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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Science, 6 (7): 651-654, 2003
ISSN 1028-8880

Effect of Probiotic on Growing Performance and Health of Calves

Murat Görgülü, [1]Alicja Siuta, Emine Öngel, Sabri Yurtseven, Hasan Rüştü Kutlu
University of Çukurova, Faculty of Agriculture, Department Of Animal Science, 01330,Adana, Turkey
[1]Agricultural University, Department of Animal Nutrition, Krakow, Poland

Abstract: The study was conducted to determine the effect of probiotic based on *Lactobacillus* sp. on performance and health status of Holstein male calves. 12 (3 days old) calves with average initial live weight 35 kg were assigned to the control and the group with probiotics applies. All calves were weaned at 60th day. Twice daily, during the time period till weaning they consumed 228 whole milk. Calves of probiotic group received 2 g probiotic daily with the morning milk. The results showed that there were no differences in daily gain, roughage, concentrate or total feed intake, feed to gain ratio and weaning weight. Calves fed with probiotic were healthier than the control calves. Three calves from control group and one calf from probiotic group were died from scour and/or bloat. In respect to diarrhea and bloat cases, probiotic group was superior to the control. It would be concluded that the probiotic administration before weaning could improve calves health and decrease mortality and veterinary cost.

Key words: Calf, probiotic, *Lactobacillus* sp. health, growth, performance

Introduction

Many cases of calf loses in dairy farms have been resulted from lack of mismanagement and misfeeding, leading to infections and depressing the immune systems of calves. Calf loses in dairy farms have been increased the usage of antibiotic to protect and to treat calf scours. Extensive and prolonged antibiotic use may impair the intestinal flora balance and increase susceptibility of calves to some pathogen microorganism, which gain the resistance to these antibiotics (Fuller, 1989). This may also increase the risk for diarrhea and malabsorption in intestines (Higginbotham and Bath, 1993). Antibiotic resistant strains of bacteria may cause disease in human by transmitting from animals to human, and have adverse consequences for human health. The use of spiramycin, tylosin phosphate, zinc bacitracin, virginamycin in EC in 1999 and zinc bacitracine, virginamycin, tylosin phosphate, avoparcin, spiramycin, carbadox and clanqundox in Turkey in 1999 were banned as growth promoters in animal feeds (Kutlu and Görgülü, 2001).

Governmental legislations and negative public opinion on the antibiotic use as growth promoters have forced to search for alternative resources to antibiotics as the feed additive manufacturers. In recent years, development in biotechnology allows to use of some microbial cultures as feed additives. They include probiotics, which has been investigated intensively. Among many beneficial capabilities possessed by probiotics the most important includes:

- stimulation of the microflora in the digestive tract by production some of antibiotics such as, acidophilin, lactolin, acidlin etc. (Speck, 1972; Shahani *et al*., 1976),
- Suppressing on pathogen microorganism in gastro-intestinal tract by the competition for living medium and available nutrients; improvement of the absorption of nutrients in small intestine (Siuta, 1997; Sissons, 1989),
- stimulation of immune system (Perdigon *et al*., 1986) due to enhance immunoglobulines (α–globulin production), detoxification of the toxins in gut (Schwab *et al*., 1980), contribute to nutrient digestion secreting enzymes.

The probiotics contain generally yeasts (Wallace, 1994), lactic acid bacteria (Cruywagen *et al*., 1996), *Aspergilus oryzae* and *A. niger* cultures (Kung, 1990), *Bacillus subtilis* culture (Jenny *et al*., 1991), some of streptococcus (Higginbotham and Bath, 1993) and enterococcus and/or their mixture.

