THE EFFECTS OF METAPHYLAXIS AND MILK REPLACER ADDITIVES ON HEALTH AND GROWTH OF NEONATAL HOLSTEIN BULL CALVES

A Junior Scholars Thesis

by

KATHERINE GRACE DEHAAN

Submitted to the Office of Undergraduate Research
Texas A&M University
in partial fulfillment of the requirements for the designation of

UNDERGRADUATE RESEARCH SCHOLAR

April 2010

Major: Animal Science

THE EFFECTS OF METAPHYLAXIS AND MILK REPLACER ADDITIVES ON HEALTH AND GROWTH OF NEONATAL HOLSTEIN BULL CALVES

A Junior Scholars Thesis

by

KATHERINE GRACE DEHAAN

Submitted to the Office of Undergraduate Research
Texas A&M University
in partial fulfillment of the requirements for the designation of

UNDERGRADUATE RESEARCH SCHOLAR

Approved by:

Research Advisor:	Glenn A. Holub
Associate Dean for Undergraduate Research:	Robert C. Webb

April 2010

Major: Animal Science

ABSTRACT

The Effects of Metaphylaxis and Milk Replacer Additives on Health and Growth of Neonatal Holstein Bull Calves. (April 2010)

Katherine Grace DeHaan
Department of Animal Science
Texas A&M University

Research Advisor: Dr. Glenn A. Holub
Department of Animal Science

A study evaluating the effects of metaphylaxis antibiotics and milk replacer additives on the health and development of Holstein bull calves (n=52; mean body weight=42.28 kg + 3 kg; starting age <3 days) was conducted. The calves were placed into a completely random 3 x 4 factorial design with each group receiving either tilmicosin phosphate (TIL), ceftiofur crystalline free acid (CEF), or saline solution (CON) injected subcutaneously into the neck area. For the duration of the study, the calves also received a commercial milk replacer powder (22% Crude Protein / 20% Crude Fat) fed at 1.1% BW. Within metaphylaxis treatment, calves were randomly assigned to receive either: 1) 4 g/d for 7 d and then 2 g/d for 14 d of an egg-based probiotic (PR); 2) 2 g/d of 96% betaine (BE); 3) both PR and BE (BP); or 4) no additives .

The calves were housed in individual fiberglass hutches with commercial calf starter and water provided ad libitum. The body weight of each calf was recorded twice weekly in addition to daily recordings of fecal scores (1 = firm to 4 = watery) for 54 days. Medical treatments provided to each calf for scours, respiratory distress, or febrile events were recorded daily. The cumulative response of these incidences were analyzed and used as an index of morbidity. None of the additive effects were significant for any of the measured variables. The use of metaphylaxis did not significantly affect the average daily gain (P>0.60) as the average daily gain was ~ 0.45 kg. However, when examining fecal scores, CEF and TIL significantly reduced the average fecal score over the control ((1.85 vs. 1.97 vs. 2.20 respectively) (P<0.01)). The incidences of neither fever nor respiratory issues (P>0.20) were influenced dramatically by metaphylaxis. Overall, the average treatments for fever was only 0.66 events and 0.39 events for respiratory distress for all calves. Metaphylaxis did not influence the occurrence of scours (fecal score >2) (P>0.87). Other than fecal score, these results indicate the use of metaphylaxis did not enhance productivity or reduce morbidity of Holstein neonatal bull calves.

ACKNOWLEDGEMENTS

I would like to thank my research advisor, Dr. Glenn A. Holub, for his time and assistance on this project. I would also like to thank Dr. Sawyer for his input and guidance of this project and for his help with statistical analysis.

I also send a sincere thank you to my parents and my sister. Without the financial support of my parents, I would not have been able to complete this project. In addition, my family also proof-read my thesis countless times and offered their support whenever possible.

It has been a tough project with many trials and tribulations, and I am very grateful for the many people who have offered help and assistance throughout the year. I could not have completed this project and thesis without the support of the many wonderful people in my life.

NOMENCLATURE

ADG	Average Daily Gain
APT	Adequate Passive Transfer
BE	Betaine 96%
BP	Protimax® then Betaine 96%
BR	Protimax®
BRD	Bovine Respiratory Disease
BW	Body Weight
CEF	Ceftiofur Crystalline Free Acid (Excede®)
CON	Saline Solution
IgG	Immunoglobin
MG	Metaphylactic Groups
MRA	Milk Replacer Additive Groups
MG/MRA	Metaphylaxis/ Milk Replacer Additive Interaction
NA	No Additional Supplement
RR	Respiratory Rate
TIL	Tilmicosin Phosphate (Micotil®)
TSP	Total Serum Protein

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE Page

LIST OF TABLES

CHAPTER I

INTRODUCTION

The dairy business is one of the most rapidly growing and dynamic industries in Texas. There are approximately 125.6 million cows used for milk production in the world. In the United States, the average dairy herd size is 121.5 milk cows, which has increased from 93.8 milk cows in 2001 and has more than doubled the average of 53.9 milk cows in 1991 (USDA, 2007). Along with the enhancement in cattle numbers, comes the increase in calf numbers. Calf management protocols have been a topic of concern and frustration among dairy producers for years, whether calves are raised on a small or large scale dairy farm or calf ranch. The most effective calf rearing methods are still being explored and decided today.

Dairy producers raise and condition their calves to serve as either heifer replacements, veal, steers for beef production, or bulls used for reproduction. Results of recent studies have focused attention on calf rearing programs which provide proper care and optimize health during the pre-weaning to post-weaning phases. Drackley (2000), indicated that the pre-weaning phase is the best time to optimize genetic growth.

This thesis follows the style of Journal of Dairy Science.

This is based on studies showing current calf programs compromise the potential of dairy calves during this important time. The most ideal time to most efficiently optimize calf growth is during the first 2 months of life (Chester-Jones et al., 2004).

The practice of using metaphylaxis (mass medication application) is common in the beef industry to sufficiently manage highly stressed, newly shipped cattle, whereas the addition of a milk replacer additive is used throughout the dairy industry to reach the same result. Could combining these practices result in better herd health and lower mortality and morbidity rates when administered to neonatal Holstein bull calves? This study focused on using metaphylaxis and milk replacer additive to treat calves. Factors such as morbidity, mortality, body weight (BW), fecal score, average daily gain (ADG), and number of treatments for scours, respiratory symptoms, and febrile events were recorded and evaluated to help answer this question.

Metaphylaxis

A metaphylactic agent (typically an antibiotic) can be used as both a prophylactic and a therapeutic. The term prophylaxis indicates an antibiotic is used as a preventative therapy while therapeutic describes its use in disease treatment. Generally, metaphylactic treatments are used to effective manage newly received, highly stressed cattle more effectively than without treatment. Newly transported cattle become more susceptible to disease as their stress levels increase drastically during shipping. Furthermore, they are usually commingled with cattle from various locations which increases the likelihood of exposure to pathogens of which they have no immunity. The use of metaphylaxis helps reduce these chances, primarily Bovine Respiratory Disease (BRD), especially for cattle which are not properly vaccinated. However, the use of metaphylactic therapy in the dairy industry is uncommon, especially in neonatal calves.

In the beef industry, research using metaphylactic therapy has been proven to reduce the occurrences of diseases in cattle, improve performance and gain, and reduce morbidity (Booker et al., 2006; Galyean et al., 1995; Guthrie et al., 2004). In a study conducted by Galyean et al. (1995), tilmicosin phosphate was used as a metaphylactic agent. The results indicated a positive result with little to no treatment for BRD in the herd. Lofgreen (1983) conducted a study using oxytetracycline and sulfadimethoxine as metaphylactic agents. This study's results demonstrated a 21% reduction in treatments for morbidity when given oxytetracycline and a 20% reduction for calves treated with sulfadimethoxine. Booker et al. (2006) discovered similar results with the use of ceftiofur crystalline free acid. The ceftiofur crystalline free acid group had significantly lower mortality and chronicity rates with a significantly higher average daily gain.

Feed intake and ADG

Feed intake and ADG are also factors negatively affected by stress and morbidity. When these aspects are suppressed, the final may be reduced or of lesser quality, in addition, the production costs may be increased. With the use of metaphylaxis to alleviate stress and increase health, feed intake and ADG can also improve. In a study conducted by

Lofgreen (1983), results showed metaphylaxis significantly ($P<.05$) increased feed intake and ADG when compared to the control group (no antibiotic). Feed intake increased from 4.48 kg/day in the non-antibiotic group to 4.65 kg/day in the antibiotic group. ADG was 1.11 kg/d in the antibiotic group and .99 kg/d in the non-antibiotic group. Cusack (2004) found similar results when using tilmicosin and oxytetracycline. Calves treated with tilmicosin ($P<0.05$) had a significantly higher ADG (1.67 kg/animal/d) versus calves treated with oxytetracycline (1.59 kg/animal/d) and non-antibiotic (1.59 kg/animal/d).

Milk replacer additives

Milk Replacer Additives have been shown to increase feed intake as well as ADG in addition to aiding the immune system. There have been many ideas as to which extra nutritional milk replacer supplements are the most beneficial and effective. Two such additives are Protimax® and Betaine 96%. Protimax® (Trouw Nutrition) (43% CP, 30% CF) is composed of pasteurized dried egg mixed with antibodies and other nutrients. It is labeled to increase the effectiveness of the neonatal immune system. Betaine 96% is a trimethlglycine compound found to aid in feed efficiency and in the reduction of the incidence of scours. Betaine is a methylating form of choline and serves as a replacement for choline in rations. As of this time, there is no sound documentation for calf management as to the effects, positive or detrimental, of adding either formulation.

CHAPTER II

METHODOLOGY

Sixty Holstein bull calves were purchased from two dairy farms located in the Texas Panhandle. During the initial stages of the project however, eight were culled due to health reasons leaving the project with fifty-two. In order to be placed into the experiment, the calves had to meet the following standards: considered true Holstein by color and markings, be three to five days of age at the time of purchase, fed colostrum no later than two hours after they were born, and weigh approximately 45 kg. The duration of the trial was 8 weeks (56 days) and took place during the summer months of June-September in Brazos County, Texas.

Upon arrival to the research site, the calves (3-4 days old) were processed immediately. This included recording measurements of: body weight (BW), immunoglobulin (IgG) levels, and Total Serum Protein (TSP) levels. These levels were evaluated in order to insure adequate passive transfer of immunity as well as to assign the calves a specific experimental protocol. For the first 2 days, the calves went through an adaptation period in which they received 4.00 L of milk replacer per day (Land O' Lakes Maxi Care 25% crude protein, 20% crude fat) with 2.00 L given in the morning and 2.00 L given in the evening. For the subsequent 9 days, 0.45 kg/calf/day of milk replacement powder was administered followed by 1.1% of BW adjusted weekly for each treatment group's mean beginning on day 10. Each group also received ad libitum water and 18% CP calf starter

(Calf Niblets, Gore Bros. Inc., Comanche, TX). Throughout the experiment, the calves were individually housed in fiberglass hutches (Calftel®) spaced 3 m apart to prevent spread of diseases. Post-adaptation, each calf received the previously assigned protocol. Additionally, a 7-way clostridium vaccine (Agri-labs, Schering-Plough Animal Health Corp., Union, NJ) was administered subcutaneously on day 10 to prevent *Clostridial* species diseases (*chauvoei, septicum, novyi, sordellii, perfringens* Types C & D).

