

Effect of Feeding Calf Starter on Daily Weight Gain, Immune Status and Parasitic Load in Crossbred HF Calves

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Abstract – Sixteen HF crossbred female calves of similar age and body weight were randomly divided into two groups of eight each. Calves in group-I (Control group) were kept on measured quantity of traditional ration, while those in group-II (Experimental group) were fed calf starter comprising sodium butyrate, calcium propionate, quality protein meal, bypass fat, vitamins A, D₃, E, toxin binder, mineral mixture, flavoring agent and anti-oxidants @ 100 g per day, which was slowly increased to 2.0 kg per day, for a period of 180 days. Calves in both the groups were fed *ad lib* green fodder. Average daily weight gain was 0.76 kg in experimental group, which was significantly ($P < 0.05$) higher than that of control group (0.56 kg). Feed conversion ratio (kg calf starter consumed/kg body weight gain) was 3.13 and 2.33 in control and experimental groups, respectively. Serum immunoglobulins IgG, IgA and IgM were 13.30 and 18.71; 0.62 and 0.96; 2.31 and 2.43 mg/ml in control and experimental groups, respectively. Parasitic load also reduced significantly in experimental group fed on calf starter. A calf starter formulated scientifically can help in significantly improving the daily weight gain, immune status and reducing parasitic infestation in growing calves, which in turn can help in reducing the age at first calving.

Keywords – Calf Starter, Daily Weight Gain, Immune Status, Feed Conversion Ratio, Parasitic Load, Young Calves.

I. INTRODUCTION

Optimum level of nutrition in early life favors faster growth, earlier onset of puberty and enhanced productivity [1]. Calves need to be reared to obtain optimum gain in body weight, so that they attain about 75-80 per cent of mature body weight at puberty. Poor feeding of young calves leads to higher age at first calving and overall loss of productive life [2]. Malnutrition also results in reduced vigor, poor immune system, suppressed vitality and more prone to disease, ultimately leading to death of calves [3]. Intake of adequate colostrum by neonatal calves and early transition to calf starter are two important factors in successful calf rearing programme [4]. Feeding calf starter during early age also reduces the chances of diarrhea in young calves as traditional ration causes mostly digestive problems due to high fiber contents [5]. Feeding calf starter and good quality leguminous hay from early life, stimulates early development of rumen papillae (rumen wall), essential for rumen functions, which favors digestion of larger proportion of fodder at an early age [6]. In view of this, a calf starter comprising sodium butyrate, calcium propionate, quality protein meal, bypass fat, vitamins A, D₃, E, toxin binder, mineral mixture, flavoring agent and anti-oxidants was formulated, produced on a pilot scale and a feeding trial was conducted to study its

effect on daily weight gain, immune status and parasitic load in young calves.

II. MATERIALS AND METHODS

A feeding trial was conducted at *R.M. Patel Dairy Farm, Sarsa* and *Sanjay Patel Dairy Farm, Chikhodra, Anand*.

2.1 Experimental animals

Sixteen HF crossbred female calves of similar age and body weight were randomly divided into two groups of eight each. All experimental calves had approximately same age and live weight at the beginning of trial. Calves in group-I (*Control group*) were kept on measured quantity of traditional concentrate mixture, while those in group-II (*Experimental group*) were fed calf starter comprising sodium butyrate, calcium propionate, quality protein meal, bypass fat, vitamins A, D₃, E, toxin binder, mineral mixture, flavoring agent and anti-oxidants @ 100 g per day, which was slowly increased to 2.0 kg per day. All the calves were de-wormed before initiation of feeding trial. Calves were vaccinated with alum precipitated HS vaccine at 3 months of age (@ 3 ml, S/C).

