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Effect of Rumen Fluid Inoculation on Performance of Calves

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ABSTRACT

A biological experiment was conducted at the cattle yard of NDRI on 12 crossbred calves (KF) for 26 wk to study the effect of rumen fluid (RF) inoculation on performance and feed intake. In the first month, half of the calves were fed control diet and the other half were given 8 ml of strained RF in addition to the control diet *i.e.,* 4 ml in milk and 4 ml inoculated orally. Almost throughout the experimental trial, the weekly growth rates of both groups were found to be statistically similar. The overall body weight gain was higher in RL inoculated group G2 (543.70g/d) than Control group G1 (496.95g/d). Daily weight gain was also better when RF was inoculated, though these differences were statistically non-significant. It can be concluded that RF inoculation during the 1st month of life slightly improved growth performance of young calves up to 6 months.

Key Words – Rumen fluid, inoculation, Calves, Body weight, feed intake.

INTRODUCTION

Feeding usually accounts for above 60 per cent of the total expenses involved in rearing of cattle. Success of dairying in terms of profitability can be improved by reducing the feed costs, without compromising the performance. But, in general, for a very young calf the milk proteins are highly digestible (92-98%) and the plant proteins (85-94%) somewhat less digestible (Moran, 2002). Well known is the fact that, young calves have undeveloped rumens and are functionally monogastric at birth and must undergo physiological changes before they can digest high fiber feeds. Therefore, if the stage of fully developed rumen or rumen digestion can be brought about earlier, it will improve animal performance as well as digestion of plant-based feed will increase. Researchers have investigated inoculating newborn calves with rumen fluid and have found it to improve average daily gain (ADG), and health (Muscato *et al,* 2002 and Todd *et al,* 2003). The rumen fluid can be used in fresh form as well as in the form of frozen ice cubes and stored at 15°C. Thus, ruminal fluid supplementation could be a practical tool for producers in improving calf performance. Baldwin states: "gut growth is not simply a function of energy substrate supply or dietary chemical composition, but rather a plexus of nutritional and physiological inputs" (Baldwin *et al,* 2004). The uniqueness of rumen development is highlighted by the lack of similar developmental changes in the small intestine in response to weaning.

Keeping the above-mentioned points in view, the present study was designed to study the effect of rumen fluid inoculation on growth performance and feed intake of calves.

MATERIALS AND METHODS

An experiment was conducted on the crossbred calves (Karan Fries) from 1 wk to 6 months of age, maintained at Institute's herd, in the calf section of the Cattle Yard of NDRI, Karnal, Haryana, to study the effect of rumen fluid inoculation on crossbred calves. Twelve, one-week old crossbred calves (KF) were selected as and when born and divided randomly into 2 groups with 6 calves (3 males & 3 females) in each group. The feeding plan for Group I was control diet throughout the experiment and the calves of Group II were supplemented with SRL in addition to the basal diet.

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Table 1. Basal diet.

Age group	Whole milk	Skim milk	Concentrates	Fodder
0-5 d	1/10th of body wt.	Nil	Nil	Nil
6-30 d	1/10th of body wt.	Nil	qs	Nil
1-2 m	1/15th of body wt.	1/25th of body wt.	0.120 kg (120 g)	*ad.lib*
2-3 m	1/25th of body wt.	1/15th of body wt.	0.250 kg (250 g)	*ad.lib*
3-4 m	Nil	6.5 kg	0.650 kg (650 g)	*ad.lib*
4-5 m	Nil	6.5 kg	1.000 kg (1000 g)	*ad.lib*
5-6 m	Nil	5.0 kg	1.500 kg (1500 g)	*ad. lib*

qs – offered *adlib* and intake was measured

From one week of age to one month of age, half the calves (6 calves) were fed basal diet and the other half (6 calves) in addition to the basal diet, were orally inoculated with freshly strained rumen liquor. The basal diet was the regular diet followed in the cattle yard, NDRI, Karnal. The rumen fluid given to the calves was obtained on a daily basis, from fistulated healthy adult cattle maintained in the cattle yard. The collected rumen liquor was strained using 4 layers of muslin cloth to obtain strained rumen liquor (SRL) and then this fresh SRL was given to the calves. This SRL was given to calves in a daily dosage of 8 ml/calf. The daily dose of 8 ml was divided into 2 equal parts of 4 ml each. Out of which one-part was mixed with milk and fed whereas the other half was taken in a syringe without needle and given orally to the calf 30 minutes after feeding of milk. RF inoculation was done once daily in the morning. Water was supplied to the calves not before 20 minutes after rumen liquor inoculation. Calves whose rumen liquor was to be collected for analysis were separated from others and allowed to drink water only after rumen liquor collection.

