mg of aureomycin per pound of starter did not improve growth or reduce scours significantly in young calves. Bartley et al. (1) compared three methods of administering antibiotic to calves: adding 45 mg aureomycin daily to whole milk, mixing 36 mg per pound of starter, or administering 45 mg daily by capsule. Antibiotic in the starter improved 8-wk growth rates 5%, antibiotic via capsule improved growth 8.5%, but antibiotic in the milk improved growth 17.6%. Hogue et al. (3) and Warner et al. (11) concluded from a summary of experiments at Cornell and other reports that supplementation of milk would give the best results. On the other hand, Preston et al. (8) reported that only 8 mg of aureomycin per pound of concentrate increased both 8- and 12-wk growth rates and concentrate consumption; whereas, 50 mg per day of aureomycin in a reconstituted buttermilk milk replacer fed for 3 wk was not effective. Hvidsten (4) noted equal responses from feeding antibiotics in starter or administering them separately from the starter. Marshall et al. (6) noted insignificant growth increases from feeding aureomycin in either milk or starter.

Many calves are fed on home-produced milk or skimmilk or home-mixed starters. Commercial calf feeds generally contain antibiotic. A farmer desiring the benefits of antibiotic feeding in young calves has the choice of supplementing his home products or purchasing a fortified feed. Since results from reported experiments were somewhat variable, there was need to determine the effects of adding antibiotic to milk, to starter, or to both milk and starter, for young calves reared on a limited milk-replacer and calf starter plan.

EXPERIMENTAL PROCEDURE

Calves. The healthy Jersey and Holstein calves not seriously undersized at birth from two University of Tennessee herds were allocated to this experiment as they were born over a period of nearly 12 months. The calves were assigned to one of four treatment groups. Each group consisted of 11 Holsteins and 19 Jerseys, which completed the experiment. In one herd only heifers were used; so the total male calves in Groups I to IV, respectively, were nine, six, seven, and nine. Data from calves which died before the end of the experiment were not used in the growth comparisons.

Treatments. Group I, the control group, was not fed antibiotic in either milk or starter. Group II was fed antibiotic in milk but none in starter. Group III was fed antibiotic in starter but none in milk. Group IV was fed

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antibiotic in both milk and starter. The antibiotic used was chlortetracycline (Aureomycin) in a water-dispersible form. It was added to the milk for Groups II and IV at the rate of one level teaspoonful of antibiotic supplement at each feed twice daily, which should have provided 50 mg of chlortetracycline per calf daily. The same source of chlortetracycline was mixed into the starter to provide 25 mg per pound for Groups III and IV.

Feeding and rations. All calves received colostrum for the first three to four days and whole milk to the sixth day. The sixth and seventh day a mixture of whole milk and reconstituted skimmilk was fed, and from eight days to weaning the milk fed was reconstituted skimmilk, made from 15 parts powder and 85 parts warm water. Milk was fed alike to all groups, at 10% of body weight, scheduled according to the expected growth rate of the calves, based on previous growth data from University of Tennessee, with maxima of 9 lb daily for Jerseys and 12 lb daily for Holsteins. Milk feeding was stopped at 42 days for Holsteins and 56 days for Jerseys, to conform to the most usually recommended milk feeding periods for the two breeds.

The calves were kept in individual pens throughout the experiment which terminated at 16 wk. Fresh water and coarse-chopped green, leafy alfalfa and alfalfa-grass mixed hay were available free choice. All hay fed was recorded and refuse weighed at least once weekly. A pelleted starter was fed free choice up to a maximum of 4 lb daily. The weight of starter fed and refused was recorded for each calf daily. The formula of the starter is presented in Table 1.

All calves were weighed at weekly intervals. Careful record of diarrhea was made. Rectal temperatures were recorded twice weekly, at 1 PM at three- to four-day intervals, for 10 wk.

Significance of differences observed was evaluated by standard analysis of variance procedures. Sources of variation considered were ration treatments, breed, and breed and treatment interaction. Least significant mean differences were calculated at a probability of .05.

TABLE 1
Formula of calf starter

Ingredients	Percentage
Ground yellow corn	35
Ground oats	20
Wheat bran	10
Soybean oil meal	27
Cane molasses	5
Defluorinated phosphate	1
Trace-mineralized salt	1
Vitamin A and D meal mix [a]	1
Total	100

[a] Vitamin A and D concentrates mixed into soybean oil meal to provide 2,500 IU of stabilized vitamin A and 400 IU of vitamin D from irradiated yeast per pound of mixed starter. Formulas for Groups III and IV also contained 0.5 lb of Aurofac D to provide 25 mg of chlortetracycline per pound. Enough soybean oil meal was added to these supplements to make the 1% premix.

