The Bioscan 13(4) : 887-891, 2018
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

EFFECT OF PROBIOTIC SUPPLEMENTATION ON PERFORMANCE OF CROSSBRED KIDS UNDER STALLFED CONDITIONS

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KEYWORDS
Crossbred Kids
Probiotic
Saccromyces cerevisiae
Lactobacillus sporogens.

Received on :
21.01.2017

Accepted on :
19.11.2018

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ABSTRACT
Thirty crossbred (Alpine x Beetal) female kids (50-60 days age) were randomly divided into three groups based on body weight. Feeding schedule comprised of concentrate and green fodder berseem *ad-lib. (*Control-C1). Kids of probiotic supplemented groups in addition to control ration, received commercial probiotic supplement of "Biobloom"(Sarabhai-Zydus) @ 2 gm/day/kid (Treatment-T_1) and 3 gm/day/kid (Treatment-T_2), mixed in concentrate ration. Overall body weight gain during the 15 weeks experimental period (kg) was significantly ($P<0.01$) higher in T_1 (10.02 ± 0.32) and T_2 (10.52 ± 0.50) than control (8.05 ± 0.44). ADG (g/day) was also significantly ($P<0.01$) higher in T_1 (95.43 ± 2.77) and T_2 (100.19 ± 4.31) than control (76.67 ± 3.79). Kids of T_1 and T_2 consumed 3.37% and 4.26% more feed than control, respectively. The FCR was significantly ($P<0.01$) better in T_1 (6.54 ± 0.25) and T_2 (6.42 ± 0.32) than control (8.44 ± 0.96). Number of kids affected with health problems was significantly ($P<0.01$) higher in control (9) than T_1 (5) and T_2 (3) groups. Similarly total duration of disease affection (days) was significantly ($P<0.01$) higher in control (35) than T_1 (13) and T_2 (6) groups. Optimum dose of probiotic supplementation was found 2gm/kid/day in the present study. It was concluded that the probiotic supplementation enhanced the performance of crossbred female kids under stallfed conditions.

INTRODUCTION

Absence of scientific or economic approach to goat rearing has been a major constraint in goat farming. Exploring new ways and means to increase the productivity with minimum cost of input is the need of the hour. Probiotics are increasingly finding favour for improving the efficiency of feed utilization, growth and health status of animals. The Food and Agricultural Organization (FAO) defined the Probiotics as "live microorganisms administered in adequate amounts, which confer a beneficial health effect on the host'. Probiotics, as 'bio-friendly agents' such as lactic acid bacteria and *Bacillus spp*., can be introduced into the culture environment to control and compete with pathogenic bacteria as well as to promote the growth of the organisms. In addition, probiotics are nonpathogenic and nontoxic microorganisms without undesirable side-effects when administered to organisms (Salini, 2013). Nowadays livestock are subjected to intensive rearing practices to attain high production performances. These practices test the animal's ability to remain healthy. To over come this, sustainable and eco-friendly practices are being advocated. The term sustainability can be defined as environmental friendly, social acceptable, economical viable and technically feasible so in this context the periodic interval applications of probiotics play an important role (Behera and Nayak, 2011). Probiotics are used to prevent and cure digestive tract disorders in weaning and stressed animals and as growth promoters. Beneficial action of probiotics are claimed to be colonization of the gastro-intestinal tract, prevention of pathogen overgrowth, neutralization of enterotoxins or modulation of the activity of bacterial enzymes in the large intestine, improvement of the digestive capacity of the small intestine, and adjuvant effect on the immune system (Anandan *et al*., 1999). The present study was therefore, undertaken to evaluate the effect of commercial probiotic supplementation on body weight gain, feed conversion ratio and incidences of health disorder in crossbred kids under stall fed condition.

