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Effect of probiotics supplementation on growth performance and nutrient utilization in buffalo calves under different housing systems

Sachin D Nimar, Madhur, SK Chhikara and Dr. Sajjan Sihag

Abstract
Present study was conducted on sixteen Murrah buffalo calves of either sex with an average age of 3±1 months. These calves were divided into four groups (T_1, T_2, T_3 and T_4) having four calves in each group based on their average weight and age. An on-farm trial of 10 days preliminary feeding with housing and 90 days experimental period was conducted between January 2017 to April 2017, on Buffalo Farm, COAS, LUVAS, Hisar. The experiment groups were randomly allocated to the following treatments: T_1: Conventional housing + feeding as per ICAR standards (2013): T_2: Conventional housing + feeding as per ICAR standards (2013) + probiotic supplementation; T_3: Loose housing + feeding as per ICAR standards (2013); T_4: Loose housing + feeding as per ICAR standards (2013) + probiotic supplementation. Average weight gain fortnightly and per day weight gain was similar in all groups. Probiotic groups showed relatively more gain in initial 2 fortnights but in later fortnight the weight gain was more in control groups (T_1 and T_3). So, no significant difference was observed in net weight gain during experiment. Wheat straw intake was significantly more ($p<0.05$) in conventional housing groups (T_1 and T_2) as compare to loose housing groups. Similarly, intake of green fodder was significantly more during initial half of the study. In the next half the intake was almost similar in all groups. The probiotic feeding in pre-weaned calves does not affect net weight gain in calves. The feed intake (i.e. Dry matter intake and Crude Protein intake) increases in Probiotic group housed in conventional system (T_2).

Keywords: buffalo calves, conventional and loose housing, feed intake, growth parameters, probiotic feeding

Introduction
For achieving the economic productivity in livestock, it is essential to enhance the feeding value of available feed resources. Successful strategies for increasing the efficiency of utilization of poor quality roughages include pretreatment of crop residues and dietary supplementation and manipulation of rumen ecosystem. Early weaning is always recommended in the cattle industry to save costs and increase profit. However, early weaning may result in depressed growth performance. For a marginal farmer, affording good quality concentrate is becoming more and more difficult due to high cost. Straw are mainstay of diet for these animals. Feed intake, microbial production and digestibility on such diets needs improvement (Srinivas *et al* .2002) [5]. In bovine production systems, the critical stage of growth is the transition from the monogastric condition, when fed with milk, to the herbivore condition, in which their pre-gastric fermentative cameras must be completely active to effectively digest fibrous intake (Bloom, 2006) [2]. Young animals are subjected to various kinds of stresses due to intensive production pressure in the present farming system, which adversely affects their performance.

Under such circumstances antibiotics and synthetic antimicrobial agents are often used to alleviate stress and to improve growth and feed efficiency. However continuous use of sub-therapeutic levels of antibiotics in animal feed results in the presence of antibiotic residues in animal products and development of drug-resistant microorganisms in human beings (Jin *et al.* 1997) [4]. As an effective alternative to antibiotics, probiotics have been widely used in the food and feed industries during the past few decades. Probiotics are living microorganisms that have been shown to produce no drug resistance or drug residues when direct-fed to human and animals (Guo *et al.* 2006) [3]. Studies on the efficacy and economics of probiotics in animals and man have often produced contrasting results. These can derive from the heterogeneity of the experimental protocol utilized and the experimental conditions. The information on the effect of probiotic feeding under different types of housing and other manage mental regimes

is inadequate on growth of buffalo calves. Therefore, this study was undertaken to investigate the effect of probiotic supplementation on growth performance and nutrient utilization in pre-weaned buffalo calves.

Types of Housing

1. Loose Housing System

Animals are kept loose in an open paddock throughout the day and night except at the time of milking and treatment. Shelter is provided along one side of open paddock under which animals can retire when it is very hot or cold or during rains. Common feed manger and water tank is provided and concentrates are fed at the treatment time in the feed manger. The open paddock is enclosed by means of half walls or plain wire fences of convenient height (figure 1).

2. Conventional Barn or Stanchion Barn

Animals are confined together on a platform and secured at neck by stanchions or neck chain. The animals are fed as wells as treated in the same barn. These barns are completely covered with roofs and the sidewalls are closed with windows or ventilator located at suitable places to get more ventilation and lighting. It is applicable for temperate and heavy rainfall region. The same type of housing can be utilized for tropical region with slight modification.