The studies on probiotics showed that feeding calves with milk replacers supplemented with *Lactobacillus acidophilus* cultures prevents weight lose during first two weeks of their lives (Cruywagen *et al*., 1996). A decrease in diarrhea incidence (Beecham *et al*., 1977; Abe *et al*., 1995a; Abu Tarboush *et al*., 1996) and number of coli group bacteria in calves before weaning (Bruce *et al*., 1979; Lema *et al*., 2001) were also observed, when probiotics, *Lactobacillus acidophilus* culture, given to

calves. However, Cruywagent *et al.* (1996) reported no differences between probiotics (*Lactobacillus acidophilus*) and control groups with respect to solid feed (calf starter) intake, diarrhea incidence and feed to gain ratio.

The literature, assessing the effects of probiotics on calf's performance, has shown that positive effect(s) of probiotic may vary according to the culture of probiotic and some conditions such as calves, management, feeds, feeding regimes etc (Fuller, 1990; Denev, 1996). Therefore, the present experiment was aimed to determine effect(s) of a mixture of probiotics culture based on *Lactobacillus* sp. on growing performance and health of Holstein male calves under these experimental conditions.

Materials and Methods

Twelve male calves were assigned to each experimental group at 3 days of age. Mean initial live weights for control and probiotics groups were 35.00±3.07 and 35.88±1.99 kg, respectively. All calves weaned at 60th day and consumed 228 L whole milk (daily 4 kg calf^{-1}) in two meals during the weaning period. Calves were allocated treatment groups in a two weeks age range to eliminate the time and age effect. Calves were taken into the experiment until the numbers of calve reached 12 for each group. During the experiment three calves from control and one calf from the probiotics group died due to scour and/or bloat. One more calf was included to each experimental group to increase the replicate. Finally, control group completed the experiment with 10 calves and the treatment group completed with 12 calves.

Calves in probiotic group received 2 g probiotic with the morning milk during the whole experimental period. The probiotics used in the experiment was a mixture of *Lactobacillus plantarum, L. bulgaricus, L. acidophilus, L. rhamnosus, Bifidobacterium bifidum, Streptococcus thermophilus, Entercoccus faecium, Aspergillus oryza and Candida pintolopesii*. Total mixture contains 3.08x10^{8} CFU g^{-1} of the mixture.

After the first week, alfalfa straw, calf starter and fresh water after milk feeding were supplied ad libitum (Table 1). Chemical compositions of the feeds were determined according to AOAC. (1998).

Data related to liveweight, daily gain, roughage and calf starter intake and feed to gain ratio were calculated for the 0-30, 31-60 days and total experimental period. In addition to this data, some health records such as bloat, diarrhoea and medication cost were taken during the experiment. Data were analysed according to the completely randomised design (CRD) in ANOVA procedure in SAS (1985) procedures.

Results and Discussion

According to the results, no difference between groups with respect to feed intake, weigh gain, feed to gain ratio were observed (Table 2). It has also been determined that calves of the probiotic group have less health problem than control group. Eight diarrhoea and/or bloat cases determined in control group and 3 of them died and the others gave response to medical treatment positively during the experiment. One case from probiotic group could not be medicated and lost.

Table 1: Chemical compositions of alfalfa straw and calf starter

Nutrients, %	Calf starter	Alfalfa
Dry matter	88.52	91.66
Crude protein	19.10	12.26
Crude fiber	9.70	26.00
Crude oil	3.20	3.40
Crude ash	7.57	7.08

