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GROWTH PERFORMANCE OF HOLSTEIN DAIRY CALVES SUPPLEMENTED WITH A PROBIOTIC

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INTRODUCTION

Administration of antibiotics in both therapeutic and sub-therapeutic doses has been the standard practice for dealing with pathogenic bacteria problems in farm animals since the 1940s. Several types of antibiotics are currently used to promote weight gain and feed efficiency in domestic livestock. There is growing concern that the use of antibiotics as growth promoters may result in the development of resistant populations of pathogenic bacteria and, in turn, influence the therapeutic use of antibiotics. The indiscriminate and improper use of antibiotics in food-producing animals could result in the presence of residues in milk, meat, and other animal food products consumed by humans. One possible alternative to antibiotics is the use of probiotics. Probiotics can be defined as "live microbial feed supplements which beneficially affect the host animal by improving its intestinal microbial balance" (Fuller, 1989). Probiotics introduce beneficial microorganisms into the gut which act to maintain optimal conditions within the gastrointestinal tract and inhibit the growth of pathogenic or other undesirable bacteria. Several functions of probiotics have been proposed, including:

1. the protection of young animals against enteropathic disorders such as diarrhea by inhibiting the colonization of the gut by coliform bacteria; and
2. an increase in feed conversion efficiency and live weight gain in growing animals (Fuller, 1990; Sissons, 1989).

The efficacy of probiotics in enteric disease prevention is based on sound scientific evidence (Bechman, et al., 1977; Barrow, et al., 1987; Fuller, 1990; Underdahl et al., 1982). Under normal circumstances, the gut microflora protects the animal against certain enteropathic diseases (Smith and Tucker, 1975). Due to the current system of animal rearing, including confinement housing, early weaning, and the movement of animals from range to feedlot systems, the "normal" microfloral population of the gut may become "out of balance." The aim of the probiotic approach is to correct the deficiencies in the gut microflora and restore the protective effect (Fuller, 1990; Sissons, 1989). With a repopulation of normal gut microflora, an animal's appetite and ability to efficiently utilize feedstuffs returns.

At present, there is insufficient scientific research data to clarify whether or not probiotics enhance feedstuff digestion and promote increases in feed conversion efficiency. Of the reports published, response to probiotics has been variable. Based on the existence of some positive results with weight gain and feed efficiency it appears that under certain conditions probiotics can achieve what is claimed for them (Fuller, 1989; Sissons, 1989). Commercial information about probiotics often includes the claim that feeding the probiotic preparations will result in increase feed conversion efficiency and live weight gain (Sissons, 1989). It is unclear whether the growth responses, if any, result directly from improved digestive performance or indirectly due to the suppression of gut pathogens which might otherwise have adverse effects on digestive metabolism and animal performance.

This report summarizes growth performance results from a study that incorporated a probiotic into the feed of dairy calves. The trial was performed at the Agricultural and Forestry Experiment Station Dairy Research Facility, Palmer.

MATERIALS AND METHODS

According to the manufacturer (Conklin Company, Inc., Shakopee, MN), the probiotic (Fastrack™) used in this trial contained a source of live (viable) naturally occurring microorganisms. Total microbial activity was generated at 40 billion colony-forming units per pound. Ingredients in the probiotic pack included yeast culture (*Saccharomyces cerevisiae*), dried *Streptococcus faecium* fermentation product, dried *Lactobacillus acidophilus* fermentation product, dried *Aspergillus oryzae* fermentation product, dried *Bacillus subtilis* fermentation product, rice hulls, and calcium carbonate. This probiotic was fed at a recommended rate of one ounce per calf per day.

Sixteen calves were divided into four groups of four calves each with two groups receiving the probiotic supplement and two groups serving as controls. Calves were started on trial at four months of age and remained on trial through seven months of age. Grain mix (Table 1) feeding was limited to four lbs per calf per day. Forage was offered free-choice throughout the trial. Long-stem bromegrass hay was fed as the forage source during the first two months on trial, and bromegrass silage was fed the last two months. The amount of forage consumed was measured daily. Calves were fed twice daily. Chemical composition of the grain mix, hay, and silage is given in Table 2. Body weights, wither height, heart girth, and paunch girth were measured every two weeks.