RESULTS AND DISCUSSION

Growth and feed consumption data were summarized for the 1- to 8-wk period, to evaluate the major effect of antibiotic fed with milk and from 8 to 16 wk to evaluate the effect of antibiotic fed only in the starter. No milk was fed to any calves after 8 wk.

The average growth curves and weight gains are shown in Figure 1. The average weights of the 30 calves in each group at 1 wk for Groups I to IV, respectively, were 70.9, 69.7, 69.3, and 71.3 lb. The 1- to 8-wk gains were 46.1, 57.7, 52.4, and 61.4 lb for Groups I to IV, respectively. The differences between ration treatments were highly significant statistically ($P < .01$), with no evidence of a ration × breed interaction. The least significant difference between group average gains was calculated to be 5.7 lb; therefore, the significantly different

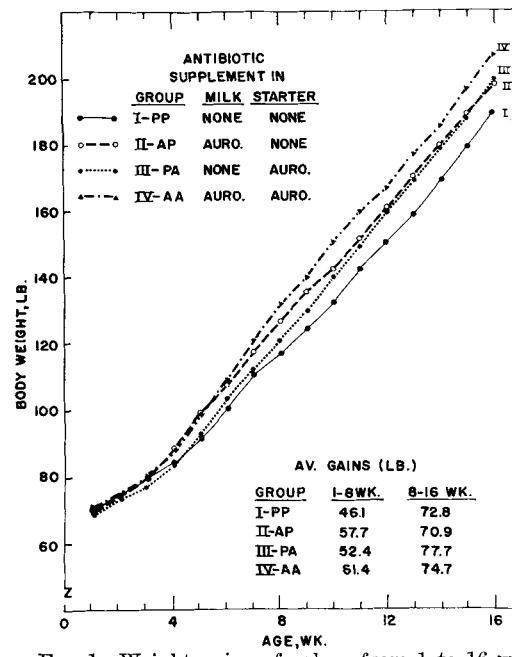

FIG. 1. Weight gains of calves from 1 to 16 wk of age fed milk and starter with various combinations of chlortetracycline supplement (30 calves in each group).

gains were due mainly to antibiotic in the milk of Groups II and IV. These exceeded Groups I and III by 11.6 and 9.0 lb, respectively. There was also an indication that starter antibiotic aided gains slightly, since gains of Group III exceeded Group I, and Group IV exceeded Group II by 6.3 and 3.7 lb, respectively.

Milk consumption was nearly the same in all groups, averaging 382, 377, 376, and 381 lb for Groups I to IV, respectively. There were very few refusals of the milk allowances. The small average differences between groups were related to the differences in average size of the calves at the start of the experiment.

The effect of the antibiotic in starter was less than in milk, because of the low average intake of starter during the milk-feeding period. Average daily starter consumption of all calves for Weeks 2 to 8 was 0.08, 0.22, 0.38, 0.65, 0.97, 1.66, and 2.26 lb. Thus, the average calf in the study got less than 25 mg of antibiotic daily from starter until the 7th wk. Also, calves not fed antibiotic in the milk ate less starter than those on treated milk; therefore, they would get less antibiotic than the average from starter. Total starter consumption from 1 to 8 wk averaged 34.4, 50.7, 40.6, and 48.4 lb for Groups I to IV, respectively.

The average gains of Groups I to IV in the 8- to 16-wk period were 72.8, 70.9, 77.7, and 74.7 lb, respectively. The differences due to ration treatments were not statistically significant in this period. As shown in Figure 1, the weight gains of all groups were nearly parallel after the milk-feeding period ended. Combining Groups I and II, which were fed no antibiotic in the starter, and III and IV, which were fed antibiotic in starter, gave average gains of 71.9 lb for the former compared to 76.2 lb for those fed antibiotic in the starter. The average difference of 4.3 lb was not statistically significant.