Two metaphylactic agents (antibiotics) were used: tilmicosin phosphate (TIL) and ceftiofur crystalline free acid (CEF). Metaphylaxis treatments were administered on day 2 of the study. Three groups were stratified to effectively evaluate the outcome of the antibiotic use. Group 1 received TIL (Micotil ®),(Elanco Animal Health, Indianapolis, IN), (10 mg CE/kg, 1.5 mL/45.36 kg) administered subcutaneously in the neck area, Group 2 received CEF (Excede ®),(Pfizer Animal Health, New York, NY), (6.6 mg CE/kg, 1.5 mL/45.36 kg) administered subcutaneously in the posterior base of the ear, and group 3 received saline solution (CON),(1.5mL) administered subcutaneously in the neck area to serve as the control group.

The calves were fed 2.00 L of milk replacer (Land O’ Lakes Maxi Care 25% crude protein, 20% crude fat) every twelve hours at 0600 h and 1800 h. Milk replacer was prepared by mixing the powder with water at 43.00°C using an electric mixer. In addition, the calves received a supplement treatment added to the milk replacer. The two supplements used were: Protimax ® (43% CP, 30% CF), (Trouw Nutrition, Highland,IL) and Betaine 96%. The supplements were added to the milk replacer during mixing. The calves were sorted into four subgroups, with each group receiving a different supplement treatment protocol. The first treatment consisted of an addition of 4.00 g/day of Protimax ® for 7 days then a subsequent reduction which eventually reached 2.00 g/ day for the next 14 days (PR); treatment 2 consisted of 2.00 g/day of Betaine 96% added from day 3 through day 54 (BE); treatment 3 consisted of 4.00 g/day of Protimax ® for 7 days, then 2.00 g/day for the next 14 days with 2.00 g/day of Betaine 96% added from days 3 thru 54 (BP); and the fourth treatment served as the control in which the calves received milk replacer with no additional supplement (NA). For the duration of the study, water and an 18% calf starter was provided ad libitum.

In order to keep an accurate record of herd growth, BW was recorded bi-weekly on Tuesdays at 1800 h and Saturdays at 0600 h. Additionally, calf starter refusals were weighed and recorded daily at 1800 h while water intake was also weighed and recorded daily at 0600 h. ADG was calculated at the end of the project by subtracting the beginning BW from the end BW and then dividing the total by the number of days in the study (54 d).

To maintain adequate herd health, fecal score was recorded each a.m. to serve as an indicator of morbidity. Morbidity rate was defined as number of calves treated for a disease or illness, while mortality was defined as death or culling from the study due to severe disease or illness. At all feedings, each calf was inspected for possible illness.

Fecal score was recorded daily using a numbering system from 1-4 (1 = formed, hard; 2 = pudding consistency; 3 = pancake batter consistency; 4 = mixture of watery liquid and solids). If a calf recorded a high fecal score, the calf received an electrolyte scour treatment of Re-Sorb® (Pfizer Animal Health, Exton, PA).

Respiratory rates (RR) were also measured and recorded twice daily at each feeding. This also served as a further indicator of morbidity. Calves with abnormal RR were treated with a preventative of 3.00 cc of florfenicol (Nuflor®, Intervet, Schering-Plough Animal Health Corp., Summit, NJ) given subcutaneously. Furthermore, rectal temperature was recorded and evaluated twice daily. Calves with a rectal temperature greater than 40 °C were treated orally with 1.00 cc of flunixin meglumine (Banamine®, Intervet, Schering-Plough Animal Health Corp., Summit, NJ) to reduce fever and possible lung inflammation that has been known to accompany BRD.

On day 54, all calves started the weaning process, at which time the data recording ceased. During the 2-day weaning period, the calves received only 2.00 L of milk replacer per day with calf starter and water provided ad libitum.

Data analysis

All recorded data was entered into a spreadsheet program (Excel, Microsoft Corp., Redmond, WA, 2003) daily. Data was analyzed in a completely randomized design with a 3 X 4 factorial treatment arrangement using an analytical software program (SAS

System for Windows, 9.1, SAS Institute Inc., Cary, NC, 2002-2003). The least square means of BW and fecal score were evaluated by PROC MIXED for Repeated Measures with metaphylactic agents, milk replacer additives, and metaphylactic agent by milk replacer additive serving in the model:

$Y_{ijklm} = \mu + D_i + T_j + A_k + TD_{ij} + AD_{ik} + TA_{jk} + CT_{jl} + e_{ijklm}$

μ = overall population mean

D = day effect as a continuous variable (i=1-54)

T = effect of milk replacer additive (j=1,2,3,4)

A = effect of metaphylactic agent (k=1,2,3)

TD = effect of milk replacer additive combined with day

AD = effect of metaphylactic agent combined with day

TA = effect of milk replacer additive with metaphylactic agent

CA = effect of l^{th} calf (l = 1,44) within k^{th} treatments

e = the random error term.

ADG, number of treatments for scours, respiratory symptoms, and febrile events were analyzed using PROC MIXED with metaphylactic, milk replacer additive, and metaphylactic by milk replacer additive as the model:

$Y_{ijkl} = \mu + T_i + A_j + TA_{ij} + e_{ijk}$

μ = overall population mean

T = effect of milk replacer additive (j=1,2,3,4)

A = effect of metaphylactic (k=1,2,3)

TA = effect of milk replacer additive with metaphylactic

e = random error term.

CHAPTER III

RESULTS

Throughout the study, eight of the fifty-two calves had to be culled from the project for severe morbidity with five eventually reaching mortality. Data collected on the remaining forty-four calves was evaluated and analyzed to reach a conclusion. The metaphylactic agents, milk replacer additives, and interactions between the two had no profound effect on BW, ADG, or reduction in number of treatments for scours, respiratory symptoms, or febrile events. Additionally, fecal score was not affected by additives (P>0.18), nor interaction with metaphylaxis (>0.14), but was reduced by metaphylaxis (P<0.01) as shown in Tables 1, 2, and 3.

Table 1. LSM for Metaphylaxis

Variables	Micotil	Excede	Control	P-value
BW (kg)	47.59 ± 1.57	47.99 ± 1.41	48.99 ± 1.55	0.8042
ADG (kg)	0.44 ± 0.04	0.41 ± 0.03	0.46 ± 0.04	0.5903
Fecal Score	2.00 ± 0.04[b]	1.86 ± 0.04[a]	2.03 ± 0.04[b]	0.0061
Number of Treatments for Scours	7.22 ± 1.18	5.89 ± 1.06	7.42 ± 1.24	0.5787
Number of Treatments for Respiratory Symptoms	0.41±0.15	0.17±0.14	0.50±0.16	0.2632
Number of Treatments for Febrile Events	0.27 ± 0.30	0.83 ± 0.26	0.52 ± 0.31	0.3634

[a,b] Means without a common superscript were significantly different (P<0.01).

Table 2. LSM for Milk Replacer Additive					
Variables	PR	BE	NA	BP	P-value
BW (kg)	47.52 ±1.77	47.61±1.72	47.66±1.80	48.42±1.69	0.9809
ADG (kg)	0.41±0.04	0.44±0.04	0.45±0.04	0.47±0.04	0.7198
Fecal Score	1.97±0.05	1.99±0.04	2.01±0.05	1.88±0.04	0.1860
Number of Treatments for Scours	6.47±1.44	7.93±1.29	7.13±1.35	5.83±1.26	0.6923
Number of Treatments for Respiratory Symptoms	0.69±0.19	0.47±0.17	0.17±0.18	0.11±0.17	0.0931
Number of Treatments for Febrile Events	0.33±0.36	0.69±0.32	0.58±0.34	0.56±0.32	0.9047

Table 3. LSM for Metaphylactic with Milk Replacer Additive													
	Micotil				Excede				Control				
Variables	PR	BE	NA	BP	PR	BE	NA	BP	PR	BE	NA	BP	P-value
BW (kg)	48.50 ± 2.74	49.07 ± 2.45	45.07 ± 3.85	46.26 ± 3.15	45.25 ± 3.15	46.17 ± 3.15	49.17 ± 2.45	49.67 ± 2.25	48.80 ± 3.15	47.60 ± 3.15	48.75 ± 2.74	49.32 ± 3.15	0.8088
ADG (kg)	00.45 ± .06	00.46 ± .05	00.37 ± .09	00.49 ± .07	00.37 ± .07	00.36 ± .07	00.44 ± .05	00.49 ± .05	00.40 ± .07	00.48 ± .07	00.53 ± .06	00.43 ± .07	0.6348
Fecal Score	1.94 ± .07	1.94 ± .06	2.17 ± .09	1.96 ± .08	1.84 ± .08	1.94 ± .08	1.88 ± .06	1.72 ± .06	2.12 ± .08	2.04 ± .08	1.97 ± .07	1.97 ± .08	0.1427
Number of Treatments for Scours	5.75 ± 2.08	7.80 ± 1.86	8.00 ± 2.94	7.33 ± 2.40	4.67 ± 2.40	9.00 ± 2.40	6.40 ± 1.86	3.50 ± 1.70	9.00 ± 2.94	7.00 ± 2.40	7.00 ± 2.08	6.67 ± 2.40	0.8118
Number of Treatments for Respiratory Symptoms	0.75 ± 0.27	0.40 ± 0.24	0.50 ± 0.38	-3.67 E-16 ± 0.31	0.33 ± 0.31	0.33 ± 0.31	-5.54 E-17 ± 0.24	5.86 E-17 ± 0.22	1.00 ± 0.39	0.67 ± 0.31	7.71 E-17 ± 0.27	0.32 ± 0.31	0.8198
Number of Treatments for Febrile Events	0.00 ± 0.52	0.40 ± 0.46	3.33 E-16 ± 0.73	0.67 ± 0.60	1.00 ± 0.60	1.00 ± 0.60	1.00 ± 0.46	0.33 ± 0.42	2.59 E-16 ± 0.73	0.67 ± 0.60	0.75 ± 0.52	0.67 ± 0.60	0.8522

Metaphylaxis

The metaphylaxis treatments had no effect on BW (P>0.8) nor ADG (P>0.6). However, there was an increase in BW throughout the study indicated in Figure 1. The overall BW average (48.17 kg) between TIL (47.59 kg), CEF (47.92 kg), and CON (48.97 kg) is demonstrated in Figure 2.

