Journal of Animal and Veterinary Advances 7 (4): 516-519, 2008
ISSN: 1680-5593
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The Effect of Direct-Fed Microbials Plus Enzymes Supplement on the Growth Performance of Holstein Friesian Calves

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Abstract: The study was carried out to determine the effect of Direct-fed Microbials (DFM) plus digestive enzymes supplement on growth performance of Holstein Friesian calves. Eighteen Holstein Friesian calves were assigned to 1 of 2 treatments, DMF plus enzymes supplement, Control with no DMF plus enzymes additive. The DMF plus enzymes supplement in pre-weaning period was offered to calves after mixing with milk. Then, it was given with starters during post-weaning period. Total of 4 kg head^{-1} whole milk was fed calves in the morning and evening. While, starter ration was limited 2 kg day^{-1}, dry hay and water were offered *ad libitum*. Calves were weaned abruptly at 8 weeks of ages. The overall results revealed that weight and weight gains in various stages of the growth of the calves as well as gains in body measurements and feed efficiency ratio were not significantly affected by feeding DMF plus enzymes supplement. However, the DFM plus enzymes supplement resulted in a decrease in the incidence of diarrhea.

Key words: Direct-fed microbials, probiotics, digestive enzymes, calves, growth

INTRODUCTION

In recent years, use of antibiotics as growth stimulants has been banned in many countries, since the widespread and prolonged use of the antibiotic feed additives resulted in a growing concern regarding the development of resistant bacteria population that may cause disease in human by transmitting from animals to human and have adverse consequences for human health. Growing concern over the use of antibiotics and other growth stimulants in cattle production prompted both manufacturer and consumer to look for alternatives such as Direct-fed Microbials (DFM) (Ghorbani *et al*., 2002).

The DMF is defined as a live (viable) naturally-occurring microorganisms and this includes bacteria, fungi and yeast (Scott and David, 1992). The DFM improves the intestinal microbial balance of host animal in favour of beneficial gut microflora (Cruywagen *et al*., 1996). It may also help prevent ruminal acidosis (Nocek *et al*., 2000) and can improve the feed efficiency and average daily weight gain of feedlot cattle (Swinney-Floyd *et al*.,1999; Rust *et al*., 2000). It may be helpful to decrease incidence of diarrhea for calves (Abu-Tarboush *et al*., 1996).

Several digestive enzymes have been studied for use as growth promoters to enhance animal performance with success in poultry diets (Kung, 1999). In the past, feeding enzymes additives to improve ruminal digestion has been a questionable practice since the enzymes are proteins and they would be subject to degradation by microbial proteases in the rumen and/or inactivated by proteases in the small intestine. In a recent research, Zinn and Salinas (1999) and Karademir and Karademir (2003) stated that an improvement in dry matter intake and average daily gain in cattle supplemented with the enzymes additive.

Although, the effect of DFM on the growth performance of calves already studied by Higginbotham and Bath (1993), Cruywagen *et al.* (1996) and Isýk *et al.* (2004) there is no information available about the influence of combination of DFM with digestive enzymes additives on the growth performance of the dairy calves.

Therefore, the study was undertaken to investigate growth performance and feed efficiency characteristics of Holstein Friesian calves fed starter diets supplemented with DFM plus enzymes additives.

MATERIALS AND METHODS

Holstein Friesian calves (10 male and 8 female) from cattle herd of the Research Farm of Agricultural Collage at

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Atatürk University, Erzurum, Turkey were randomly allocated to combination of DFM plus enzymes (treatment group) and control group according to gender. The supplement of DFM plus enzymes was provided from a private company and contained *Lactobacillus acidophilus*, *Lactobacillus plantarum*, *Lactobacillus casei*, *Bacillus licheniformis*, *Bacillus subtilis* and *Aspergillus oryzae* as well as protease, amylase, cellulase, lipase, pectinase.

After calves were born, they suckled their dams to receive colostrums for 3 days. Then, they were housed in a calf barn that had individual pens furnished by feeders and plastic water-milk buckets. In the preweaning period, total of 4 L of whole milk as twice a day was offered to calves. The calves were weaned at 8 weeks of age.

Two kinds of starters were used in this study. While starter I was fed calves until 4 months of age, starter II was offered calves between 4 and 6 months of ages. Chemical composition of starter I and II were 18.0 and 16.9% for protein; 89.4 and 89.0% for dry matter; 7.1 and 7.5% for ash; 3.0 and 3.1% for ether extract; 10.5 and 11.0% for cellulose respectively. Dry hay contained 87.9% for dry matter, 7.1% for protein, 3.8% for ether extract, 8.4% for ash, 28.4% for cellulose. The daily amounts of DFM plus enzymes fed calves in pre-weaning period, between weaning and 4 months age and after 4 months of age were 5, 10 and 20 g per animal, respectively. In the pre-weaning period, DMF plus enzymes supplements were mixed with milk every morning. After weaning, the additives were offered to the calves with concentrate feed. The calves were fed individually and daily amount of starter was limited to 2 kg head^{-1}. Dry hay was offered calves as *ad libitum* during 6 months.

