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Effects of Probiotics Supplementation in Daily Milk Intake of Newborn Calves on Body Weight Gain, Body Height, Diarrhea Occurrence and Health Condition

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Abstract: The effects of probiotic administration were studied in an experiment, using 120 newborn calves. Calves were randomly assigned to two experimental groups (sixty calves for each group) and probiotic (0.25 g h^{-1} day^{-1}) was added in their daily milk intake until 90 days of age. After the first week, all calves (including control group) received starter ration containing 21.0% crude protein and 3.0% crude fat. Body weight gain, body height and general health condition of all calves were observed at day 30, 60 and 90. Also condition of feces was examined daily and the occurrence of diarrhea was recorded throughout the experiment. Mean values of weight gain during three successive months for treatment and control groups were 57.52 and 50.58 kg, respectively. Body weight gained was not significantly different for first and second mo between treatment and control groups (16.9 and 33.87 vs. 14.49 and 33.07 for fist and second months in treatment and control groups, respectively). However, these values were significantly different ($p<0.001$) between treatment (57.52) and control (50.58) groups third months of age. Diarrhea was observed in 35 calves of control group, which was higher than 11 cases in calves treated with probiotic ($p<0.001$). The body height values of control and treatment groups in three successive months were 5.49, 10.82 and 15.00 cm for control and 5.44, 9.25 and 15.75 cm for treatment groups in first, second and third mo, respectively, which showed no significant difference between two groups during this study. The results of this study indicated that present probiotic compound have beneficial effects, especially on the third month of age in rearing calves.

Key words: Probiotic, body weight gain, newborn calves

INTRODUCTION

Probiotic compounds have recently been used for controlling and maintaining the intestinal bacteria. Avita *et al.* (1995) compared the efficiency of a probiotic with anti-K99 and anti-A14 vaccines in the control of diarrhea and concluded that the combinations of the vaccine with the probiotic administration for 15 and 30 day were useful for the control of diarrhea in calves. For a long time, antibiotics have been widely used to promote growth in calves (Abe *et al.*, 1995). It is suggested that in newborn calves, administration of antibiotics are useful for prevention of infections caused by pathogenic bacteria (Fuller, 1989). However, the use of antibiotics could have serious consequences such as drug resistance and harmful alteration of bacterial population in the intestine (Abe *et al.*, 1995). Therefore, some researchers have replaced it with probiotics (Donovan *et al.*, 2002).

It has been reported that probiotics play an essential role in the completeness of intestinal mucosa barrier, some probiotic could modulate intestinal mucosal immune response; some could play protective roles by inhibiting the adhesion of pathogenic bacteria to intestinal epithelia. This has been tested by Bal *et al.* (2004) *in vitro* and showed its beneficial effects and probable role of probiotic to reduce intestinal disease.

These products are used as food additives to improve performance of dairy cattle. However some researchers such as Zhao *et al.* (1998) have used injection roots and reported that selected probiotic bacteria administered to cattle prior to exposure to *E. coli* O157:H7 could reduce the level of carriage of *E. coli* O157:H7 in most animals. Tkalcic *et al.* (2003) have given *E. coli* O157:H7 and *E. coli* O111:NM orally and found them effective. Zhao *et al.* (2003) have tried *E. coli* O26:H11 and had the same results. On the other hands, Harp *et al.* (1996) could not find any significant difference in the

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incidence of diarrhea and oocyst shedding among three groups of calves infected with *Cryptosporidium parvum*. Some others have used dietary probiotic for layer hens (Balevi *et al*., 2001), or broiler chicks (Modirsanei *et al*., 2003). Jukna *et al*. (2003) reported that in probiotics treated groups of calves, haematological parameters were in physiological range and indicated good status of calves. They also reported that immune system was enhanced in treated calves. On the other hands no significant differences in the haematological, immunological, energy, mineral, nitrogen and vitamin profiles were observed among the groups by Huska *et al*. (2002). Whereas, a positive effect of probiotics on the incidence of diarrhea and also a positive effect on the health and weight gains of experimental groups was reported.