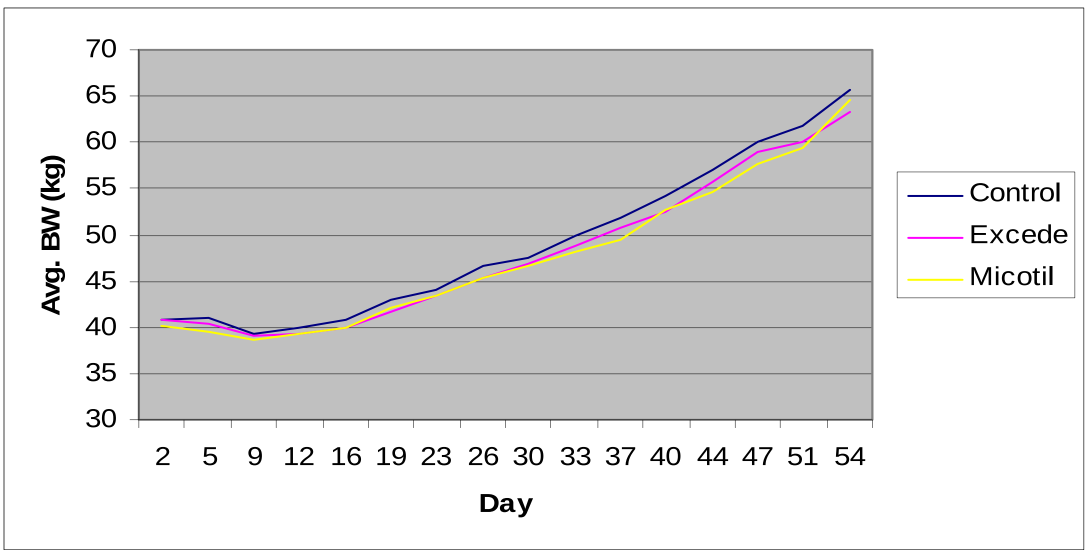

Figure 1. Mean BW from day 1- 54 for MG

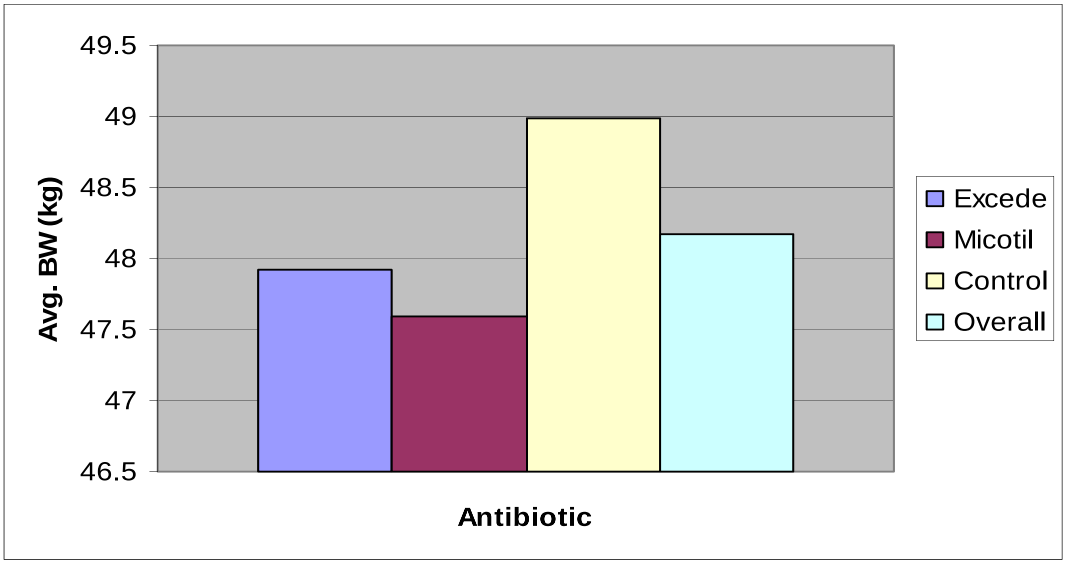

Figure 2. Mean BW for MG

Figure 3 demonstrates the means of the three groups. Overall, the calves gained 0.45 kg/d with averages of: 0.44 kg/d (TIL), 0.41 kg/d (CEF), and 0.46 kg/d (CON).

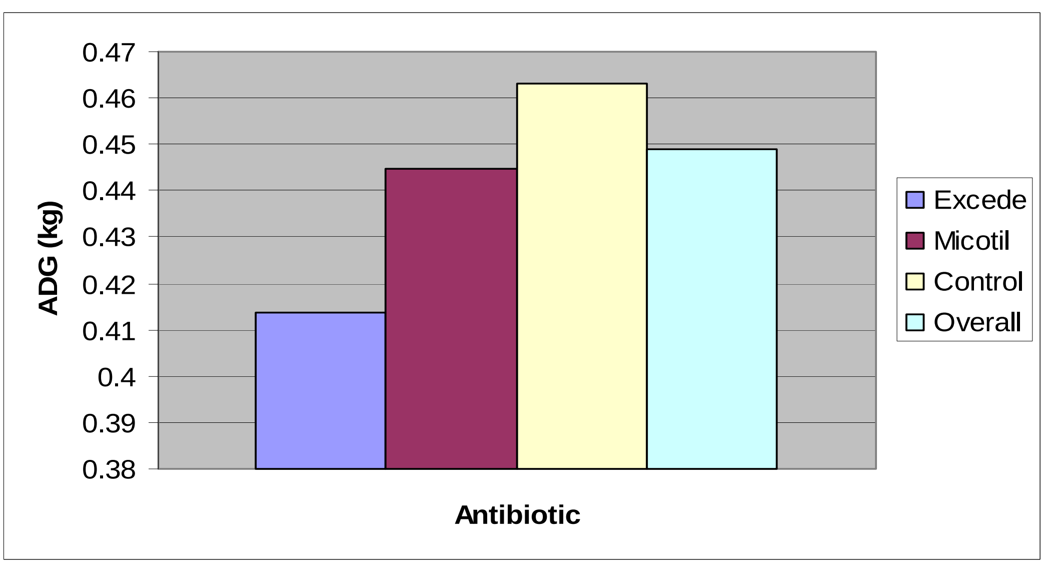

Figure 3. ADG for MG

Fecal score saw a dramatic increase from day 1 through day 6 and then declined steadily for the remainder of the trial. This event could have been the result of stress or environmental changes (Figure 4). It was shown that the fecal scores were reduced by 39% when CEF was administered when compared to both TIL (P<.01) and CON (P<.01). The average fecal score for CEF (1.86) was lower than both TIL (2.00) and CON (2.03) as outlined in Figure 5.

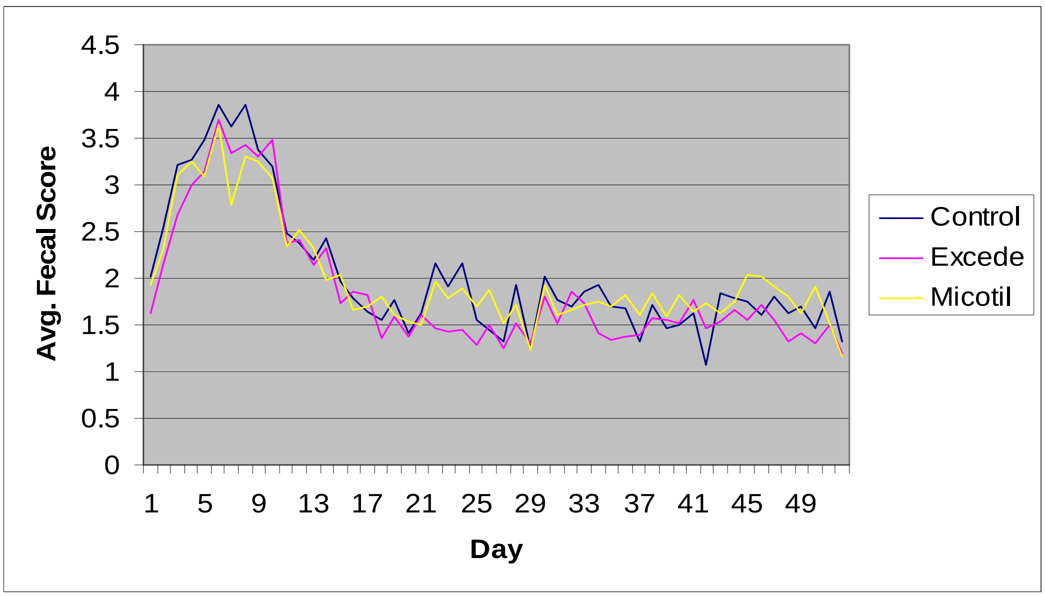

Figure 4. Mean fecal score from day 1-54 for MG

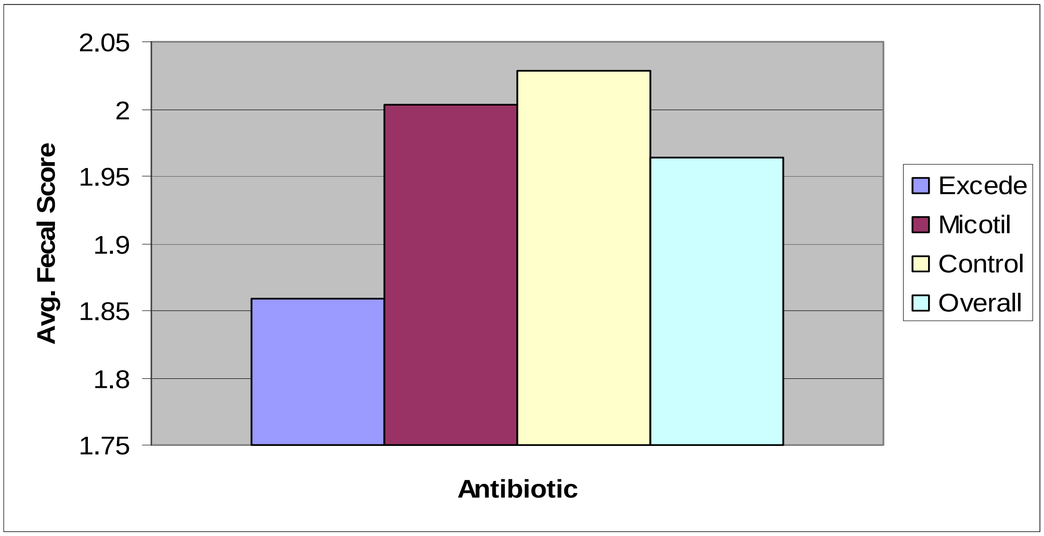

Figure 5. Mean fecal score for MG

Conversely, there was no significant difference in number of treatments for scours ($P > 0.6$), respiratory events ($P > 0.2$), or febrile events ($P > 0.3$) when using metaphylaxis. Throughout the study, the calves were treated for scours an average of 6.84 in the metaphylactic groups. CEF presented the lowest average (5.89) while TIL (7.22) and CON (7.42) were similar (Figure 6). Respiratory symptoms treatments were the lowest for the CEF group (0.17 treatments), while TIL (0.41), and CON (0.5) were once again similar (Figure 7). However, CEF showed the highest average for febrile events (0.83 treatments) while the overall average was lower (0.54) (Figure 8).