Materials and Methods

Location

Buffalo farm, Department of Livestock Production Management, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar.

Animals used

Sixteen Murrah calves were divided into four groups (T_1, T_2, T_3 and T_4) having four calves in each group based on their average weight (62.00±17.4, 61.50±14.8, 60.25±3.9 and 58.75±6.1 kg) and age (3±1 months). The experiment was conducted for a period of 100 days (January to April, 2017) including an adjustment period of 10 days. All calves were dewormed before conducting trial. The experiment groups were randomly allocated to the following treatments: T_1: Conventional housing + feeding as per ICAR standards (2013) T_2: Conventional housing + feeding as per ICAR standards (2013) + probiotic supplementation T_3: Loose housing + feeding as per ICAR standards (2013) T_4: Loose housing + feeding as per ICAR standards (2013) + probiotic supplementation.

Materials and feed used

Commercial Probiotic mixture was used which each Kg consists of Saccharomyces cerevisiae (8000 billion c.f.u), Lactobacillus acidophilus and Lactobacillus sporogenes (240000 million c.f.u. each), Bacillus subtilis and Bacillus licheniformis (480000 million c.f.u. each), Fructo oligo Saccharide and Manon oligo Saccharides (40000 mg each). Each treatment calf was fed 4-5 g probiotic daily mixed in 40ml milk and 40ml water mixture through bottle feeding in the morning after concentrate feeding. While other control group calves were fed 40ml milk.

As Green fodder green Oat and green Berseem used. Daily given in afternoon time and leftover was removed next morning. As Dry fodder Wheat straw used which remain available 24 hrs. Concentrate mixture consists of Maize (20%), Wheat (15%), GNC (15%), Mustard cake (25%), Wheat bran (22%), Mineral mixture (2%) and Common salt (1%), was given in early morning. Chemical composition of feed ingredients used in experiment are given in Table 1.

Housing

Calves were maintained individually in concrete- floored, well-ventilated pens in a properly managed shed. In the Loose housing animals had different dry fodder and green feeding trough while water was available 24 hour in different water trough in open area. In conventional housing animal were tied at the trough and watered two to three times a day. Animals were untied 2.5 to 3 hrs. daily in both the systems. Water troughs were cleaned fortnightly and white washed monthly.

Tests and Procedure

The body weight of the calves was recorded with the help of spring weighing balance at the start of experimental feeding and thereafter regularly at fortnightly intervals. Weighing was done before feeding and watering in the early morning. Other body parameters (body length, heart girth, paunch girth, body height at shoulder point and pin width) were recorded before exp. then at monthly interval. Blood was collected two times from Jugular vein, at the starting and in the end. It was tested for Hb, TLC, TEC, Total protein, Albumin, Globulin, Urea, Lactate dehydrogenase, Calcium and Phosphorous using auto-analyzer. No calves died during the experimental period. Diarrhoea was seen during the first week after separation from herd when they were fed with the green oat. Slight alopecia was seen in all calves which could be the result of parasitic load.

Statistical analysis

Body weight change, feed utilized and body parameters were analyzed using SPSS statistics 17.0. Data were compared in Multivariate generalized linear model.

Results and Discussion

Body weight gain

Probiotic groups T_2 and T_4 more weight gain during 15-45 days of experiment. This shows better initial adaptability of probiotic groups to changing rumen conditions. In all later fortnights wt. gain was high in control groups (Table 1). The results indicate that supplementation of mix culture of probiotic in the diet of buffalo calves had a positive effect in the early stage of life but the effect subsides with advancement of time. Vishal Mudgal and R.P.S. Baghel (2010) [7] also concluded that in the initial one month, body weight gain was significantly ($P<0.01$) improved in the supplemented group, while the effect was non-significant in the second month leading to a reduced overall ($P<0.05$) effect on the growth performance of the buffalo calves at COVS, Jabalpur.

Average per day body weight change

Daily average body wt. gain was 440.22 ±92.87, 391.30 ±132.53, 432.07 ±59.78 and 410.33 ±45.58 g/day in T_1, T_2, T_3 and T_4 respectively. There is slight decrease in avg. daily weight gain from 344.87 ±45.54 to 311.11 ±130.84 g/day in T_1 and from 373.43 ± 42.18 to 272.22 ± 49.27 g/day in T_3 (as shown in Table 2) in first 45 days of experiment. The weight is increased from 316.40 ±21.44 to 338.89 ±118.11 g/day in T_2. It is decreased from 343.93 ±42.94 to 311.11 ±18.14 g/day in T_4. So, the difference was non-significant. Before the experimental period, the calves housed in loose housing have avg. daily weight gain 358.68 g/day which increases to 421.2

g/day during experiment. Similarly the weight increased from 330.63 to 415.76 g/day in conventional housing. So, increase was almost similar in both the housings.