Rumen fluid and jugular blood samples were collected every four weeks. Fecal samples were collected for three consecutive days at the end of each month to monitor nutrient digestion. Results of these samples will be given in a later report.

Table 1. *Ingredient content of pelleted grain mix.*

Ingredient	% of dry matter
Barley	26.6
Corn	26.6
Alfalfa meal	8.3
Animal fat	3.2
Beet pulp	8.3
Soybean meal	22.8
Limestone	1.9
Dicalcium phosphate	1.0
TM salt	.8
Magnesium oxide	.2
Vitamin premix	.3

RESULTS

Body weight gain, feed intake, and growth performance are shown in Table 3. There were no statistically significant differences between the control and probiotic treatments. Average daily gain (ADG) at 1.94 lbs/day was well within the range expected for young growing dairy heifers. Feed consumption was slightly lower on the probiotic diet. Feed efficiency (lb feed/lb gain) was improved slightly on the probiotic diet. Initial weights, final weights, and total body weight gain were similar for both treatments. Body measurements are given in Table 4. Final wither height, initial wither height, and wither height gain were similar for both treatments. Heart girth gain was greater ($P<.06$) for the probiotic treatment. Initial paunch girth tended to be lower ($P<.09$) for the probiotic treatment groups. Paunch girth gain was slightly higher with the probiotic treatment. Over-

Table 2. *Chemical composition of dietary ingredients.*

Item	Grain mix	Bromegrass hay	Bromegrass silage
Dry matter, %	88.0	81.4	29.2
		% of dry matter	
Organic matter	92.2	95.2	92.4
Crude protein	20.7	13.1	11.9
Neutral detergent fiber	16.2	60.9	62.2
Acid detergent fiber	7.6	31.1	34.6
Ether extract	5.5	——	2.9
Ca	1.24	.32	.46
P	.57	.29	.23
Mg	.36	.15	.20
K	1.11	1.21	1.22

all, it appeared that probiotic supplemented calves showed a slight advantage in body measurement gains compared to the control calves.

SUMMARY AND DISCUSSION

Although differences between the two treatment groups were largely non-significant, slight improvements in feed efficiency and body measurement gains suggest that the feeding of probiotics may have a beneficial effect. It should also be noted that the calves used in this study were housed indoors under "warm-housing" conditions. It appeared that little, if any, environmental or other stresses were placed on these calves during the trial. This is important to note since Fuller (1989) suggested that the growth stimulatory effect of probiotics will operate only when the animals are stressed by the presence of growth depressing microflora in the gut. The

Table 3. *Body weight gain and feed performance of Holstein heifer calves supplemented with a probiotic.*

Measurement	Treatment	
	Control	Probiotic
No. of calves	8	8
Final wt., lb	495	489
Initial wt., lb	277	272
Gain, lb	218	217
Days on trial	112	112
ADG, lb./day	1.94	1.94
Feed consumption, lb/calf/day[a]	10.46	10.08
Feed efficiency, lb feed/lb gain	5.41	5.25

[a]Calculated as total feed consumption of each pen divided by number of calves per pen.

Table 4. *Body measurements of Holstein heifer calves supplemented with a probiotic.*

Measurement	Treatment	
	Control	Probiotic
No. of calves	8	8
Wither height (inches):		
Final	44.0	43.7
Initial	39.9	39.2
Gain	4.1	4.5
Heart girth (inches):		
Final	56.2	56.7
Initial	46.8	45.6
Gain[a]	9.4	11.1
Paunch girth (inches):		
Final	70.8	69.7
Initial[b]	59.0	57.0
Gain	11.8	12.7

[a,b]Treatment effect ([a]P<.06).

presence of a growth depressing microflora may be directly related to environmental conditions, including temperature, humidity, overcrowding, and changes in the type of feed being fed or changes in the method of feeding, among other factors.

Currently, a one-to-two year trial involving probiotic supplementation of young dairy calves housed in outdoor hutches is planned. This trial will begin January, 1991. Due to the relatively severe winter conditions in Alaska, outdoor housed dairy calves are often subjected to less than optimal environmental conditions. Under these stressful conditions, the incidence of health-related problems increases among these calves. It is possible that the feeding of a probiotic may help to alleviate health problems in these calves.

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