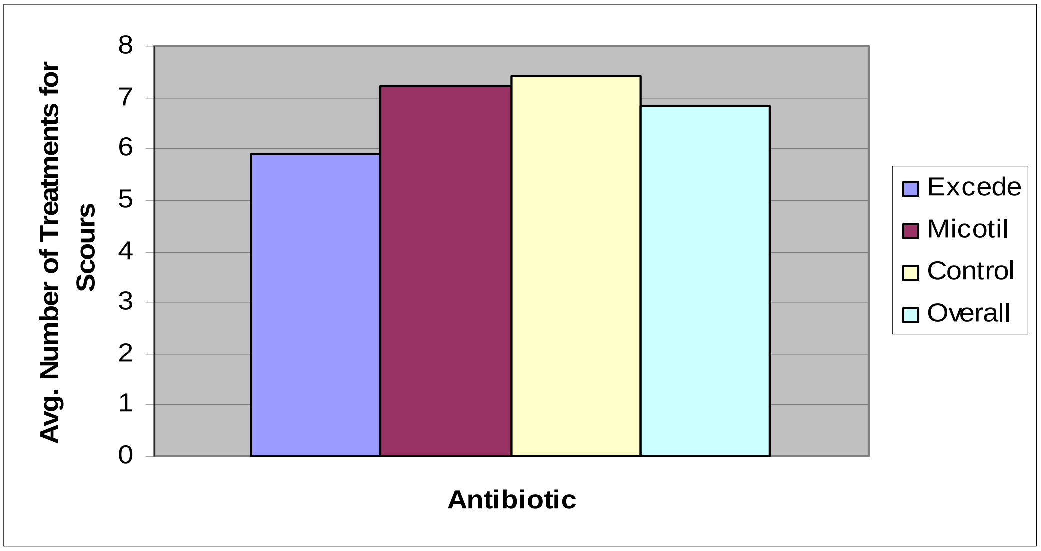

Figure 6. Mean number of scours treatments for MG

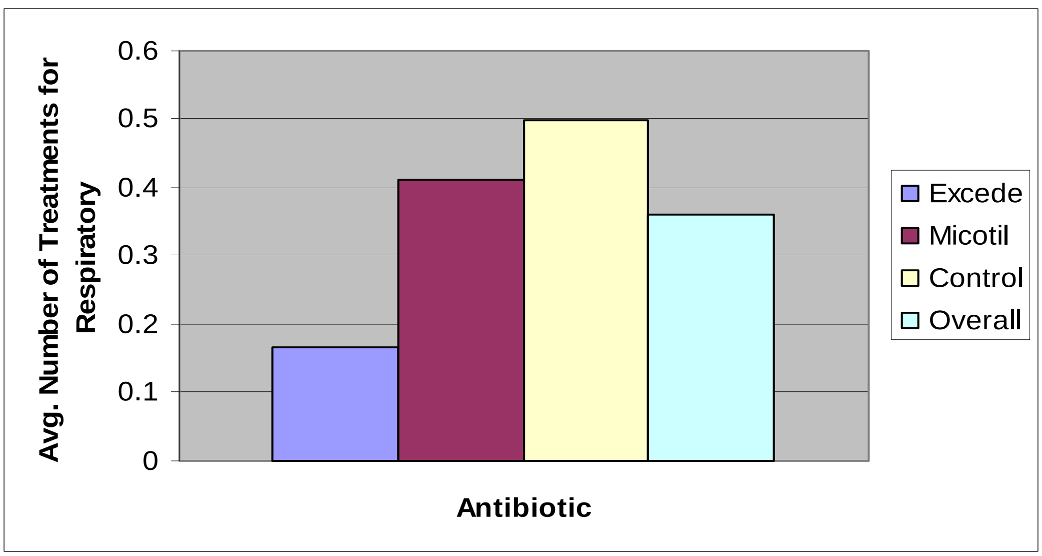

Figure 7. Mean number of respiratory symptoms treatments for MG

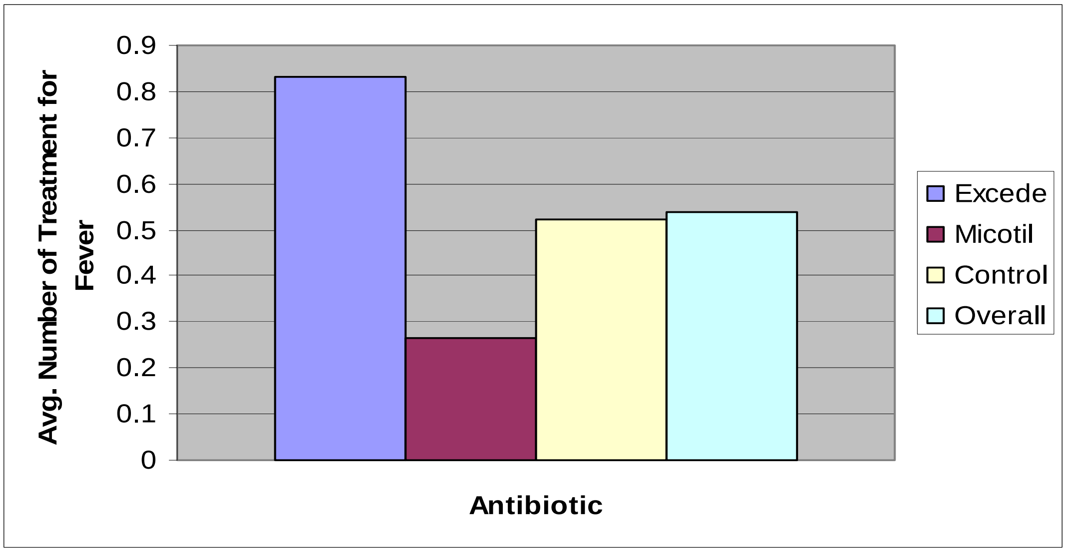

Figure 8. Mean number of febrile event treatments for MG

Milk replacer additive

Milk Replacer Additives had no effect on BW (P>0.98), ADG (P>0.7), fecal score (P>0.18), respiratory symptoms (P>0.09), febrile events (P>0.9) or a reduction in treatments for scours (P>0.69) (Table 2). Figure 9 displays BW ranging from 47.52 kg (PR) to 48.42 kg (BP), with a steady increase throughout the study between the four groups as outlined in Figure 10. The ADG across treatments was 0.44 kg/d, with PR showing the lowest value (0.41 kg/d) and BP showing the highest value (0.47 kg/d) (Figure 11).

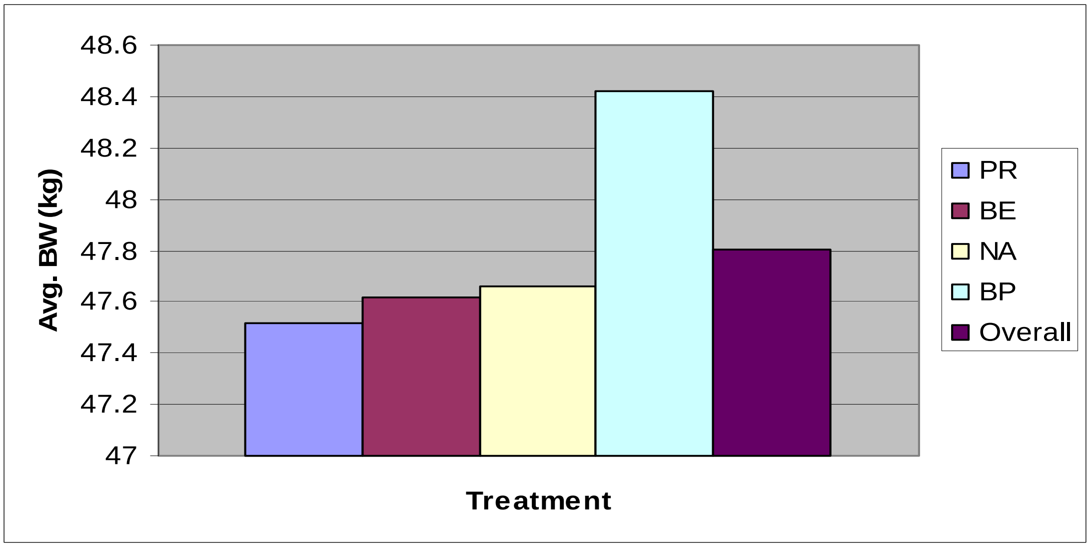

Figure 9. Mean BW for MRA

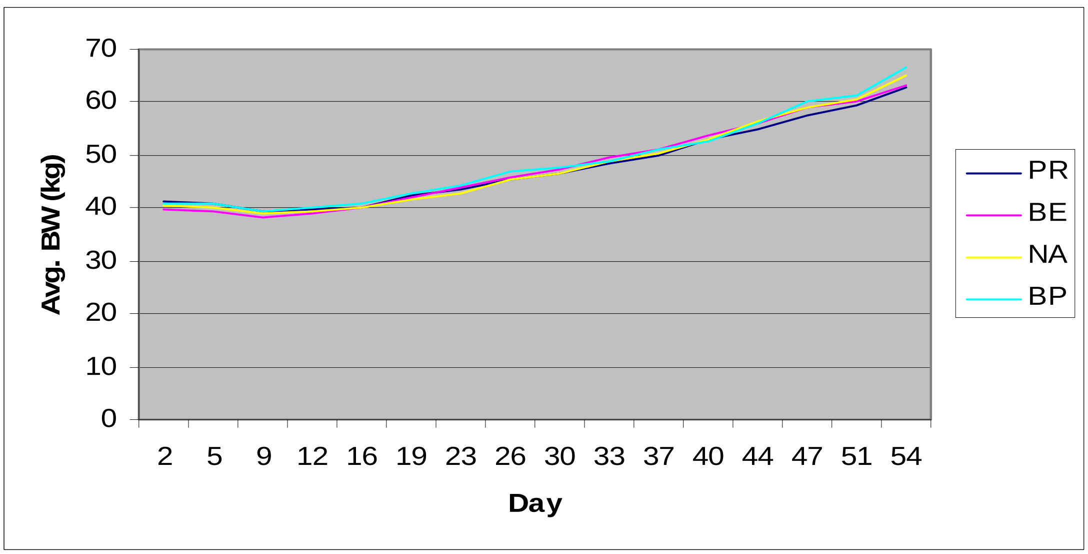

Figure 10. Mean BW from day 1-54 for MRA

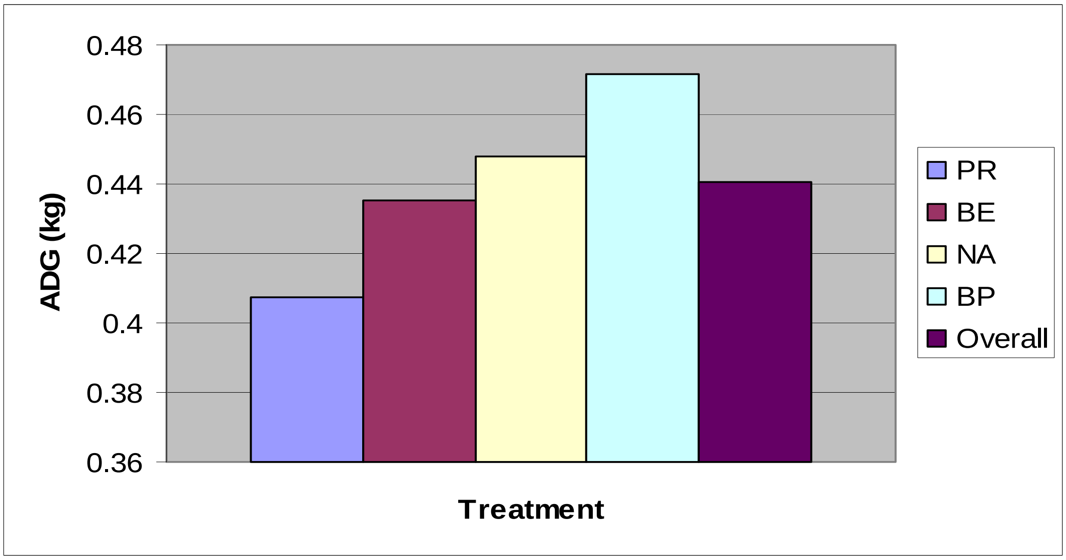

Figure 11. Mean ADG for MRA

The same trend observed in the metaphylactic groups is continued in the milk replacer additive groups (Figure 12). The overall mean fecal score for the additive groups was 1.96, with BP having the lowest score (1.88) as shown in Figure 13.