Body weights and body measurements such as body length, heart girth, chest depth, front shank circumferences and height at withers were determined and recorded at birth, weaning, 4 and 6 months of ages. Amount of feed consumed daily by each calf was also determined during the trial.

Data were analyzed statistically by using 2×2 completely randomised factorial experimental design in SPSS (2004) statistics package program.

RESULTS AND DISCUSSION

Least squares means with standard error for weights at birth, weaning, 4 and 6 months of ages are presented in Table 1. The average birth weight of Holstein Friesian calves allocated to the diet groups were not statistically significant, but average birth weight of male calves was greater ($p<0.05$) than that of females. The result concerning birth weight is in agreement with finding of Ugur *et al.* (1996). Average weaning weight was also not significantly influenced by both diet groups and gender of calves. Similar findings are also reported by Jenny *et al.* (1991) and Cruywagen *et al.* (1996) who found that effect of DFM concentrates on weaning weight was not statistically significant. Weights at 4 and 6 months ages were also not significantly affected by feeding DFM plus enzymes supplement (Table 1). The result is in accordance with findings of Isýk *et al.* (2004) and Wetscherek *et al.* (1991) who noted respectively insignificant effects of the DFM or enzymes supplements on the weights of calves at 4 and 6 months of ages.

Least squares means with standard error for weight gains at various stages of the growth are depicted in Table 1. The body weight gains between birth and weaning were not statistically significant. Higginbotham and Bath (1993) and Cruywagen *et al.* (1996) revealed that in pre-weaning period, no significant differences between DFM additive and control groups for average daily weight gains were detected in their studies. On the other hand, the result of the present study is in contrast with these of Schwab *et al.* (1980) who concluded that although differences in weight gains in the three trials were not statistically significant, there was a trend for fermentation products to have a positive effect on these variables, particularly during pre-weaning periods. Flores Bernal *et al.* (2006) reported that fibrolitic enzyme supplements in the pre-weaning stage improved daily weight gains of Holstein Friesian calves. Body weight gains from weaning to 4 months of ages and from 4-6 months of ages did not significantly differ between treatment and control groups.

Amount of dry matter intake of milk and solid feed per kg weight gain is presented in Table 2. Differences for feed efficiency values were not statistically significant, since total weight gain and total dry matter of feed intake did not differ between treatment and control groups. Feed efficiency ratio determined in the pre-weaning stage of the present study corresponded with reported data on Holstein Friesian calves by Abou-Tarboush *et al.* (1996). Differences of feed efficiency ratio at various stages of the trial were not statistically significant. Similar findings are also reported by Schwab *et al.* (1980) and Jenny *et al.* (1991).

Gains in body measurements were also not influenced significantly by feeding DFM plus enzymes supplements, and gender (Table 3). Morrill *et al.* (1995) also found that increases in height at withers and in hearth girth did not differ significantly by DFM supplements. The effects of gender on the gains of all body measurements were also not significantly different except for gains in height at withers between 4 and 6 months of ages.

Table 1: Least squares means with standard error for body weights and weight gains (kg)

	Diet groups			Gender		
	DFM plus enzyme supplement n = 9 $\bar{X} \pm S\bar{X}$	Control n = 9 $\bar{X} \pm S\bar{X}$	S	Male n = 10 $\bar{X} \pm S\bar{X}$	Female n = 8 $\bar{X} \pm S\bar{X}$	S
Weights at.						
Birth	37.78±4.79	35.78±4.68	NS	38.90±4.82	34.13±3.09	*
Weaning	65.11±4.14	64.78±8.80	NS	66.90±6.87	62.50±5.93	NS
4 Months of Age	102.33±8.92	101.89±14.03	NS	106.80±12.25	96.25±7.23	NS
6 Months of Age	140.00±8.62	140.33±19.07	NS	147.40±13.22	129.86±9.92	NS
Daily Weight Gain Between;						
Birth and Weaning	0.488±0.049	0.518±0.112	NS	0.500±0.093	0.507±0.080	NS
Weaning and 4 Months of Ages	0.620±0.111	0.619±0.121	NS	0.665±0.125	0.563±0.062	NS
4 and 6 Months of Ages	0.623±0.077	0.641±0.115	NS	0.677±0.093	0.569±0.060	NS

Significance, NS: Non-significant, *p<0.05

Table 2: Least squares means with standard error for amount of feed (kg) consumed per kg weight gain (on dry matter basis)