Despite the fact that many antibiotic products are now in use for therapeutic purposes for newborn calves in dairy industry, diarrhea is still a relevant problem and blamed for one of the highest economic loss in such operations. Some probiotic compounds are claimed to have formulae designed to provide suitable condition in alimentary tract so as to minimize the incidence of diarrhea, therefore improvement in body weight gain, body height and general health condition. This study was conducted to find whether or not administration of probiotic bacteria (*Lactobacillus* spp. *Bifidiobacterium bifidum*, *Entrococcus faecium*, Streptococcus *thermophilus*) and two species of fungi (*Aspergillus oryzae* and *Candida pinotopesti*) in this product were effective in promoting the growth of newborn calves and decrease of diarrhea.

MATERIALS AND METHODS

One hundred and twenty newborn calves were divided into two groups, a treatment group and control group of which half male and half female. Both groups were fed milk for the first week of age and then starter ration was offered. The following composition was supplemented (Table 1).

A probiotic compound containing; *Lactobacillus* spp. *Bifidiobacterium bifidum*, *Entrococcus faecium*, *Streptococcus thermophilus* and two species of fungi (*Aspergillus oryzae* and *Candida pinotopesti*) with the total viable count of 8×10^8 cfu g^{-1} was supplemented in the daily milk intake of treatment group, 0.25 g per calf for 90 day until all calves were weaned. In the first month 5.5, the second month 6.5 and the third month 3.0 L of milk were fed daily to the calves of both groups (all calves were received colostrum immediately after birth). Also each calf consumed between 27.0 to 30.0 kg of DM feed over the 90 day of experiment with insignificant amount of orts. Each calf was placed in an individual concrete pen and kept independently to prevent cross-contamination among calves. Water and dried grass were available for *ad lib* consumption throughout the trail period. Body Weight Gain (BWG), Body Height (BH) and health condition were observed at day 30, 60 and 90. Cases of diarrhea were determined by clinical examination, defined by Garcia *et al*. (2000). Stages of dehydration of the calves, firmness and color of feces and agility and fitness of the newborns were considered as standard criteria for diarrhea. Although no bacterial shedding in the feces was measured, but condition of feces was observed daily and the occurrence of diarrhea in different stages were recorded throughout the experimental period.

Statistical analysis: The mean values of BWG, BH and incidence of diarrhea were analyzed by one-way ANOVA and Fisher's test using SPSS software.

RESULTS

The initial body weight for treatment and control groups were 43.16 and 42.10 kg, respectively (Table 2). BWG was not significantly different for first and second month. between treatment and control groups (16.9 and 33.87 kg vs. 14.49 and 33.07 kg for first and second months in treatment and control groups respectively). However, these values were significantly different ($p<0.01$) between treatment (57.52) and control (50.58) groups in the third month of age.

These values were 5.49, 10.82 and 15 cm for control and 5.44, 9.25 and 15.75 cm for treatment groups in first,

Table 1: Starter ration composition

	Percentage	Ingredient analysis	Percentage
Barely grain	26	CP	21.08
Colza seed meal	13	NDF	23.49
Corn grain	26	ADF	8.60
Soybean meal (44%)	16	Starch	32.33
Wheat bran	16	Lipids	3.06
Min. supple.	2	Ca	0.66
Plain salt	1	P	0.74

NEm: 1.67 MCal kg^{-1}, NEg: 1.08 MCal kg^{-1}

Table 2: The initial body weight and BWG of calves during the trial

	Probiotics		Control	
Parameters	Mean	SE	Mean	SE
Calf #	57	-	55	
Initial BW (kg)	43.16	0.78	42.10	0.82
First mo. BWG (kg)	16.60	0.58	14.49	0.73
Second mo. BWG (kg)	33.87	1.02	33.07	1.09
Third mo. BWG (kg)	57.52^a	1.14	50.58^b	1.27

^{a,b}Mean in the same row with different superscripts are significantly different ($p<0.01$)