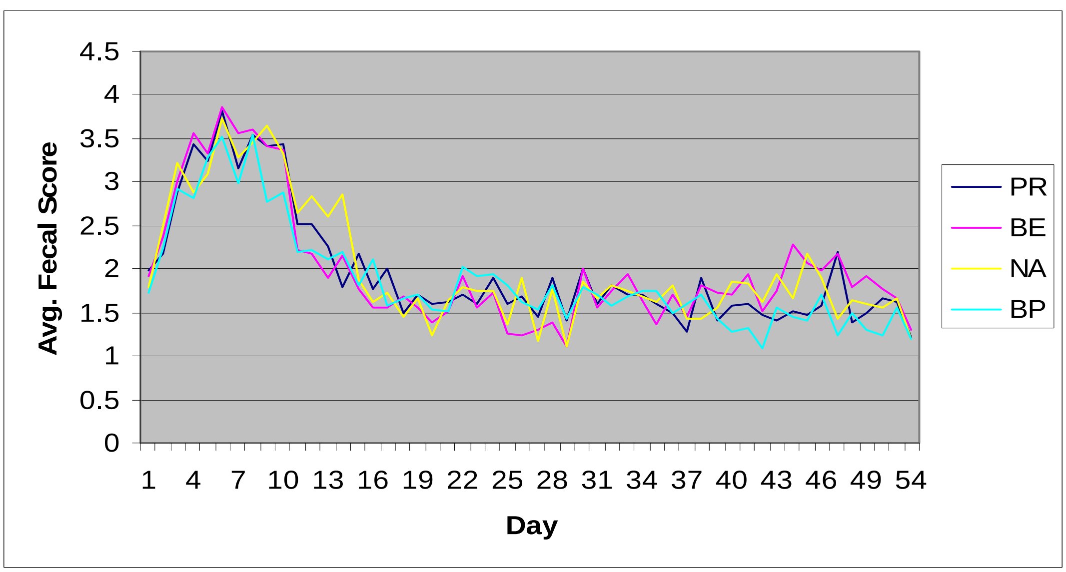

Figure 12. Mean fecal score from day 1-54 for MRA

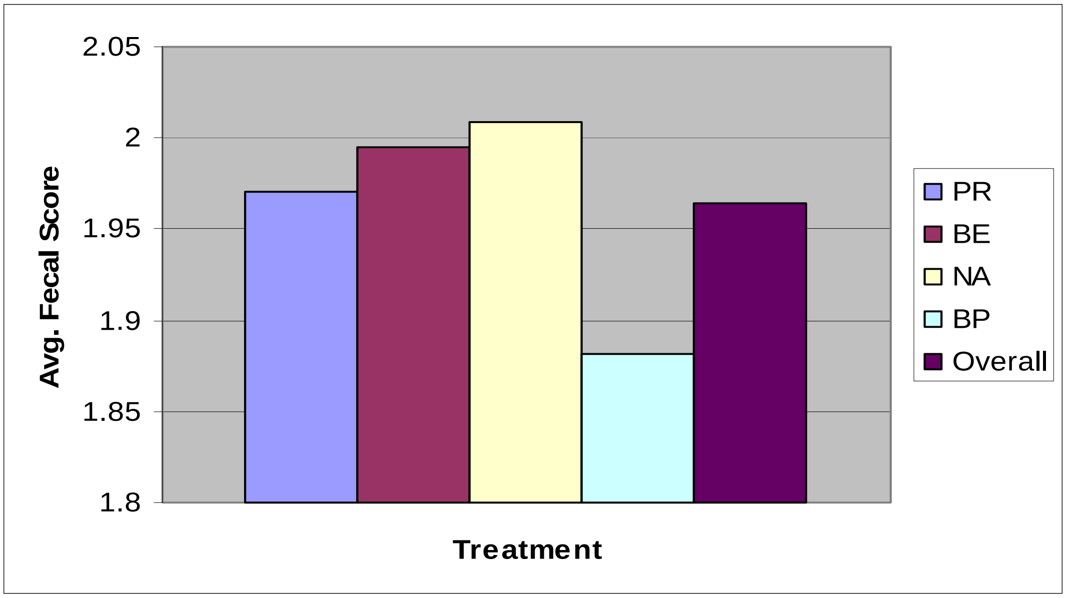

Figure 13. Mean fecal score for MRA

The mean number of respiratory symptoms treatments was the highest in the PR group (0.70) and the lowest in the BP group (0.11) with a mean of 0.36 for all groups combined (Figure 14). The mean number of scour treatments was 6.84 (Figure 15) while the mean number of treatments for febrile events was found to be 0.54 (Figure 16).

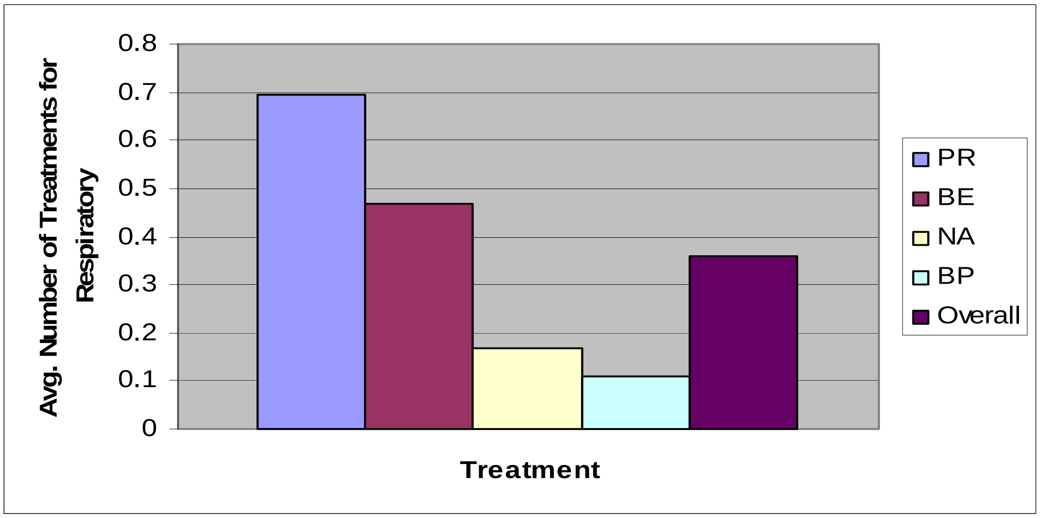

Figure 14. Mean number of respiratory treatments for MRA

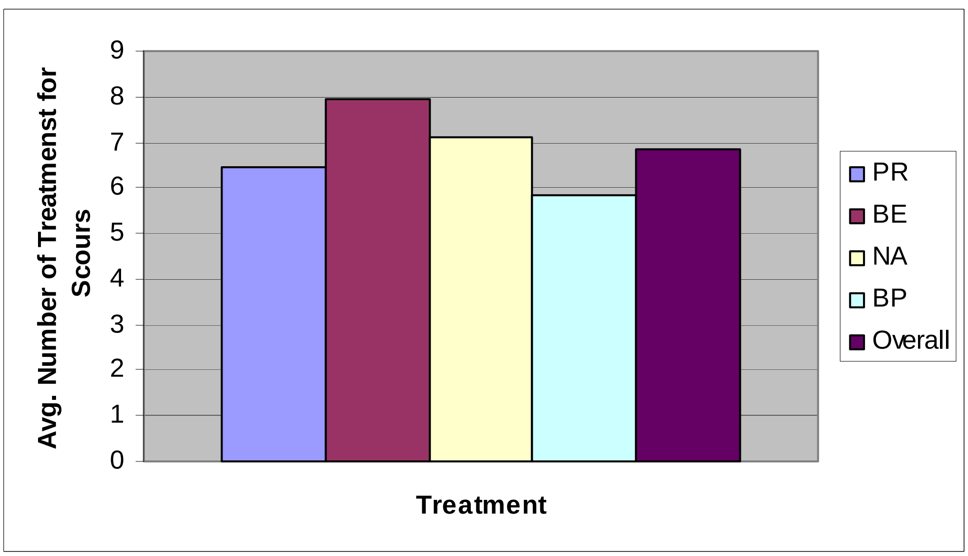

Figure 15. Mean number of scours treatments for MRA

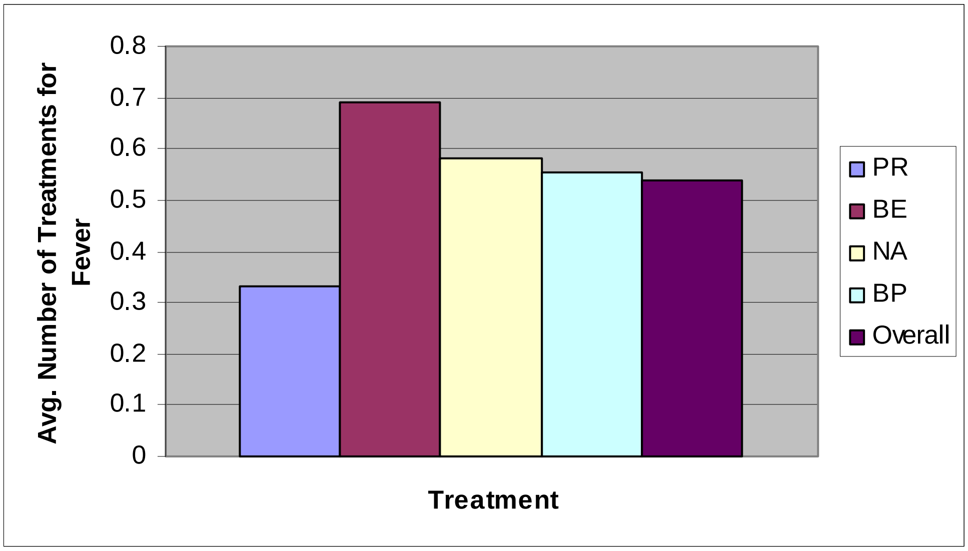

Figure 16. Mean number of febrile event treatments for MRA

Metaphylaxis and milk replacer additive interaction

The interaction of metaphylaxis and milk replacer additive had no effect on the tested variables. Figures 17-34 refer to the metaphylaxis combined with milk replacer for the studied variables. All agents caused a variation in BW with CEF ranging from 45.25 kg (PR) to 49.67 kg (BP), TIL from 45.07 kg (NA) to 49.07 kg (BE), and CON from 47.6 kg (BE) to 49.32 kg (BP). ADG also had a variation from 0.36 kg/d (CEF/BE) to 0.54 kg/d (CON/NA). The fecal score mean was the highest in the TIL/NA groups (2.17) and the lowest in the CEF/BP groups (1.71). CEF/BE and CON/PR reflected the same number of scour treatments (9.00), whereas CON/BE and CON/NA had slightly lower incidents (7.00). The lowest scour treatments were recorded in the CEF/BP mixture group (3.50). The highest respiratory treatment mean was documented in the CON/PR group (1.00), while CEF/PR, CEF/BE, and CON/BR all showed the same mean (0.33). CEF/PR, CEF/BE, CEF/NA all showed a mean of 1.00 treatments for febrile events, TIL/BP, CON/BE, CON/BP had a mean of 0.67 treatments, and the TIL/PR group was the lowest with 0.00 treatments.