Daily average feed intake and voluntary water intake

Avg. daily intake of green fodder was 3.13 ±0.28, 3.20 ±0.20, 3.02 ±0.12 and 3.33 ±0.09 kg in case of T_1, T_2, T_3 and T_4 respectively. Wheat straw intake was improved with 595.79 ±37.32 and 668.00 ±39.39 g/day in T_1 and T_2 (Table 3). This intake was 507.70 ±10.47 and 550.57 ±16.34 g/day in T_3 and T_4. So the wheat straw intake was significantly improved in conventional housing groups. Concentrate mixture supply was limited in all animal groups according to body weight so, no difference was observed.

Average nutrient intake per kg weight gain

The average crude protein intake per kg body weight gain was recorded as 799.51 ±55.04, 964.84 ±110.96, 791.45 ±38.25 and 854.40 ±42.31 g in T_1, T_2, T_3 and T_4. Similarly, dry matter intake per kg weight gain was 6.12 ±0.37, 7.46 ±0.87, 5.96 ±0.28 and 6.55 ±0.33 kg in T_1, T_2, T_3 and T_4 respectively (Table 4). Slight reduction was observed in probiotic groups (as shown in Table 8). It is also shown by high wheat straw intake in these groups. But weight gain was less in these groups. It could be due to high intake of low nutritional valued wheat straw. The FCE was improved in calves but non-significantly.

Feeding cost per kg body weight gain

Cost of feeds per kg weight gain was Rs 73.12, 91.56, 74.27 and 87.68 in T_1, T_2, T_3 and T_4 (Table 5). The feeding cost in conventional housing was Rs 82.34 and in loose housing it was Rs 80.97(Table 5). Moreover both of these costs are same. Raval AP and Bhagwat SR *et al.* (2013) [10] also concluded that supplementing probiotics to lactating Kankrej cows significantly improved fat percent and return as percent of feed cost were increased but remained statistically similar as compared to control.

Feed conversion efficiency (FCE)

The average crude protein intake per kg body weight gain was recorded as 799.51 ±55.04, 964.84 ±110.96, 791.45 ±38.25 and 854.40 ±42.31 g in T_1, T_2, T_3 and T_4. Similarly, dry matter intake per kg weight gain was 6.12 ±0.37, 7.46 ±0.87, 5.96 ±0.28 and 6.55 ±0.33 kg in T_1, T_2, T_3 and T_4 respectively (Table 6). Slight reduction was observed in probiotic groups (Table 6). It is also shown by high wheat straw intake in these groups. But weight gain was less in these groups. It could be due to high intake of low nutritional valued wheat straw. The FCE was improved in calves but non-significantly. Similar kind of results was observed in housing effect. The slight increase was there in conventional housing. So, FCE was recorded better in loose housing. The growth efficiency was also studied by Singh (1982) in terms of dry matter, digestible crude protein and total digestible nutrients intake per unit weight gain which also indicated that economic efficiency of growth was better under loose house. No significant difference was recorded in any of the haemato-biochemical parameters.

Table 1: Effect of probiotic supplementation on average body weight change (kg)

Groups	0 Day	15 Day	30 Day	45 Day	60 Day	75 Day	90 Day
T_1	66.50±15.7	69.50±15.9	73.00±16.8	80.50±20.1	88.00±21.9	98.75±23.57	107.00±23.8
T_2	65.50±14.3	70.00±14.8	74.50±15.6	80.75±18.1	86.00±18.9	94.00±21.2	101.50±24.1
T_3	64.25±3.8	67.00±4.2	70.00±5.2	76.50±5.9	84.25±7.9	93.50±8.7	104.00±9.1
T_4	63.25±5.7	67.00±5.2	71.50±5.4	77.25±6.5	83.00±7.0	91.75±7.9	101.00±8.9
C.D.	NS	NS	NS	NS	NS	NS	NS

Table 2: Average weight change in buffalo calves treatment wise during experiment