	Diet groups			Gender		
	DFM plus enzyme supplement n = 9 $\bar{X} \pm S\bar{X}$	Control n = 9 $\bar{X} \pm S\bar{X}$	S	Male n = 10 $\bar{X} \pm S\bar{X}$	Female n = 8 $\bar{X} \pm S\bar{X}$	S
Between birth and weaning						
Amount of milk	0.949±0.103	0.927±0.214	NS	0.944±0.165	0.929±0.172	
Amount of dry hay	0.126±0.055	0.102±0.017	NS	0.106±0.030	0.125±0.053	NS
Amount of starter	0.771±0.153	0.804±0.189	NS	0.825±0.198	0.741±0.116	NS
Total amount of feed	1.846±0.164	1.833±0.258	NS	1.875±0.252	1.795±0.145	NS
Between weaning and 4 months of ages						
Amount of dry hay	1.586±0.568	1.783±0.855	NS	1.512±0.356	1.901±0.985	NS
Amount of starter	3.300±0.485	3.324±0.602	NS	3.099±0.547	3.578±0.391	*
Total amount of feed	4.886±0.621	5.107±1.047	NS	4.611±0.446	5.479±0.996	NS
Between 4 and 6 months of ages						
Amount of dry hay	3.594±0.759	3.515±0.657	NS	3.642±0.846	3.424±0.383	NS
Amount of starter	3.254±0.410	3.214±0.585	NS	3.012±0.461	3.548±0.371	*
Total amount of feed	6.849±1.090	6.728±0.950	NS	6.654±1.205	6.972±0.593	NS
Between birth and 6 months of ages						
Amount of dry hay	1.915±0.216	1.936±0.418	NS	1.925±0.321	1.928±0.365	NS
Amount of starter	2.562±0.132	2.565±0.357	NS	2.447±0.214	2.731±0.257	*
Total amount of feed	4.477±0.176	4.501±0.533	NS	4.372±0.348	4.659±0.421	NS

S: Significance, NS: Non-significant, *p<0.05

Table 3: Least squares means with standard error for gains in body measurements (cm)

	Diet groups			Gender		
	DFM plus enzyme supplement $\bar{X} \pm S\bar{X}$	Control $\bar{X} \pm S\bar{X}$	S	Male $\bar{X} \pm S\bar{X}$	Female $\bar{X} \pm S\bar{X}$	S
Gains between birth and weaning;						
Body length	14.38±5.37	12.17±3.10	NS	13.05±3.15	13.43±5.91	NS
Height at withers	8.00±2.00	9.06±4.00	NS	8.35±3.82	8.86±2.19	NS
Chest depth	6.25±2.49	6.78±1.64	NS	6.30±2.36	6.86±1.57	NS
Heart girth	13.25±4.95	13.78±4.09	NS	13.60±4.25	13.43±4.89	NS
Cannon bone girth	0.75±0.65	0.83±0.43	NS	0.75±0.54	0.86±0.56	NS
Gains between weaning and 4 months of ages						
Body length	12.50±1.77	11.33±2.65	NS	11.80±1.87	12.00±2.94	NS
Height at withers	9.13±1.81	9.44±1.59	NS	8.90±1.79	9.86±1.35	NS
Chest depth	7.38±2.00	6.11±2.03	NS	6.70±2.11	6.71±2.14	NS
Heart girth	16.00±3.42	14.67±3.20	NS	16.00±2.71	14.29±3.95	NS
Cannon bone girth	1.00±0.65	0.78±0.36	NS	0.90±0.39	0.86±0.69	NS
Gains between 4 and 6 months of ages						
Body length	8.75±2.31	9.89±0.93	NS	9.40±1.65	9.29±2.06	NS
Height at withers	7.00±4.00	6.78±1.99	NS	8.10±3.00	5.14±2.12	*
Chest depth	3.25±3.01	4.44±1.13	NS	4.40±2.46	3.14±1.77	NS
Heart girth	9.38±4.78	11.22±2.82	NS	9.80±4.57	11.14±2.67	NS
Cannon bone girth	1.19±0.65	1.11±0.49	NS	1.20±0.42	1.07±0.73	NS

S: Significance, NS: Non-significant, *p<0.01

Feeding of DFM plus enzymes supplements resulted in decrease (40%) incidence of diarrhea cases. While number of calves suffered from diarrhea in control group was 5, number of scour cases in treatment group was 3. Abe ***et al.,*** 1995 and Isýk ***et al.,*** 2004 reported that feeding of DFM reduced number of scour cases in calves.

CONCLUSION

Under conditions of the present study, the feeding of DFM plush enzymes supplements did not have a significant effect, either positive or negative, on calf growth performance and feed efficiency ratio. However, it could be stated that feeding DFM plush enzymes additives may be beneficial for reducing incidence of the scour.

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