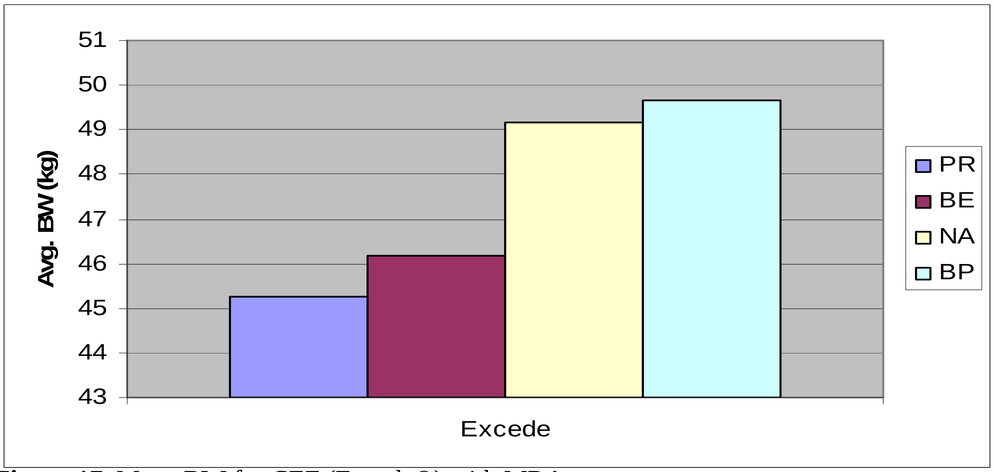

Figure 17. Mean BW for CEF (Excede®) with MRA

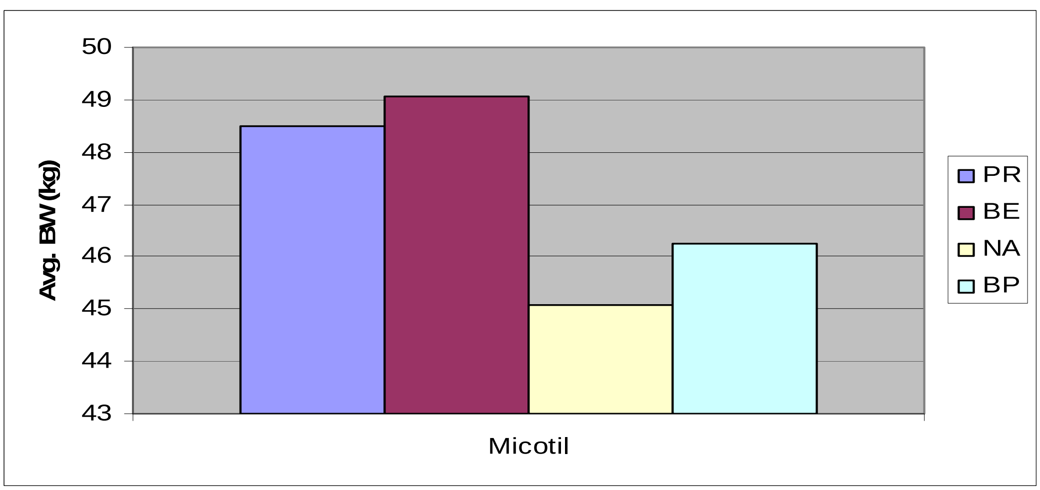

Figure 18. Mean BW for TIL (Micotil®) with MRA

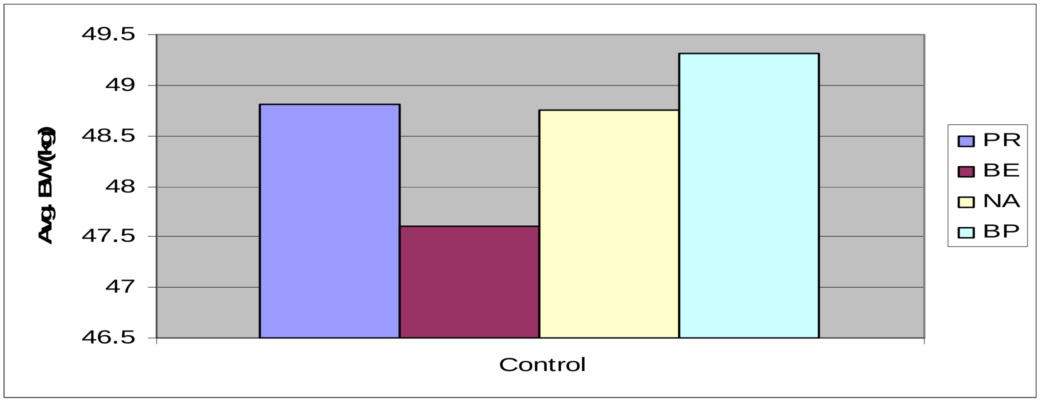

Figure 19. Mean BW for CON (Saline) with MRA

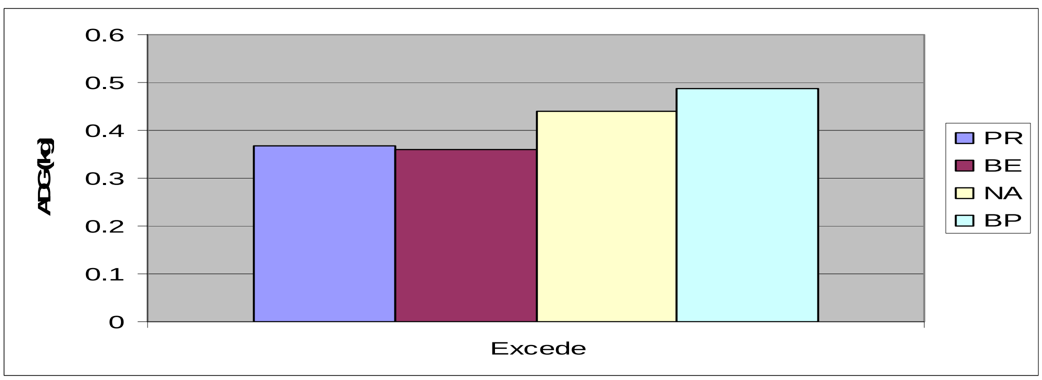

Figure 20. ADG for CEF (Excede®) with MRA

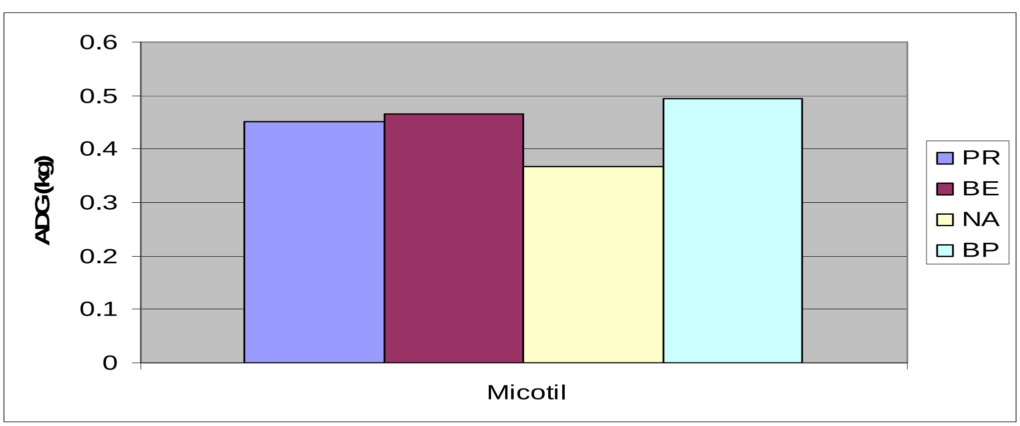

Figure 21. ADG for TIL (Micotil®) with MRA

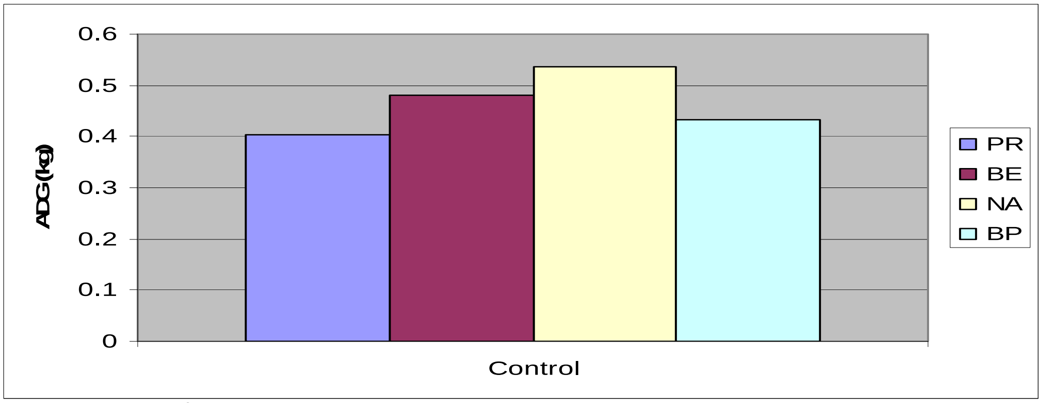

Figure 22. ADG for CON (Saline) with MRA

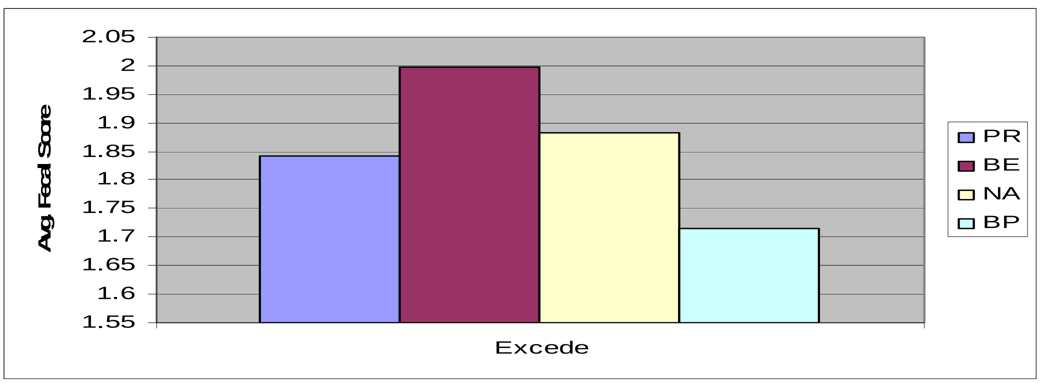

Figure 23. Mean fecal score for CEF (Excede®) with MRA

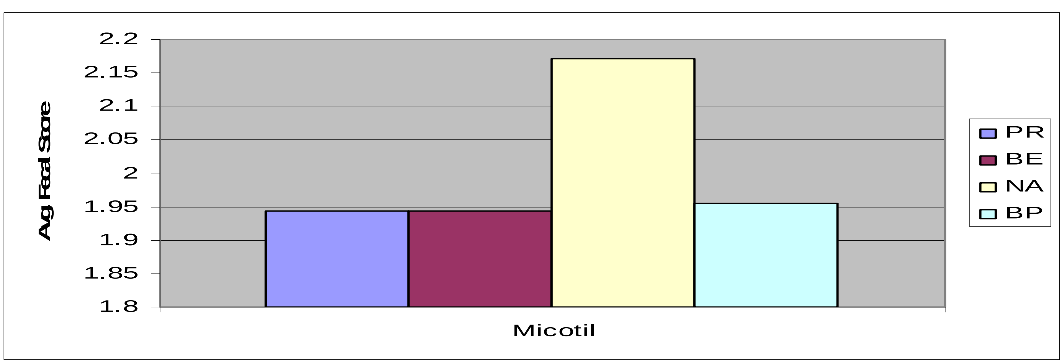

Figure 24. Mean fecal score for TIL (Micotil®) with MRA

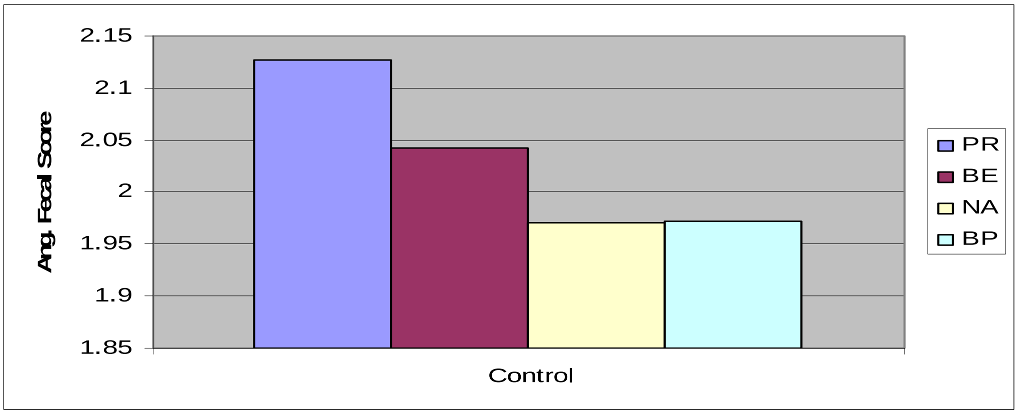

