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An Evaluation of a Probiotic Supplement on Dairy Calf Growth: Birth – 60 Days Old

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Abstract

The objective of this study was to determine if feeding probiotics to a young calf would result in earlier development of rumen function and the concomitant increase in daily grain intake, permitting the calf to be weaned at a younger age. A total of 72 heifer calves were assigned at birth to one of two groups: the control group was fed grain without any probiotics and the treatment group was fed the same grain, but with the probiotics added. The probiotic used was Dairyman’s Edge Pro®. The calves were measured for height and weight at birth, 30 days, weaning, and 60 days of age. The amount of feed consumed was also measured daily. Upon analysis of the data collected, it was clear that the probiotic components in Dairyman’s Edge Pro® did not result in faster calf growth or a younger age at weaning. However, the product’s actual activity inside the calf is unknown and could be the subject of future research.
Introduction

Cattle have been a major part of human civilization throughout the centuries, depicted in Egyptian hieroglyphics, in ancient paintings and mentioned multiple times in the Bible itself. There are many variations of cattle that produce differing quality products like beef, milk, leather and manure. Dairy cattle in particular were selected and bred for their ability to produce large amount of quality milk. Healthy function of the rumen, the first compartment of the bovine stomach, is essential to the production of these large quantities of milk as well as to the animal’s overall health. The microbial population within the rumen determines the effective function of that organ. A number of agribusinesses are attempting to influence the population of the microbes in order to increase milk production and feed efficiency in adult cows, or increase growth rates of young calves. The Papillon Agriculture Company approached the Andrews University Dairy to conduct a feeding trial using their probiotic-containing product Dairyman’s Edge Pro®. The proprietary probiotic content included Enterococcus, Lactobacillus sp., Bacillus, live yeast, enzymes, and salt of glutamate (Papillon, 2012). This product had demonstrated to be effective in enhancing the rumen function in mature dairy cows. However, it had never been evaluated in calves. Calves are weaned off milk when their rumen has developed enough for them to be able to grow well from a diet of grain and forages. While all cattle are born with a four-compartment stomach, a calf’s rumen, destined to be the largest and most important compartment, is not yet developed or functional; it has not yet been colonized by bacteria and other microbes required for proper fermentation of the feed.

Previous research on feeding probiotics to calves has resulted in a variety of outcomes. Cruywagen, et al (1996) conducted a feed trial on 40 Holstein-Friesian calves in which they fed one group *Lactobacillus acidophilus* in their milk replacer and the control group just received milk replacer without the additive over a period of 6 weeks. Their goal was to determine whether this additive would increase the body weight of the calf. They found that it did not affect body weight at any
stage however the control calves lost weight until week two while the test group maintained their weight. My project did not add the probiotic to milk because we wanted the probiotics to enter the rumen not the abomasum, the true stomach. Suckling calves exhibit a reflex, the reticular or esophageal groove, which allows milk to bypass the rudimentary rumen and enter directly into the abomasum to be digested. If the probiotic is in the liquid diet, it would enter the abomasum and be inactivated. To prevent this occurrence the probiotic was added to the starter grain, which would enter the rumen and inoculate it (Ensminger, 1990). Riddell et al (2010) ran a 56-day feeding trial on 40 Holstein calves adding a Bacillus-based probiotic to the milk replacer and starter grain of the test group and feeding the control group milk replacer and starter grain without the additive. Their goal was to determine the effects of the probiotic on calf growth, health, and blood parameters. They found that the probiotic did not affect the calf growth, occurrence of scours, which would indicate poor health, or overall blood hematocrit or plasma levels. This study provided evidence that the probiotic additive would not negatively affect calf health.

Our hypothesis was that a calf’s rumen, which is relatively small and nonfunctional at birth, would be colonized by the microbes in the probiotics provided by the Dairyman’s edge pro and increase in size and function (Fig. 1). As the rumen develops the calf will become less reliant on milk and be able to digest more grains and hay, therefore allowing the calf to be weaned at a younger age.

![Image of calf anatomy](image1.png)

**Figure 1.** Differences in the anatomy of a calf’s gastric tract versus that of an adult cow.
Methodology

A total of 72 Holstein heifer calves were assigned at birth to one of two groups: the control group was fed grain without any probiotics and the treatment group was fed the same grain, but with the addition of the probiotic, Dairyman’s Edge Pro®. Both grain mixtures contained 22% protein and were considered nutritionally balanced for calves in this age group. To be eligible to be in the study, a calf had to be a single birth, in good health, and weigh more than 27kg at birth. The calves were group housed, six per pen, and group fed about four liters of pasteurized milk twice daily no less than 10hrs apart. The milk was tested on a weekly basis to ensure nutritional consistency. After one week, the calves in a pen were offered either the test grain or control grain, ensuring that there was more than sufficient feed for the group, i.e. some was left over. At the same time, they were also provided with fresh water renewed at least once a day. The duration of the feed trial was 60 days, during which measurements were taken of each calf at birth, 30 days old, weaning and 60 days old.