MATERIALS AND METHODS

Thirty crossbred (Alpine x Beetal) female kids of similar body weight and age (50-60 days) were taken from the National Dairy Research Institute (NDRI) herd. Kids were randomly distributed into three different groups (10 kids in each group), *i.e*., control (C_1), treatment-1 (T_1) and treatment-2 (T_2). All kids were stall-fed during the fifteen weeks of experimental period. For feeding of milk, concentrate and roughage standard feeding practices of NDRI herd were followed. Feeding of milk was carried out twice a day. Milk feeding was continued up to the attainment of 12 kg body weight. In Control group (C_1) the feeding schedule comprised of concentrate @ 250 gm/head/ day up to 3 months and 350 gm/head/day up to the end of trial and green fodder berseem *ad lib*. Concentrate feed (NDRI herd supply 10.5% Moisture, 20%CP and 70%TDN) was offered once in the morning and green berseem (*Trifolium alexandrium*) was offered 3 times a day. The left over were collected and weighed in the evening. The kids of probiotic supplemented groups in addition to control ration, received commercial probiotic supplement of "Biobloom" @ 2 gm/day/kid (Treatment -T_1) and 3 gm/day/kid (Treatment-T_2), mixed in concentrate ration. Continuous supplementation of probiotic is needed to get the maximum response from ruminants since the growth of *L. acidophilus* and / or *S. cerevisiae* in the intestine is less than that excreted in faeces (Malik and Sharma 1998). Commercial probiotic 'Biobloom' contains *Saccromyces cerevisiae* 1.496 x 10^8 CFU, *Lactobacillus sporogens* 50 million CFU per gram, fortified with phytase and rich in calcium, phosphorus, protein, carbohydrate, vitamins and unknown growth factors (UGFs).

Kids were maintained and housed in groups. During day time kids were kept in open paddocks and feeds were offered in 2-tier kid feeding racks. All the kids were weighed on a spring balance at the initiation of experiment and thereafter at weekly interval for two consecutive days in morning before offering them any feed and water till the end of experiment. Body measurements Height at wither (height from ground to wither point), Height at croup (height from ground to croup), Height at elbow (height from ground level to elbow joint), Height at stiflle (height from ground level to stifle joint), Straight length (length between pin bone to point of wither), Oblique length (length between pin bone to point of shoulder), Chest girth (minimum circumference of chest cavity just behind the forelegs) and Abdominal girth / Paunch girth (circumference over the abdomen just behind the posterior border of the last rib and in front of the umbilicus) were taken at fortnightly interval on a fixed platform with the help of measuring tape and scale according to Yadav (1992).

Dry matter content of fresh as well as leftover of concentrate mixture and green fodder was estimated by drying the samples in electric oven at 100 ± 1ºC for 24 h at fortnightly interval. All the kids were dewormed at the start of experiment. Observations on disease occurrences were recorded along with duration and total number of episodes of diseases during the experimental period. The faecal consistency was judged as per method of Larson *et al.* (1977). Faecal consistency scores 3 or more were taken as digestive tract disorders. The data were subjected to Chi-square test and analysis of variance for testing significance as per standard method (Snedecor and Cochran, 1994).

RESULTS

Body Weight and Average Daily Gain (ADG)

In the initial phase (1-5 weeks) of experiment, the body weight gain and ADG were found the lowest in T_1 group (Table 1). In the middle phase of experiment (6-10 weeks) the body weight gain and ADG was not different among the groups. During last phase (10-15 week) the body weight gain and ADG was significantly higher ($P<0.01$) in T_1 and T_2 groups than C_1. The differences between treatment groups were not significant. During the overall experimental period (1-15 weeks) increase in body weight and ADG was significantly higher ($P<0.01$) in probiotic supplemented group than C_1, whereas, differences between treatment groups were found non-significant.

Dry Matter Intake (DMI) and Feed Conversion Ratio (FCR)

There was no significant effect of probiotic supplementation on DMI in different treatment groups (Table 1). However, the kids of T_1 and T_2 group consumed 3.37 % and 4.26 % more feed than control, respectively. FCR (DMI kg/day/ADG kg) was significantly ($P<0.01$) higher in T_1 group during initial phase of experiments. Probiotic supplemented groups require almost 2 kg less feed than the control group kids to gain 1 kg body weight. During the last phase (11-15 weeks) as well as overall experimental period (01-15 weeks), the kids of probiotic supplemented groups T_1 and T_2 had significantly ($P<0.01$) lower FCR than control group. Kids of T1 group required 22.51% and T2 group required 23.93% less feed for unit gain in body weight.