Figure 25. Mean fecal score for CON (Saline) with MRA

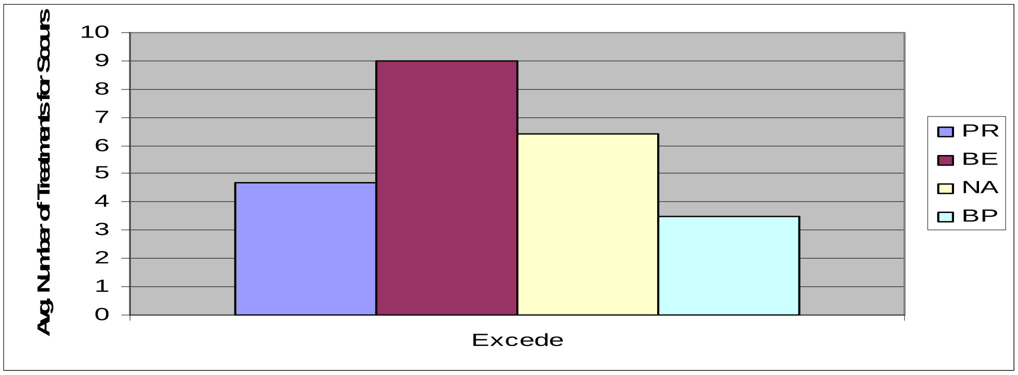

Figure 26. Mean number of scour treatments for CEF (Excede®) with MRA

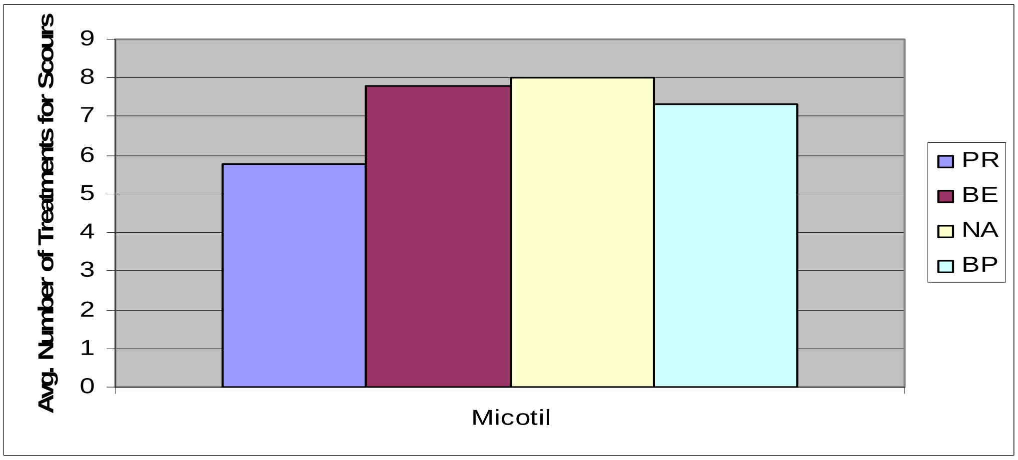

Figure 27. Mean number of scour treatments for TIL (Micotil®) with MRA

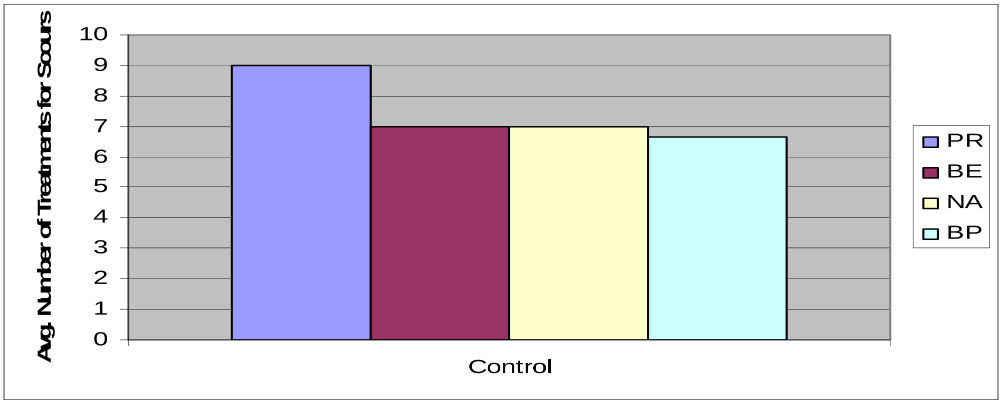

Figure. 28. Mean number of scour treatments for CON (Saline) with MRA

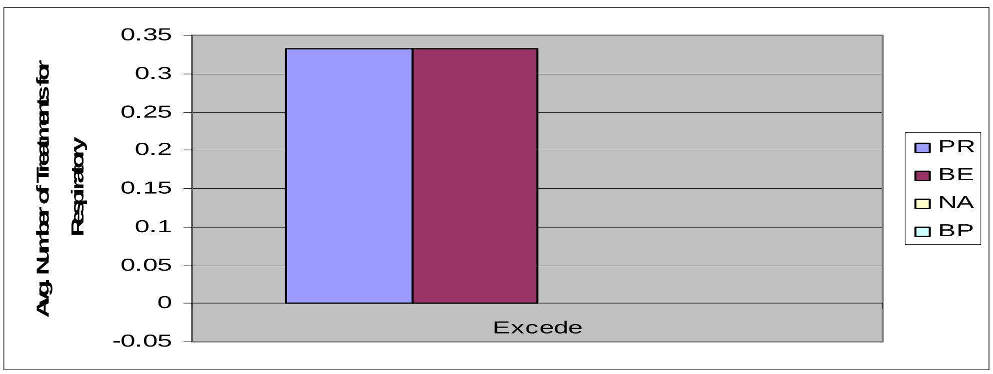

Figure 29. Mean number of respiratory symptom treatments for CEF (Excede®) with MRA

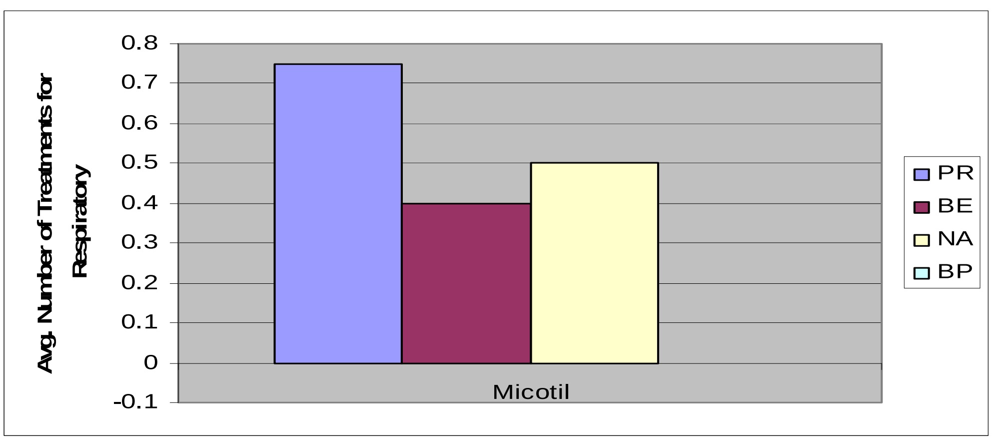

Figure. 30. Mean number of respiratory symptom treatments for TIL (Micotil®) with MRA

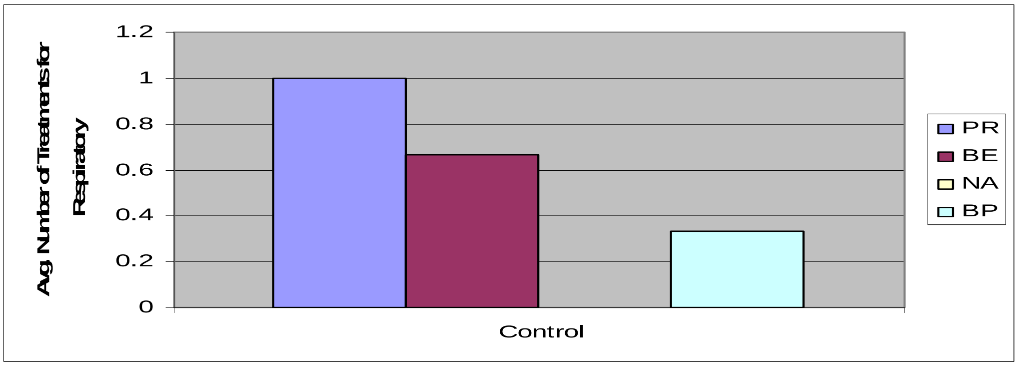

Figure 31. Mean number of respiratory symptom treatments for CON (Saline) with MRA