Table 2: Growing performance and health records of Holstein male calves

Characteristics	Control	Probiotic
Number of Calves	10	12
Birth weight, (kg)	35.00±3.07	35.88±1.99
From birth to 30 days old		
Daily gain, g day^{-1}	161.16±32.69	196.25±24.00
Roughage intake, g day^{-1}	10.55±4.34	5.17±1.86
Concentrate intake, g day^{-1}	175.98±44.45	169.30±25.49
Total feed intake, g day^{-1}	186.54±47.00	174.00±25.50
Feed to gain ratio	1.50±0.46	0.99±0.17
From 31 day old to weaning (60 days old)		
Daily gain, g day^{-1}	557.26±26.74	530.11±64.23
Roughage intake, g day^{-1}	67.51±13.23	85.31±31.09
Concentrate intake, g day^{-1}	669.81±150.28	780.48±107.88
Total feed intake, g day^{-1}	682.37±114.95	865.80±119.00
Feed to gain ratio	1.27±0.23	1.73±0.20
From birth to weaning;		
Weaning weight, (kg)	54.56±2.14	56.33±2.89
Daily gain, g day^{-1}	349.29±53.36	366.26±29.68
Roughage intake, g day^{-1}	38.28±8.94	45.62±16.11
Concentrate intake, g day^{-1}	408.38±89.00	474.28±58.47
Total feed intake, g day^{-1}	446.66±95.89	519.90±62.64
Feed to gain ratio	1.25±0.24	1.44±0.14
Number of diarrhea and/or bloat cases	8	3
Number of death calves	3	1
Cost of probiotic (EU calf^{-1})	-	0.463*
Proportional cost of medication(%)	275	100

It was calculated from 2g day^{-1} calf^{-1} x 57 days x 4.06 EU 1000g^{-1}

The treatment costs for calves suffered from diarrhea and/or bloat were higher for control group than for probiotic group (Table 2). The medication cost for probiotic group was 2.75 folds less than the control group. Probiotic cost^{-1} calve was about 0.463 EU calf^{-1} for probiotics group.

The present results showed that there were no differences between control and probiotic group with respect to growing performance during pre-weaning period. However, probiotic group was superior to control group in terms of health records and medication cost. The results also revealed that all calves in this trial had less

daily gain and feed intake than breed standards for Holstein calves. This could be attributed to birth weight of the calves used in this study. The birth weight of calves used in the study is lower 5-7 kg than the breed standards of Holstein in the USA (Roy, 1980; Heinrichs and Hargrove, 1987). It is well known that lower birth weight may result in decrease capability of adaptation to the solid feed intake and increase morbidity (Morrill, 1991). Roughage and concentrate intakes especially for the first half of the trial were also lower than the predicted or expected intake for the male Holstein calves. Görgülü *et al.* (1999) reported that there were large variations in the roughage intake during the early stage of pre-weaning period of calves.

The studies on probiotics have different results with respect to growing performance and health status of calves. Some researchers (Skrivanova and Machanova, 1990; Avila *et al.*, 1995; Abu-Tarboush *et al.*, 1996; Morrill *et al.*, 1995) reported that probiotics use during preweaning period has not changed the calf performance but health status has generally been affected positively. However, other studies on using probiotics in calves revealed increases in growing performance (Cerna *et al.*, 1991; Roth *et al.*, 1992; Feist *et al.*, 1997; Abe *et al.*, 1995a; Strzetelski *et al.*, 1996). Gill *et al.* (1987) reported that the calves fed with probiotic had 10.9% less health problem than those fed diets without probiotic.

Similarly Hooper (1989) pointed out that probiotics decreased 37.3% of the incidence of diarrhoea. These results suggest that improvements in growing performance of calves by probiotics could be depending on rearing conditions and calf. In our trial, health status of the calves was improved by probiotic, while having no positive effects on growing performance. Although the modes of action of the probiotics are still under discussion, it is generally accepted that they improve the health condition and vitality of animals and also reduce mortality rate (Vanbelle *et al.*, 1990; Siuta, 1990; Fuller, 1992; 1996). The beneficial effects of the probiotics on animal heath and vitality are usually attributed to their stimulant effects on the specific immunological response to antigens and pathogens. Our results with respect to health status and mortality are in agreement with the findings of Gill *et al.* (1987), Abe *et al.* (1995b) and Abu-Tarboush *et al.* (1996) and confirm the beneficial effects of the probiotics on the health condition and vitality under our experimental condition.

The results obtained in the present experiment suggest that probiotics based on *Lactobacillus* sp. improved health status of calves and decrease the medication cost in these experimental conditions.

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