The effects of the antibiotic treatments on dry feed (starter plus hay) consumption are presented in Figure 2. Starter and hay were combined to give a measure of total appetite. The over-all average consumption in the 1-8 wk period was 52.1 lb, of which 8.6 lb was hay and 43.5 lb was starter. The average dry feed consumptions of Groups I to IV were 42.4, 61.5, 47.5, and 57.3 lb. The difference between groups was highly significant statistically ($P < .01$). The least significant difference was 8.6 lb feed. Thus, the two groups fed antibiotic in milk (II and IV) did not differ significantly, and those not fed antibiotic in milk (I and III) did not differ significantly from one another. However, the calves in both groups fed antibiotic in milk ate significantly more feed than the calves in the two groups not fed antibiotic in milk. The feed consumption was related to growth differences in the four groups, and was probably the greatest factor influencing the different growth responses.

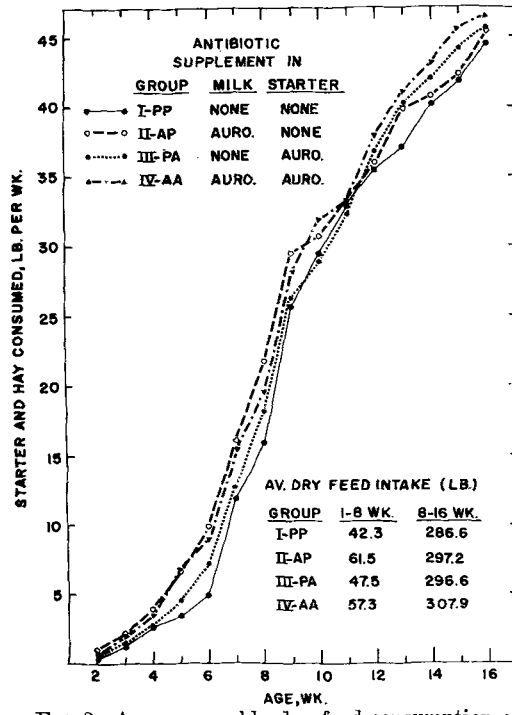

FIG. 2. Average weekly dry feed consumption of calves fed no antibiotic, compared to antibiotic in milk or starter or in both milk and starter (30 calves in each group).

In the 8- to 16-wk period the over-all average dry feed consumption was 297.0 lb, of which 202.4 lb was starter and 94.6 lb was hay. Dry feed consumptions in this post-weaning period for Groups I to IV were 286, 297, 297, and 308 lb. Differences between ration groups were not statistically significant. The slight differences in feed consumption and growth during the 8- to 16-wk period were probably affected by the response during the 1- to 8-wk period which resulted in slower growth for Group I calves.

Rectal temperatures were taken twice weekly to indicate possible presence of unobserved illness or infection. Results of these tests, however, were seldom associated with instances of diarrhea or other observable illness; thus, their value is questionable. The rectal temperatures averaged 102.6 F for Holstein calves, and 102.1 F for Jerseys. The difference in rectal temperatures between the ration treatment groups was not significant at any age.

TABLE 2

Average days of notable diarrhea per calf in four groups of calves comparing antibiotic in milk and starter

	Treatment group			
	I	II	III	IV
	(days scouring per calf)			
All calves started experiment	2.6	1.7	3.2	2.1
Calves completing experiment	2.3	1.5	3.2	2.2

Noticeable diarrhea in the calves occurred only in the first few weeks of age, and almost exclusively during the milk-feeding period. The average number of days scouring reported per calf in each group are presented in Table 2 for the calves which completed the experiment, as well as all calves, including those which died. The differences according to treatment groups were not significant statistically. Comparing the groups receiving and not receiving antibiotic in their milk, the average days of scouring were 1.9 and 2.9, respectively.

Feeding antibiotic in the milk did not prevent calf deaths, as 17 calves in Groups II and IV died, compared to 13 deaths in Groups I and III. Most deaths occurred within the first week or two of the experiment, and most of them were among Jersey calves. The high death rate during the period of this study indicates that a serious calf infection problem existed in these herds. It is believed that most of the infection occurred before the calves reached the calf barn and started on the experiment. The favorable responses to antibiotic feeding in milk were probably enhanced by this disease situation.

Results of this experiment have confirmed the observations of others (1, 3, 5, 10, 11), that the major benefit from feeding small calves antibiotic will result from adding it to the milk. The growth response to antibiotic in starter was small, but significant at early ages. The growth and feed consumption responses observed here due to antibiotic feeding indicate an increased general health and well-being of the calves, which was probably demonstrable because of the disease situation of the environment. Lack of response to antibiotics in milk as reported by Preston et al. (8) and Marshall et al. (6) may have been influenced by comparatively lower disease incidence.

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