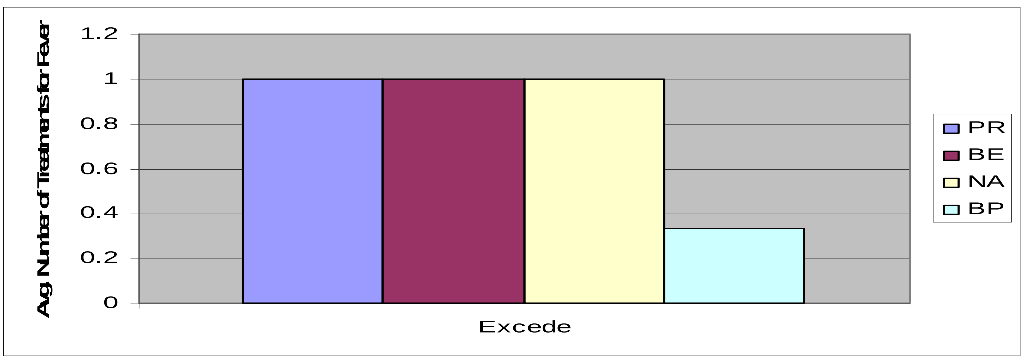

Figure. 32. Mean number of febrile event treatments for CEF (Excede ®) with MRA

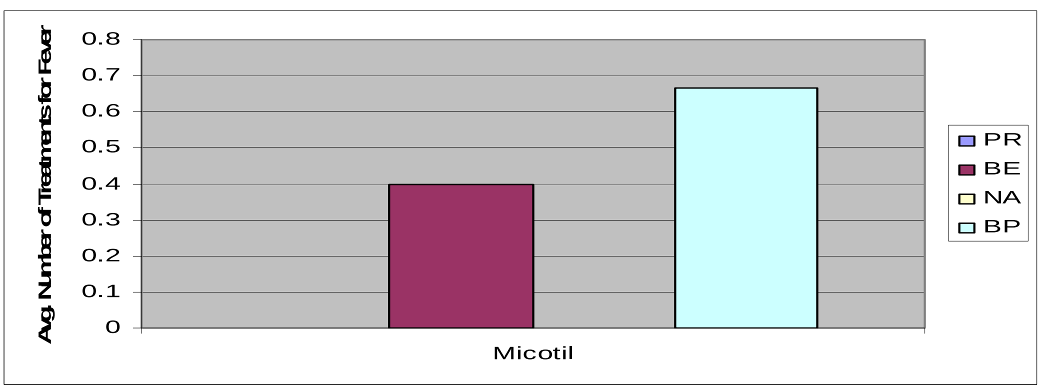

Figure 33. Mean number of febrile event treatments for TIL (Micotil®) with MRA

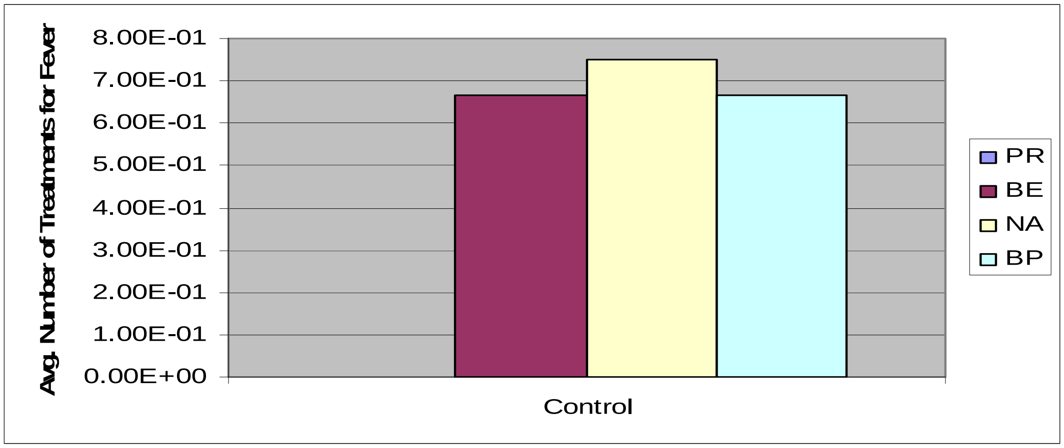

Figure. 34. Mean number of febrile event treatments for CON (Saline) with MRA

CHAPTER IV

SUMMARY AND CONCLUSIONS

Previous research has shown implementing a metaphylaxis protocol had a positive impact on the production of beef cattle by decreasing the incidence and severity of disease. Therefore, the treatments usually show a positive correlation to ADG and BW (Booker et al., 2006; Galyean et al., 1995; Guthrie et al., 2004). However, the test groups showed no significant difference in the variables when treated with metaphylaxis or milk replacer additives. This may be due to a lack of disease challenge in the project.

Stress and noninfectious types may be other explanations for scour rates. These causes and their subsequent treatments have no correlation with antibiotic treatment. Therefore, it is possible for a calf to develop scours and need treatment independent of a metaphylactic protocol. In this study, fecal score was the only factor that was significantly affected. On average, calves treated with CEF had a firmer stool than those in either the TIL or control groups. This is most likely due to a reduction in the number of subclinical pathogens for diseases which cause diarrhea by metaphylactic treatment with CEF. However, this treatment may have been detrimental to the overall health of the calves as calves fed milk replacer do not normally have a firm, formed stool. Stress (transport, feed change, etc.) and environmental changes may have been the cause of the increase in fecal score during the first few days of the study. The change was seen in all groups with a uniform decrease at the same time in all groups, revealing changes that were not associated with a metaphylactic, milk replacer additive, or both.

As there was no significant difference between the MG or MRA groups, BW may have also had an effect on the results of this study. Research has shown that heavier calves (>39 kg) are less susceptible to morbidity than light weight calves (Fallon et al., 1987; Moore et al., 2002). On of the requirements of the study was that all calves must weigh around 45 kg (range 39 – 46 kg), which is well above the weight (~39 kg) that is determined to distinguish calves to be more or less susceptible to morbidity and mortality. As a result, the calves in this study were less susceptible to disease due the fact of having a proper BW.

In addition, Protimax® and Betaine 96% had no affect on the tested variables. This result could have been due to the fact the calves were provided with the necessary requirements to maintain adequate health and proper growth. Colostrum could have accounted for the necessary requirements that Protimax® provides, while Betaine 96% requirements could have been met through either milk replacer, calf starter, or both.

There was no notable difference in BW, fecal score, ADG, or number of treatments between the different milk additive groups. Both additives were designed to target specific diseases or metabolic challenges. The calves were not in need of such supplementation and therefore, no response was observed.

Since the results showed no effect on health and growth of neonatal calves when using TIL or CEF as a metaphylactic nor when using a milk replacer additive, further research needs to be done in order to assure a proper calf management protocol. Even though CEF was shown to reduce fecal score, it should not be widely used in the dairy industry without further testing. It is likely that the absence of disease and other, foreign pathogens caused the lack of response in the subjects. In order to determine an accurate response, disease should be challenged in a further study.

REFERENCES

Booker, C.W., O.C. Schunicht, P.T. Guichon, G.K. Jim, B.K. Wildman, T.J. Pittman, and T. Perrett. 2006. An evaluation of the metaphylactic effect of ceftiofur crystalline free acid in feedlot calves. Vet. Ther. 7:257-274.

Chester-Jones, H., R. Hall, B. Perry, D. Ziegler, J. Linn, and A. DiCostanzo. 2004. Effects of an intensive feeding program for Holstein bull calves from 1 week to 12 weeks of age on pre- and immediate post-weaning growth and subsequent overall feedlot performance and carcass characteristics. Proc. of Minnesota Dairy Days. pp. 35-44.

Fallon, R.J., F.J. Harte, D. Harrington. 1987. The effect of calf purchase weight, serum Ig level and feeding systems on the incidence of diarrhoea, respiratory disease and mortality. Bovine Pract. 22: 104-106

Galyean, M.L., S.A. Gunter, and K.J. Malcolm-Callis. 1995. Effects of arrival medication with tilmicosin phosphate on health and performance of newly received beef cattle. J. Anim. Sci. 73:1219-1226.

Guthrie, C.A., K.C. Rogers, R.A. Christmas, G.J. Vogel, S.B. Laudert, and G.D. Mechor. 2004. Efficacy of metaphylactic tilmicosin for controlling bovine respiratory disease in high-risk northern feeder calves. Bov. Pract. 38:46-53.

Lofgreen, G.P. 1983. Mass medication in reducing shipping fever-bovine respiratory disease complex in highly stressed calves. J. Anim. Sci. 56:529-536.

Moore, D.A., W.M. Sischo, D.M. Festa, J.P. Reynolds, E.R. Atwill, C.A. Holmberg. 2002. Influence of arrival weight, season and calf supplier on survival in Holstein beef calves on a calf ranch in California, USA. Pre. Vet. Med. 53: 103-115.

Supplemental sources consulted

Archambault, D., G. Morin, Y. Elazhary, R. Roy, and J. Joncas. 1989. Immune response of pregnant heifers and cows to bovine rotavirus inoculation and passive protection to rotavirus infection in newborn calves fed colostral antibodies or colostral lymphocytes. Am. J. Vet. Res. 49: 1084-1091.

Bartlett, K.S., F.K. McKeith, M.J. VandeHaar, G.E. Dahl, and J.K. Drackley. 2006. Growth and body composition of dairy calves fed milk replacers containing different amounts of protein at two feeding rates. J. Anim. Sci. 84:1454-1467.

Berge, A.C.B., P. Lindeque, D.A. Moore, and W.M. Sischo. 2005. A clinical trial evaluating prophylactic and therapeutic antibiotic use on health and performance of preweaned calves. J. Dairy Sci. 88:2166-2177.

Blome, R.M., J.K. Drackley, F.K. McKeith, M.F. Hutjens, and G.C. McCoy. 2003. Growth, nutrient utilization, and body composition of dairy calves fed milk replacers containing different amounts of protein. J. Anim. Sci. 81:1641-1655.

Cusack, P.M.V. 2004. Effect of mass medication with antibiotics at feedlot entry on the health and growth rate of cattle destined for the Australian domestic market. Aust. Vet. J. 82: 154-156.

Donovan, G.A., I.R. Dohoo, D.M. Montgomery, and F.L. Bennett. 1998. Associations between passive immunity and morbidity and mortality in dairy heifers in Florida, USA. Pre. Vet. Med. 34:31-46.

Drackley, J.K. 2000. Calf nutrition related to heifer growth and longevity. Proc. 61st Minnesota, Nutr. Conf. and Minnesota Soybean Research Promotion Council Tech. Symp. pp. 153-168. September 19-20, Bloomington, MN. University of Minnesota Extension Service, St. Paul, MN.

Harp, J.A., D.B. Woodmansee, H.W. Moon. 1989. Effects of colostral antibody on susceptibility of calves to *Cryptosporidium parvum* infection. Am. J. Vet. Res. 50: 2117-2119.

Heinrichs, A.J. and C.M. Jones. 2003. Feeding the Newborn Dairy Calf. Penn State Cooperative Extension. Pennsylvania State University, University Park.

Laven, R. and A.H. Andrews. 1991. Long-acting antibiotic formulations in the treatment of calf pneumonia: a comparative study of tilmicosin and oxytetracycline. Vet. Rec. 129:109-111.

McCoy, R., R. Stock, D. Shain, R. Huffman, and G. White. 1994. Effect of Micotil ® 300 on receiving and finishing health and performance of calves. J. Anim. Sci. 72(Suppl. 1): 293 (Abstr.).

National Research Council. 2001. Nutrient Requirements of Dairy Cattle. 7th rev ed. Natl. Acad. Sci., Washington, DC.

Ose, E.E., and L.V. Tonkinson. 1988. Single-dose treatment of neonatal calf pneumonia with the new macrolide antibiotic tilmicosin. Vet. Rec. 123:367-369.

Smith, B.P., F.B. Habasha, M. Reina-Guerram, A.J. Hardy. 1980. Immunization of calves against salmonellosis. Am. J. Vet. Res. 12: 1947-1951.

Turgeon, A. 1996. Study conducted using Micotil ® 300. Elanco Animal Health. http://www.fda.gov/cvm/FOI/1355.htm Accessed November 13, 2008.

United States Department of Agriculture (USDA). 2007. Dairy 2007, Part II: Changes in the U.S. Dairy Cattle Industry, 1991-2007. USDA-APHIS-VS, CEAH. Fort Collins, CO.

CONTACT INFORMATION

Name:	Katherine Grace DeHaan
Professional Address:	c/o Dr. Glenn Holub Department of Animal Science 114 Kleberg, 2471 TAMU Texas A&M University College Station, TX 77843
Email Address:	deha102@tamu.edu
Education:	B.S., Animal Science, Texas A&M University, May 2011 Undergraduate Research Scholar