2.2 Feeding of Calves and growth measurements

Calves in both the groups were fed *ad lib* green fodder. Dry fodder was also offered after three months of age. Clean, free-choice water was available to calves at all times. Body weights of calves in both the groups were recorded in the beginning of trial and subsequently at fortnightly interval till the completion of the trial, which lasted for 180 days. The growth rate of animals was computed by the differences of these two recorded body weights. The body weight of animals was calculated using *Shaeffer's formula*: $Body\ weight\ (kg) = \left(\frac{[(heart\ girth\ in\ inches)^2 \times length\ of\ the\ body\ in\ inches]}{300} \right) \times 0.4536$. Similarly, feed conversion ratio (FCR) for calves of the two groups and economics of feeding both the rations were also worked out. Dry matter intake through starter feed, green and dry fodder was recorded daily and measured, on a weekly basis.

2.3 Analytical method

The chemical composition of feeds and fodder offered during the trial period was carried out as per *AOAC* [7]. Feeds and fodder were also analyzed for neutral detergent fibre (NDF) and acid detergent fibre (ADF) as per *Goering and Van Soest* [8]. Blood samples were collected by *jugular veni-puncture* of each calf for estimation of serum immunoglobulins, using kit supplied by *DiaSys Diagnostic Systems GmbH (Germany)*. Fresh faecal samples were collected from all the calves and analyzed for parasitic eggs count. The *McMaster Technique* was used to prepare

the faeces for quantification of worm eggs and results are expressed as number of eggs/g faeces.

2.4 Statistical analysis

Statistical analysis of the data was carried out by Student's 't' test [9] with SPSS package programme (SPSS 9.00 software for Windows, SPSS Inc., Chicago, IL).

III. RESULTS AND DISCUSSION

The chemical composition of both the rations is presented in Table I. The calf starter produced in 3 mm size pellets is depicted in Figure 1. The calf starter was found to be palatable to young calves.

Table I: Chemical composition of starter feed and fodder (on DM basis)

Parameters	Traditional Concentrate Mixture	Calf starter	Lucerne green	Maize green	Wheat straw
Crude protein (%)	23.40	22.80	17.10	4.90	3.15
Ether extract (%)	4.03	4.41	3.90	1.75	0.90
NDF (%)	18.21	19.13	47.80	56.65	67.82
ADF (%)	10.37	9.07	36.52	30.24	53.65
Total ash (%)	9.28	9.46	9.68	6.65	16.10
Organic matter (%)	90.72	90.54	90.32	93.35	83.90
Acid insoluble ash (%)	2.10	2.45	0.90	2.70	5.12
Calcium (%)	0.60	1.70	2.12	0.37	0.25
Phosphorus (%)	0.70	0.90	0.35	0.18	0.11



Fig.1. Calf starter in pellets form used for feeding trial

3.1 Effect of Feeding Calf Starter on Dry Matter Intake

The average daily dry matter intake (DMI) of calves in control and experimental group is given in Table II. The

average DMI was 3.33 and 4.52 kg in control and experimental groups, respectively. Statistical analysis revealed that there was no significant difference in DM intake through the traditional concentrate mixture (1.75 kg/day) in control group and calf starter (1.78 kg/day) in experimental group. However, total DMI (kg/100 kg body weight) was significantly higher (3.29 kg) in experimental group than that of control group (3.33 kg). The average crude protein, total digestible nutrients, calcium and phosphorus intake was better in calves in experimental group as compared to control group. The feed additives such as sodium butyrate, calcium propionate, minerals and vitamins added in calf starter might have helped in the early development of rumen papillae, which resulted into higher consumption of dry matter through roughages. The higher DM intake through dry and green fodder had also reported by [10] on feeding calf starter to growing calves.

Table II: Effect of feeding calf starter on different parameters in young calves

Parameters	Control group	Experimental group
Dry matter intake		
Dry matter intake (kg/day)	3.33±0.82	4.52±0.46
Dry matter intake (kg/100 kg body weight)	3.31 ^a ±0.29	3.29 ^b ±0.16
Nutrient intake		
TDN intake (kg/day)	2.50 ^a ±0.60	3.40 ^b ±0.30
CP intake (kg/day)	0.80±0.20	1.10±0.10
Ca intake (g/day)	23.20 ^a ±5.70	44.20 ^b ±4.10
P intake (g/day)	13.90±2.70	19.80±1.60
Age and body weight		
Average age of calves (days)	56.50± 15.13	63.00± 15.03
Initial body weight (kg)	47.00±9.74	47.75±9.28
Final body weight (kg) after 180 days	147.50±33.82	184.75±19.60
Change in body weight (kg)	100.50 ^a ±24.09	137.0 ^b ±10.90
Average daily weight gain (kg)	0.56 ^a ±0.14	0.76 ^b ±0.07
^{ab} Means with different superscripts differ significantly ($P<0.05$)		