Effect of Probiotic on Health Status

During the study period, one case of lameness was observed

Table1: Growth and health performance of crossbred kids under control feeding and probiotic supplementation.

Parameters	Control (C)	Treatment-1 (T_1)	Treatment-2 (T_2)
Initial body weight	8.92 ± 0.31	8.89 ± 0.16	8.90 ± 0.23
Final body weight	16.97 ± 0.51	18.91 ± 0.33	19.42 ± 0.49
Body weight gain (kg) (0-5 weeks)	2.76 ± 0.18	2.63 ± 0.15	3.20 ± 0.36
Body weight gain (kg) (6-10 weeks)	2.72 ± 0.32	3.38 ± 0.28	3.25 ± 0.26
Body weight gain (kg) (11-15 weeks)	2.57 ± 0.25^a	4.01 ± 0.19^b	4.07 ± 0.17^b
Overall Body weight gain (kg)	8.05 ± 0.44^a	10.02 ± 0.32^b	10.52 ± 0.50^b
ADG (0-5 weeks)	78.86 ± 5.27	75.14 ± 4.32	91.43 ± 10.15
ADG (6-10 weeks)	77.71 ± 9.13	96.57 ± 7.97	92.86 ± 7.34
ADG (11-15 weeks)	73.43 ± 7.04^a	114.57 ± 5.54^b	116.29 ± 4.95^b
Overall ADG	76.67 ± 3.79^a	95.43 ± 2.77^b	100.19 ± 4.31^b
DMI/day (kg) (0-5 weeks) for group	3.33 ± 0.13	3.56 ± 0.14	3.63 ± 0.14
DMI/day (kg) (6-10 weeks) for group	5.47 ± 0.11	5.60 ± 0.10	5.61 ± 0.11
DMI / day (kg) (11-15 weeks) for group	8.07 ± 0.20	8.31 ± 0.24	8.38 ± 0.40
DMI / day (kg) (Overall) for group	5.63 ± 0.21	5.82 ± 0.21	5.87 ± 0.22
FCR (DMI kg/day / ADG kg)(0-5 weeks)	4.48 ± 0.21^a	5.54 ± 0.45^b	4.49 ± 0.25^a
FCR (DMI kg/day / ADG kg)(6-10 weeks)	8.90 ± 0.81	6.82 ± 0.57	7.84 ± 0.76
FCR (DMI kg/day / ADG kg)(11-15 weeks)	11.95 ± 0.64^a	7.25 ± 0.15^b	7.23 ± 0.23^b
FCR (DMI kg/day / ADG kg)(overall)	8.44 ± 0.96^a	6.54 ± 0.25^b	6.42 ± 0.32^b
Times affected with diseases	9^a	5^b	3^b
Total duration of affection (days)	35^a	13^b	6^b

a, b values in a row bearing different superscripts differ significantly.

Table 2: Mean ± S.E. change in body measurement (cm) in different feeding managemental groups.