Individual calf measurements included:

- Body weight, taken by placing the calf on a standing scale and recording the weight shown.
- Hip height, taken with the use of a T-stick, measuring the height at the iliac crest.

Pen measurements included:

- Recording the amount of feed offered to each pen on a daily basis, making sure to provide more feed than pen had eaten the day before.
- Recording the amount of feed refused by each pen at the end of each day.
- Recording the occurrence of illness of each calf, by documenting the medications they were given for treatment.
To calculate how much each pen was eating on a daily basis, the amount refused was subtracted from the fed. When a pen was eating an average of 5.5kg of grain a day, for three consecutive days, then the weaning process began. Weaning involved reducing milk feeding to once daily and increasing the amount of grain offered for seven days. On the eighth day, the calves were considered weaned and milk feedings ceased. The study proceeded in this respect, until each calf reached 60 days old, following a split-plot repeated measurement statistical design. To assess the data collected, the Student’s T-test was applied, where the independent variable was the feed group and the dependent variables were calf height and weight’s, as well as the amount of feed consumed. The p-values were calculated using the SPSS computer software program.
Results

Body Weight and Hip Height

Past research concerning the effects of feeding probiotics to calves has lacked consistent results. This study confirms the findings of Cruwagen et al. and Riddell et al. stating no difference between the control and treatment group in regard to differences in body weight (Fig. 2) and height (Fig. 3). Statistical analysis of the data represented in Figure 1 determined a $p=0.403$ which is insignificant at 0.05 level with 95% confidence. Statistical analysis of the data represented in Figure 3 resulted in a $p=0.133$.

Figure 2. The increase in body weight over time for the treatment and control groups.
Figure 3. The increase in hip height over time for the treatment and control groups.

**Starter Grain Intake**

The daily amount of starter grain ingested per pen by the treatment group was slightly less than that of the control group, but the difference was not significant at $p=0.247$. (Fig.4)

Figure 4. The daily intake of starter grain per pen for the treatment and control groups.
Age-at-Weaning

In disagreement with previous studies as to days-to-weaning, Riddell et al. found no effect on days-to-weaning, however this study found a small difference of about two days between the treatment group and the control group. Nonetheless, the difference is still too small to be statistically significant (p=0.295) (Fig. 5).

Figure 5. The average age-of-weaning of the treatment and control groups.
Milk Components

To ensure consistency in the milk fed to the calves, a sample was taken and tested weekly for fat, protein, lactose, and total solid levels. (Fig. 6) With the exception of one date point, the results demonstrate consistent milk content. The outlying date point is likely the result of improper collection or storage of the sample.

Figure 6. The percentage of fat, protein, lactose and solids present in the milk fed to both groups of calves.
Incidence of illness

The incidence of illness was recorded to determine if there was any differences between the treatment and control groups. An illness at Level 1 refers to mild to moderate illnesses, like common scouring treated with broad-spectrum antibiotics. At Level 2 the calf has a more serious condition such as pneumonia, which needs to be treated with stronger medications like Baytril, Draxxin, Nuflor or Micitil. The treatment group had 25 Level 1 calves with mild to moderate illness and only five Level 2 calves treated for more serious conditions. The control group contained 21 Level 1 calves that had mild to moderate illness with only 5 Level 2 calves needing stronger medication.

Figure 7. The incidence of illness within the control and treatment groups.
Discussion

From these results we can conclude that the probiotic components in the Dairyman’s Edge Pro® did not result in faster calf growth or a younger age at weaning. An explanation for this could be the minimal stress environment in which a calf is reared, since probiotics are more effective during times of stress. If so, a trial on beef calves could produce different results as they more exposed to the elements and times of stress. Another explanation for the results could be the combination of probiotic components; a component may be absent which could have made the product more effective. Nevertheless, the actual function of the product inside the calf is unknown and could be the subject of future research with Dairyman’s Edge Pro®. One possible avenue for future study could be to collect and culture fresh fecal samples from calves in the control and test groups to determine if any of the probiotics were being established in the digestive tract. Another route could be to collect samples of rumen contents or blood samples for culture without undue stress on the calves. A third less desirable route would be to sacrifice a calf from each group at predetermined intervals during the study to collect and culture their digestive tract microbial contents.
Bibliography