Parameters	T_1	T_2	T_3	T_4
Initial weight (kg)	62.00±17.42	61.50±14.82	60.25±3.95	58.75±6.08
Final weight (kg)	107.00±23.81	101.50±24.08	104.00±9.09	101.00±8.87
Average Daily Gain (g/d) Birth-0 Days	344.87±45.54	316.40±21.44	373.43±42.18	343.93±42.94
Average Daily Gain (g/d) 0-45 Days	311.11±130.84	338.89±118.11	272.22±49.27	311.11±18.14
Average Daily Gain (g/d) 46-90 Days	563.83±94.35	441.49±146.77	585.11±72.67	505.32±78.41
Average daily Gain (g/d) 0-90 Days	440.22±92.87	391.30±132.53	432.07±59.78	410.33±45.58

Table 3: Effect of probiotic supplementation on average feed and water intake from 0-90 days on air dry basis

Treatment groups	Green fodder (kg/d)	Wheat straw (g/d)	Conc. mix. (kg/d)	Water (litres/d)
T_1	3.13 ±0.28	595.79^a ±37.32	1.36 ±0.05	5.62 ±0.48
T_2	3.20 ±0.20	668.00^a ±39.39	1.36 ±0.03	5.76 ±0.70
T_3	3.02 ±0.12	507.70^b ±10.47	1.37 ±0.04	5.62 ±0.52
T_4	3.33 ±0.09	550.57^b ±16.34	1.37 ±0.03	6.08 ±0.66
C.D.	NS	89.77	NS	NS

Mean in column with different superscripts differ significantly ($P<0.05$)

Table 4: Effect of probiotic supplementation on per kg weight gain nutrient intake in growing calves' groups

Feeding attributes intake	T_1	T_2	T_3	T_4	C.D.
DMI (kg)	6.12 ±0.37	7.46 ±0.87	5.96 ±0.28	6.55 ±0.33	NS
CP (g)	799.51 ±55.04	964.84 ±110.96	791.45 ±38.25	854.40 ±42.31	NS
CF (g)	1,496.66 ±77.09	1,841.50 ±219.34	1,440.39 ±65.94	1,611.91 ±83.66	NS
EE (g)	218.50 ±17.54	263.07 ±29.60	216.69 ±10.93	230.02 ±11.22	NS
NFE (kg)	2.36 ±0.13	2.86 ±0.34	2.33 ±0.11	2.57 ±0.13	NS

Table 5: Effect of probiotic supplementation on feeding cost under different treatments

Feeding cost (Rs)	T_1	T_2	T_3	T_4
Green fodder	3.91	4	3.77	4.16
Wheat straw	1.09	1.22	0.93	1.01
Concentrate	27.19	27.19	27.39	27.39
Probiotics	-NA-	3.42	-NA-	3.42
Total per day cost (Rs/d)	32.19	35.83	32.09	35.98
Avg. daily weight gain (g/d)	440.22	391.30	432.07	410.33
Feeding cost per kg weight gain (Rs/kg)	73.12	91.56	74.27	87.68

Table 6: Effect of probiotic supplementation on per kg weight gain nutrient intake in growing calves' groups

Feeding attributes intake	T_1	T_2	T_3	T_4	C.D.
DMI (kg)	6.12 ±0.37	7.46 ±0.87	5.96 ±0.28	6.55 ±0.33	NS
CP (g)	799.51 ±55.04	964.84 ±110.96	791.45 ±38.25	854.40 ±42.31	NS
CF (g)	1,496.66 ±77.09	1,841.50 ±219.34	1,440.39 ±65.94	1,611.91 ±83.66	NS
EE (g)	218.50 ±17.54	263.07 ±29.60	216.69 ±10.93	230.02 ±11.22	NS
NFE (kg)	2.36 ±0.13	2.86 ±0.34	2.33 ±0.11	2.57 ±0.13	NS

Conclusion

Initially the wt. gain was more in probiotic group but in later half of study it was higher in control groups. Overall no difference observed in body wt. gain. Similarly, the net body wt. gain in both housing was also equal.

Wheat straw intake was significantly improved in probiotic group. Overall the feed intake was improved in probiotic groups but the average weight gain was almost similar in all treatments. It could be the result of higher intake of poor quality feed stuff which has low nutritional value (i.e. straw). The loose housing was better at this age for calves as feed conversion efficiency was slightly improved and feeding cost was slightly less for per kg weight gain (Table 10).

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