Parameter	Group	Fortnights 1	2	3	4	5	6	7	Overall
Height at wither (HW)	C_1	1.50 ± 0.22	2.20 ± 0.42	2.40 ± 0.34	1.70 ± 0.21	1.30 ± 0.30	0.90 ± 0.18	1.10 ± 0.31	1.56 ± 0.12
	T_1	1.40 ± 0.16	1.70 ± 0.21	1.80 ± 1.33	2.10 ± 0.28	1.50 ± 0.27	1.20 ± 0.20	1.20 ± 0.20	1.59 ± 0.09
	T_2	1.90 ± 0.10	2.00 ± 0.21	1.80 ± 0.25	1.60 ± 0.16	1.70 ± 0.15	1.20 ± 0.13	1.50 ± 0.17	1.67 ± 0.07
Height at elbow (HE)	C_1	1.20 ± 0.20	1.60 ± 0.27	0.90 ± 0.23	0.50 ± 0.22	0.80 ± 0.20	0.30 ± 0.15	0.60 ± 0.16	0.84 ± 0.09
	T_1	1.10 ± 0.10	0.90 ± 0.23	0.80 ± 0.20	1.20 ± 0.20	1.00 ± 0.21	0.70 ± 0.21	0.80 ± 0.25	0.93 ± 0.08
	T_2	1.20 ± 0.13	1.10 ± 0.23	1.00 ± 0.21	1.40 ± 0.27	0.40 ± 0.15	1.10 ± 0.23	1.10 ± 0.28	1.03 ± 0.09
Height of croup (HC)	C_1	1.20 ± 0.25	1.80 ± 0.29	1.90 ± 0.31	1.80 ± 0.20	1.70 ± 0.21	1.10 ± 0.23	1.10 ± 0.28	1.51 ± 0.10
	T_1	1.40 ± 0.16	1.50 ± 0.22	1.30 ± 0.15	2.30 ± 0.13	1.90 ± 0.18	1.40 ± 0.27	1.30 ± 0.21	1.59 ± 0.09
	T_2	1.40 ± 0.16	1.40 ± 0.27	1.90 ± 0.28	1.80 ± 0.20	1.90 ± 0.31	1.40 ± 0.16	1.40 ± 0.22	1.60 ± 0.09
Height at stifle (HS)	C_1	0.70 ± 0.21	1.30 ± 0.34	1.30 ± 0.30	1.60 ± 0.31	0.80 ± 0.20	1.20 ± 0.20	0.80 ± 0.20	1.10 ± 0.10
	T_1	0.80 ± 0.13	1.00 ± 0.29	0.90 ± 0.31	1.50 ± 0.22	1.50 ± 0.22	1.50 ± 0.17	1.00 ± 0.20	1.17 ± 0.09
	T_2	0.90 ± 0.10	1.30 ± 0.15	1.10 ± 0.23	1.10 ± 0.23	1.30 ± 0.21	1.20 ± 0.20	0.70 ± 0.21	1.09 ± 0.08
Straight length (SL)	C_1	1.10 ± 0.28	0.80 ± 0.20	0.80 ± 0.20	0.90 ± 0.23	0.30 ± 0.15	0.50 ± 0.16	1.20 ± 0.20	0.80 ± 0.08
	T_1	1.20 ± 0.20	0.90 ± 0.23	0.60 ± 0.22	1.30 ± 0.15	0.20 ± 0.13	0.90 ± 0.10	0.80 ± 0.13	0.84 ± 0.08
	T_2	0.80 ± 0.13	0.70 ± 0.15	0.90 ± 0.18	0.80 ± 0.20	1.00 ± 0.13	0.70 ± 0.15	0.80 ± 0.13	0.81 ± 0.06
Oblique length (OL)	C_1	1.30 ± 0.15	1.40 ± 0.27	0.70 ± 0.21	0.80 ± 0.20	0.50 ± 0.17	0.60 ± 0.16	0.70 ± 0.15	0.86 ± 0.08
	T_1	1.00 ± 0.00	1.00 ± 0.21	1.40 ± 0.22	1.00 ± 0.15	0.90 ± 0.18	1.10 ± 0.10	0.70 ± 0.21	1.01 ± 0.07
	T_2	1.10 ± 0.10	1.00 ± 0.21	1.10 ± 0.18	0.90 ± 0.18	1.00 ± 0.15	1.00 ± 0.21	1.20 ± 0.20	1.04 ± 0.07
Chest girth (CG)	C_1	1.50 ± 0.17	0.70 ± 0.30	0.90 ± 0.23	1.30 ± 0.26	1.30 ± 0.15	1.00 ± 0.21	1.20 ± 0.20	1.13 ± 0.09
	T_1	1.20 ± 0.20	1.00 ± 0.21	1.10 ± 0.10	1.50 ± 0.17	1.70 ± 0.15	1.20 ± 0.25	1.50 ± 0.27	1.31 ± 0.08
	T_2	1.30 ± 0.15	1.00 ± 0.21	1.10 ± 0.18	0.60 ± 0.16	1.60 ± 0.27	1.60 ± 0.27	0.90 ± 0.18	1.16 ± 0.09
Abdominal girth (AG)	C_1	1.40 ± 0.31	1.10 ± 0.28	0.80 ± 0.20	0.90 ± 0.23	1.40 ± 0.16	1.00 ± 0.21	1.30 ± 0.21	1.13 ± 0.09
	T_1	1.20 ± 0.20	0.90 ± 0.10	0.80 ± 0.20	1.50 ± 0.17	2.00 ± 0.21	1.20 ± 0.13	1.30 ± 0.21	1.27 ± 0.08
	T_2	1.60 ± 0.16	1.10 ± 0.10	1.00 ± 0.20	0.90 ± 0.18	1.40 ± 0.27	1.50 ± 0.22	1.20 ± 0.20	1.24 ± 0.08