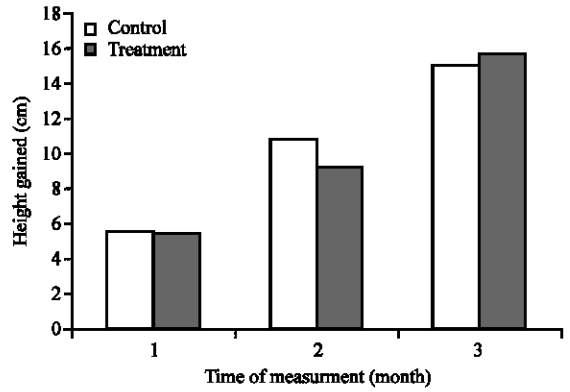

Fig. 1: Body height gained of calves during the trial

second and third months, respectively (Fig. 1). No significant difference was observed between control and treatment groups during this study.

Clinical case diarrhea was diagnosed in both groups, in which, 35 cases in control group was significantly higher ($p<0.01$) than 11 cases in treated group with probiotic compounds. In control group, the condition of feces was identified as 7% severe fluid, 16% watery, 41% soft and the rest were normal. Whereas in the treated group, there was no severe fluid, only 9% watery and 11% soft feces and the rest were normal. Another index of concern for the diarrhetic material was their color, such that in the control group 40% yellow, 26% white and 34% showed greenish color, but in the treated group, they had 55% yellow, 18% white and 27% greenish color, showing more normal condition. The degree of dehydration in diarrhetic calves of both groups reported as 39% first degree, 23% second degree, 23% third degree and 15% fourth degree of dehydration according to Garcia *et al.* (2000) and Lotfollahzadeh *et al.* (2004). Also the agility and firmness of diarrhetic calves of both groups showed 17% agile and firm, 68% agile and skinny and 15% calm and skinny.

DISCUSSION

Abe *et al.* (1995) reported that probiotics had beneficial effect on body weight of newborn calves until 25 day of age. However, they did not mention the results of their study afterwards. Muscato *et al.* (2002) have also reported that ruminal fluid (their choice of probiotics) supplementation could be a practical tool for improving calf health. Prahalada *et al.* (2001) also found beneficial effects when they fed *Saccharomyces cerevisiae*, or *Lactobacillus acidophilus* to crossbred calves (Bos taurus×Bos indicus), of -12 months of age. Morrill *et al.* (1995) did not observe a significant different in body weight of calves fed probiotics during a 6 week trial, neither Kamra *et al.* (2002) nor Gorgulu *et al.* (2003) have reported a significant different in body weight gain for calves fed probiotics. In the present study, BWG was monitored for three months in which no significant difference was observed until two months, surprisingly in third month of age, probiotic fed group had significantly higher body weight than others ($p<0.01$), which is in agreement with Higginbotham and Bath (1993), who studied the body weight until first month and Alves *et al.* (2000) who reported a significant effect for probiotics on body weight gain during the period of study in which calves were between 160 and 190 kg body weight, but not in agreement with Abdala *et al.* (2002) who reported a significant difference in body weight gain of probiotics fed groups for 21 and 42 days.

Foster *et al.* (2003) have shown that *Cryptosporidium parvum* oocysts were reduced by pre-administration of probiotics. They concluded that probiotics prevent diarrhea since severity and duration of symptoms associated with cryptosporidiosis was reduced. Gorgulu *et al.* (2003) reported that with respect to diarrhea, the probiotics fed calves were superior to control group. They concluded that probiotics administration before weaning could improve calf health and decrease mortality and medication cost, the same results as the present study. Marcin *et al.* (2003) had the same conclusion for piglets and calves. Surprisingly Abdala *et al.* (2002) reported no significant differences in diarrhea occurrence among treatment (probiotics fed and control) groups. Ohya *et al.* (2001) have reported that probiotic product could reduce faecal shedding of *E. coli* O157 from experimentally infected calves. In the present study, we concluded that this probiotic significantly improved production parameters (BWG and BH) as well as general health condition by reduction in diarrhea cases and the type of diarrhea calves affected during the nursing period. The results of this experiment are in agreement with many different researchers in this area in different parts of the world although we suggest that supplemental experiment should be done in various climatic conditions.

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