3.2 Effect of Feeding Calf Starter on Daily Weight Gain

The change in body weight over a period of 180 days was 110.5 and 149 kg in control and experimental groups, respectively. The fortnightly body weight change (kg) of calves in both the groups is depicted in Figure 2. The average daily weight gain (ADG) in calves of control and experimental groups was 0.56 and 0.76 kg, respectively (Table II). Statistical analysis revealed that ADG of the calves fed calf starter was significantly higher than that of the control group. [11] reported 0.40 kg ADG in Murrah buffalo calves fed on calf starter. The ADG in calves fed

on calf starter was found to be better (0.47 kg) than the conventional ration (0.34 kg), as reported by [10]. [12] also observed similar values (0.40 kg) of growth rate in Belgian White Blue male calves fed on milk replacer and calf starter ration. A pair of calf born on the same day and fed traditional ration in control group and calf starter in experimental group is given in Figure 3. All the calves in experimental group were healthy, heavy in body weight with lustrous skin coat as compared to control group. Calves in experimental group were expected to attain faster maturity weight and conceive at an early age.

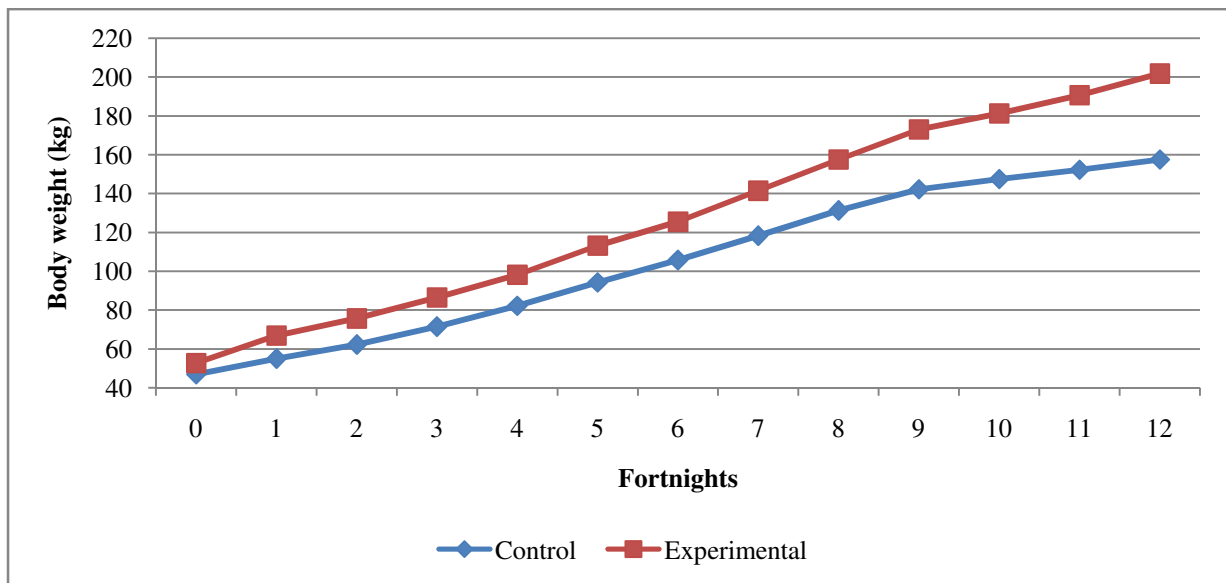


Fig.2. Effect of feeding calf starter on fortnightly body weight changes in CB calves



Fig.3. A pair of calf after 4 months under control (L: body wt.: 122 kg) and experimental (R: body wt.:150 kg) groups, born on the same day

3.3 Economics of Feeding Calf Starter

The cost of traditional concentrate mixture and calf starter is given in Table III. The total feed cost for the calves fed on calf starter was higher than the calves fed on traditional concentrate mixture. But the cost per kilogram

weight gain was almost the same in both groups. As calves fed on calf starter had greater daily weight gain and feed conversion ratio, they would grow faster, attain maturity earlier and would have more productive span in their life than the calves fed on traditional concentrate mixture.