C_1 = Control; T_1 = Treatment-1; T_2 = Treatment-2.

which was not included in the analysis. Digestive tract disorder was most prevalent health disorder. Number of kids affected with digestive tract disorders were significantly ($P<0.01$) higher in control (9 kids) than T_1 (5 kids) and T_2 groups (3 kids). Duration of disease affection was significantly ($P<0.01$) higher in control (35 sick days) than treatment groups T_1 (13 sick days) and T_2 (6 sick days) ($P<0.01$). However, the differences were not significant between the treatment groups.

Body measurements

The body measurements were recorded at fortnightly interval to find out the effect of probiotic supplementation on body measurements (Table 2). It was observed that the effect due to probiotic supplementation on all body measurements under study was non-significant. The period had significant effect on all the body measurements. The changes in body measurement at fortnightly interval in probiotic supplementation groups, T_1 and T_2 were higher than the control.

DISCUSSION

Body Weight and Average Daily Gain (ADG)

The lowest body weight gain and ADG in T_1 group during the initial phase (1-5 weeks) of experiment might be due to digestive health disorder in few kids of T_1 group. Due to illness, the balance of intestinal microflora disturbed and the performance of kids could not be up to the expectation. During the overall experimental period (1-15 weeks) and especially during last phase (10-15 week) the experimental kids grew at a significantly ($P<0.01$) faster rate than the control representing ability of the yeast cells on promoting growth rate of young kids. The result of present investigation corresponds with the earlier observations of Bhoi (1992) in crossbred kids; Anandan *et al.* (1999) in crossbred chegu kids; Singh *et al.* (1999) in Marwari kids; Jayabal *et al.* (2008) in non descript kids; Kochewad *et al.* (2009) in Osmanabadi kids, Jinturkar *et al.* (2009) and Singh *et al.* (2015) in non descript kids. Saleem *et al.* (2017) reported that ADG and total weight gain, and FCR of the lambs receiving probiotic treatments tended to be greater ($p \leq 0.10$) compared with the group receiving the concentrate only during post-weaning period, which might be due to improved nutrients availability and their quick digestion by rumen microorganisms. The probiotics are considered to exert positive effects on the balance and function of the intestinal flora, which explains improved growth in the present study (Reddy *et al.*, 2011).

Dry Matter Intake (DMI)

Probiotic supplementation has no significant effect on DMI. There are several reports supporting the fact that yeast cells could improve DMI in animals reviewed by Kamra and Pathak, (2005). Yeast cells can stimulate rumen fermentation resulting increase in the DMI (Bhoi, 1992). The results of present study concurred with the findings of Rao *et al.* (2003) indicating no effect of probiotic supplementation on DMI in lambs. Jinturkar *et al.*(2009) reported that dry matter intake on percent body weight was significantly ($P<0.05$) higher in control group (3.62 %) than in probiotic supplemented groups (3.34 % and 3.28%) but the total mean concentrate consumption was almost 24.0 kg in all the groups as the gain in body weight was higher in treatment groups. Khalid *et al.* (2011) reviewed that diet composition and probiotic supplementation are known to influence the performance of ruminants and concluded that its supplementation has been found to increase the feed intake. Recently, Saleem *et al.* (2017) concluded that a positive effect of probiotic supplementation on feed intake during post-weaning period may be due to an increasing number and proportion of cellulolytic bacteria in the rumen and improved ruminal pH, which would be reflected by improved feed intake and fiber digestibility.