Calves from birth till 5 days were housed in calving pens and from 6th day onwards, they were shifted to another shed. The calves were housed according to their age groups for convenience of feeding, to avoid bullying of younger calves by older calves and to ease other managemental practices. Throughout the experimental period similar managemental conditions were maintained.

All calves in the age group of 0-5 days were housed in one pen, where they received the first feed of colostrum. The quantity of colostrum fed per day was 1/10th of the body weight. It was ensured that the colostrum fed to the calves were from their respective dams. Both colostrum and the liquid diet (whole milk and skim milk mixed together) were fed to calves in 2 equal parts, i.e., twice a day at 8:00 hrs in the morning and 16:00 hrs. in the afternoon at an interval of 8-10 hours. Liquid diet was provided individually to each calf. Care was taken that the temperature of the liquid diet was as close to the body temperature as possible. Liquid diet was provided to animals in aluminum utensils. The hands of the attendant and the tub used for feeding were cleaned before and after every feed. General management was the same as being practiced at NDRI, Karnal. Throughout the experimental period, the managemental practices for all calves were similar.

Parameters estimated

Composition of skim milk, roughage and concentrate feed were estimated by proximate analysis. Individual calves were weighed on weekly basis from birth to sixth month of age. Daily feed intake (whole milk, skim milk, roughage and concentrate) of each calf was recorded from birth to six months of age.

Table 2. Proximate composition of constituents of milk replacer, skim milk, roughage and concentrate used for the trial.

Ingredients	DM %	CP %	CF %	EE %	Ash %
Skim milk (as is basis)	7.78	2.04	0.00	0.56	0.58
Concentrate (DM basis)	91.22	22.52	9.88	3.17	6.57
Roughage (DM basis)	17.62	3.12	4.84	0.35	1.42

RESULTS AND DISCUSSIONS

Proximate composition of the concentrate and roughage fed to the calves was analyzed (Table 2).

Effect of RL inoculation on Body weight gain:

Weekly body weights were taken at the end of 1st week of life onwards. Initial body weights at the beginning of the experiment were similar (P>0.01) for both treatment groups i.e., 31.65 kg and 29.52 kg for G1 and G2 treatment groups.

The data presented here shows that throughout the experiment, the Rumen liquor inoculated group showed numerically higher ADG (g) except in the 2nd, 3rd, 15th, 16th, 18th, 20th, 22nd, 23rd and 24th weeks. Also, in the 9th week (beginning of the 3rd month) and in the 17th week the ADG of the group G2 (rumen liquor inoculated group) were about 49% and 31% higher than the corresponding mean ADG of G1 group. But the differences were statistically non-significant which could be due to the large individual variations among calves in the same treatment group. These findings are in agreement with the observations made by Todd *et al* (2003), who obtained a non-significant improvement due to large variation within group, in performance of calves inoculated with a daily dosage of 8 ml of fresh rumen fluid stored as ice cubes and fed after mixing with milk. Similarly, Cersosimo *et al* (2019) showed that calves when inoculated with rumen fluid from 3-6 weeks of age did not show any significant difference in Average Daily body weight gain when compared to uninoculated calves. Our results were contrary with the findings of Belanche *et al* (2019) who found 2.2 times higher weight gain among the fresh rumen fluid inoculated goat kids during the 8th week of age than the other groups. They also found that the weaning shock in the form of weight loss and health problems was less among the inoculated kids.

The overall ADG (g) of the treatment groups over the period of 26 weeks of experiment was 496.95 ± 25.28 and 543.70 ± 17.36, for G1 and G2, respectively. The overall average ADG of G2, over the whole experiment is numerically higher by 9% but again, is significantly not different. Our observations can be corroborated with the findings of Muscato *et al* (2002) who conducted 4 different trials involving rumen fluid inoculation in day old calves upto 6 weeks of age, at a dose rate of 8 ml/ day, mixed in the milk fed to the calves. The experiment involved inoculation using fresh ruminal fluid, ruminal fluid supernatant, ruminal fluid cells, and autoclaved ruminal fluid. Other than fresh ruminal fluid, others were stored at -15°C until use. Significantly better weight gains were seen in calves inoculated with fresh rumen fluid. Improved weight gains were seen in inoculated animals of all other groups but the difference was not significant.