Table III: Economics of feeding calf starter to growing HF calves

Economics	Control group	Experimental group
Average consumption of starter feed (kg/day)	1.75	1.78
Cost of one kg starter feed (Rs.)	15	20
Quantity of starter feed consumed (kg) during the feeding trial	315	320
Cost of starter feed used during the feeding trial (Rs.)	4725	6400
Cost of starter feed for gaining one kg live weight (Rs.)	47.01	46.71
Feed conversion ratio (kg starter intake/kg gain)	3.13 ^b ±0.19	2.33 ^a ±0.12

^{ab}Means with different superscripts differ significantly ($P<0.05$)

3.4 Effect of Feeding Calf Starter on Immunity Status

Levels of serum immuno-globulins such as IgG, IgA and IgM were 13.30 and 18.71; 0.62 and 0.96; 2.31 and 2.43 mg/ml in control and experimental group, respectively (Table IV). Statistical analysis of data revealed that on feeding calf starter, there was significant increase in immuno-globulin IgG in calves of experimental group. Imbalances or inadequacy of nutrients in the diet can alter the activity of certain enzymes, thereby, impairing overall immune function [13]. Feeding a calf starter to growing calves might have provided all the nutrients required for the normal functionality of numerous structural proteins, enzymes and cellular proteins.

Table IV: Effect of feeding calf starter on immunity

Immunity status	Control group	Experimental group
Serum IgG (mg/dl)	13.30 ^a ±1.3	18.71 ^b ±3.0
Serum IgA (mg/dl)	0.62±0.14	0.96±0.22
Serum IgM (mg/dl)	2.31±0.40	2.43±0.32

^{ab}Means with different superscripts differ significantly ($P<0.05$)

3.4 Effect of Feeding Calf Starter on Parasitic Load

During the trial period, the intensity of infection as faecal egg counts ranged from 100 to 400 per gram of faeces in control group, while in experimental group, there were significant reduction in parasitic eggs and coccidian oocyst in faecal samples (Table V). Studies showed that feeding essential nutrients in balanced form has the potential to reduce parasitic load in dairy animals [12], [14]-[15]. An increased availability of essential nutrients can be expected to improve host resistant to gastrointestinal parasites provided that they are first limiting for immune functions [16]. Animals fed on imbalanced diet are vulnerable to parasitic infestation due to lower host immunity reaction [17]. Parasitic load in dairy animals affect growth, milk production [18] and general health as these parasites hijack vital essential nutrients in the assimilation form supplemented through feed and feed supplements. Supplementing essential nutrients in adequate amount is an excellent way to reduce parasites by enhancing overall vitality of the body. Good nutrition has been shown to reduce parasitic load through improvement in immunity of animals as reported by [16] and [19].

Table V: Effect of feeding calf starter on Parasitic Load

Faecal egg count	Control group	Experimental group
<i>Trichostrongyles</i> eggs	Present	Absent
<i>Trichuris</i> eggs	Present	Absent
<i>Coccidian</i> oocyst	Present	Present (oocyst revealed)
Eggs per gram (EPG)	200 ^b ±37.78	50.0 ^a ±7.40

^{ab}Means with different superscripts differ significantly ($P<0.05$)

IV. CONCLUSION

This study demonstrated that calf starter formulated scientifically can help in significantly improving the daily weight gain, immune status and reducing parasitic load in growing calves, which in turn could help in reducing the age at first calving and enhancing productive span of their life.

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