Feed Conversion Ratio (FCR)

During initial phase of experiments, FCR (DMI kg/day/ADG kg) was significantly ($P<0.01$) higher in T_1 group which might be due to more number of kids of T_1 group affected with digestive tract disorder and also lower digestibility of nutrients. The kids of probiotic supplemented groups T_1 and T_2 had significantly ($P<0.01$) lower FCR than control group. This might be due to the beneficial effect of probiotics on well established ruminal micro flora. Kamra and Pathak (2005) reviewed that the addition of Yeast Cell (YC) has been reported to enhance the number of cellulolytic bacteria, total viable bacteria, ruminal VFA concentration, ruminal pH and ruminal as well as total tract feed digestion. Yeast supplementation in diet of goat caused a significant higher digestibility of nutrients and higher production of carboxymethylcellulase in rumen liquor of goats (Maurya *et al*., 1993). The present findings are in conformity with those of Bhoi (1992). Jinturkar *et al*. (2009) observed marked reduction in the requirement of feed when probiotics were added and such addition almost halved the requirement from 10 kg of feed gain (Control) to merely 5.7 kg and 5.60 kg per kg of weight gain in T1 and T2 groups, respectively. It may be concluded that supplementation of probiotic was found effective in reducing the feed requirement and improving the feed conversion ratio.

Effect of probiotic on health status

Probiotic supplemented group kids were less affected by the digestive tract disorder. Anandan *et al*. (1999) reported that there was higher, moderate and severe diarrhea occurrence in the control group than the probiotic supplemented group in crossbred Chegu kids. The results of present study concurred with the findings of Bhoi (1992) in kids; Malik and Sharma (1998), Pandey and Agarwal (2001) and Das *et al*. (2002) in calves. Probiotics are known to have several desirable effects in young animals, such as prevention of pathogen overgrowth by lactic acid bacteria, the reduction of pH, the production of secondary metabolites harmful to pathogens, and possibly the competition for nutrients and colonization sites Moreover, probiotics are also known to improve digestive capacity of the small intestine, increase bacterial enzymes activity in the large intestine and to have an adjuvant effect on the immune system (Anandan *et al*. (1999). Also, the reduced incidence of diarrhoea in the probiotic supplemented group could also be attributed to these reasons. Lower incidence of diarrhoea in the experimental group could also have contributed to higher weight gains in the experimental group. Agarwal *et al*. (2002) concluded that the microbial feed supplement was able to successfully control diarrhea in crossbred animals by competing with the pathogens in the gastrointestinal tract.

Body measurements

Almost all the parameters of body measurement were non-significantly higher in the probiotic supplementation kids than the control group. However, Jayabal *et al*. (2008) reported that final body length, body height, heart girth, paunch girth parameters were significantly ($P<0.05$) higher in probiotic supplementation group than control group in non descript kids. Similar results have been reported by Kochewad *et al*. (2009) in Osmanabadi kids. Gain in body weight proportionally increases the gain in the body measurement. Yadav (1992) reported that the change in body weight and changes in body measurement were not significant for different feeding management groups. Alike this, Bohrey and Jain (2004) reported that there was significant change in body weight gain in the semi-intensive and intensive system of management of Barbari kids, but the changes found in the body measurement of height, length, heart girth and paunch girth were not significant. In the present investigation, the change in body weight was found significant ($P<0.01$) in probiotic supplemented groups T_1 and T_2 than control. Changes in the body measurements were found higher in probiotic supplemented group than control, but statistically non-significant. The growth in body parameters is very small in a fortnight and it may be fraction of a centimeter. The observations of body measurements were recorded as an integer of centimeter (cm). This might have affected the result.

Increased growth rate, better FCR and reduce incidences of health disorders was observed in probiotic supplementation groups. It may be concluded that the probiotic supplementation enhanced the performance of crossbred female kids and 2 g/kid/day is the optimum supplementation rate among the two levels investigated.

ACKNOWLEDGEMENTS

The authors are thankful to the Head, DCB Division and In-charge, Cattle yard and Goat section of NDRI, India for providing necessary facility. The authors are also thankful to the Director, NDRI, India for financial assistance provided during the research work.

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