Also, Dengpan Bu *et al* (2020), found that at the end of the experiment, no significant difference was noted in any of the measurements of animal growth including BW and ADG. The weekly average of the above measurements was also similar between the inoculated and the control calves and between the two groups of each treatment. Our results are also in agreement with studies conducted decades ago (Hardison *et al,* 1957; Hibbs and Conrad, 1958; Bryant and Small, 1960; Schonhusen *et al,* 2003) and recent studies (Yu *et al,* 2020).

Table 3. Average Daily Body Weight Gain (g/ day).

Age (week)	G1 (Control)	G2 (RL)
2	200.34 ± 79.12	78.89 ± 54.43
3	229.38 ± 97.97	155.22 ± 40.17
4	181.64 ± 66.28	275.82 ± 51.24
5	126.97 ± 91.53	258.57 ± 101.64
6	247.01 ± 82.97	387.80 ± 96.18
7	397.49 ± 108.45	433.72 ± 39.87
8	381.21 ± 70.52	492.88 ± 54.59
9	369.94 ± 56.00	551.00 ± 67.77
10	490.08 ± 81.78	591.81 ± 29.50
11	360.47 ± 74.47	633.90 ± 37.34
12	574.46 ± 172.07	744.33 ± 51.02
13	573. 00 ± 63.24	584.99 ± 67.82
14	593.94 ± 88.64	651.58 ± 86.69
15	747.91 ± 95.74	744.30 ± 150.01
16	592.66 ± 119.64	557.57 ± 143.60
17	609.18 ± 105.70	799.55 ± 92.39
18	786.73 ± 142.42	725.51 ± 112.03
19	650.45 ± 136.85	701.63± 74.97
20	725.40 ± 65.16	705.77 ± 71.43
21	445.61 ± 159.17	592.86 ± 114.16
22	763.09 ± 83.08	679.59 ± 42.36
23	756.87 ± 110.11	625.13 ± 65.72
24	643.45 ± 166.47	519.18 ± 68.41
25	577.04 ± 84.70	605.95 ± 71.86
26	598.56 ± 66.26	807.52 ± 239.46

Effect of RL inoculation on Dry matter intake

The overall mean monthly total dry matter intake (kg) of both the groups over the period of 6 months (Table 4).

The data in the table 4 showed that dry matter intake in calves belonging to both groups was similar and the difference was non-significant. This may be due to the fact that the animals were fed the liquid feed with comparable dry matter and fixed amount of concentrate with *ad libitum* forage. Each calf was fed whole milk as well as concentrate in the same quantity as per its allowance, according to age and body weight. So, the DM intake in terms of whole milk, skim milk, and concentrate was similar in all groups. Therefore, the only difference in DM intake could be through roughage which was fed *adlib*. and roughage having a DM content of 17.62 per cent, showed insignificant difference in DM intake in kg though there was difference in the quantity fed. These findings are in agreement with the observations made by Conrad *et al* (1950) where he found in both the trials conducted by him, that the feed intake was higher, though statistically non-significant, in uninoculated group of calves than the Rumen fluid inoculated calves.

Table 4. Total mean monthly dry matter intake (kg/month).

Age (Month)	G1 (Control)	G2 (RL)
1st	13.57 ± 0.72	12.55 ± 0.34
2nd	21.15 ± 1.09	20.86 ± 0.31
3rd	40.67 ± 1.28	41.64 ± 0.47
4th	80.81 ± 0.17	80.75 ± 0.07
5th	118.67 ± 0.25	118.70 ± 0.15
6th	146.72 ± 0.50	146.66 ± 0.20

Also, Cersosimo *et al* (2019) showed that calves when inoculated with rumen fluid from 3-6 wk of age did not show any significant difference in Dry Matter Intake when compared to uninoculated calves. Similarly, Dengpan Bu *et al* (2020), found that at the end of the experiment, no significant difference was noted in any of the measurements of feed intake and feed conversion ratio. The weekly average of the above measurements was also similar between the inoculated and the control calves and between the two groups of each treatment. On the contrary, Belanche *et al* (2019) showed that during the post weaning period the fresh rumen fluid inoculated kids had a higher forage intake (up to +44%) than the other groups.

CONCLUSION

It was concluded that the inoculation of rumen liquor in calves during the first month of life slightly improved growth performance of young calves up to 6 months of age. These results suggest that under typical farm conditions, when calves are repeatedly inoculated with fresh strained rumen fluid from healthy adult cattle, it probably yields limited benefits to their growth.

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