International Journal of Agriculture Innovations and Research
Volume 3, Issue 1, ISSN (Online) 2319-1473

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

**B. M. Bhanderi, M. R. Garg, Ajay Goswami**

***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, $D_3$, 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 immuno-globulins 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, $D_3$, 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, $D_3$, 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) = ([(heart girth in inches)$^2$ x length of the body in inches]/300) x 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

International Journal of Agriculture Innovations and Research
Volume 3, Issue 1, ISSN (Online) 2319-1473

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.

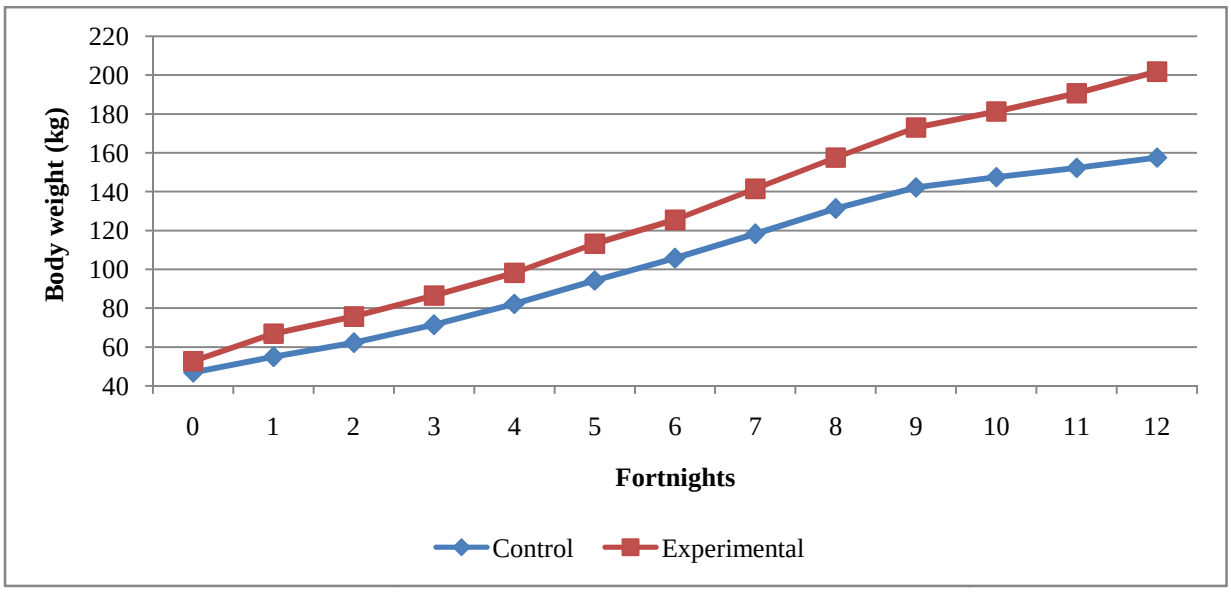


Fig.2. Effect of feeding calf starter on fortnightly body weight changes in CB calves

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 13.30and18.71; 0.62 and 0.96; 2.31and2.43 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 400per 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 gastro-intestinal 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 |
|---|---|---|
| *Trichostrongyles* eggs | Present | Absent |
| *Trichuris* eggs | Present | Absent |
| *Coccidian* 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.

## V. Acknowledgements

The authors are grateful to the management of National Dairy Development Board, for providing necessary facilities and financial support to carry out this study. Necessary facilities and help rendered during the trial period by Farm Manager of *R.M. Patel Dairy Farm, Sarsa* and *Sanjay Patel Dairy Farm, Chikhodra, Anand, Gujarat* are gratefully acknowledged.

## References

[1] Patterson, D.J., Perry, R.C., Kiracofe, G.H., Bellows, R.A., Staigmiller, R.B. and Corah, L.R. (1992). Management consideration in heifer development and puberty. *Journal of Animal Science*, 70:4018-4035.

[2] Van Amburgh, M. 2008. Early life management and long-term productivity of dairy calves. *Proceedings of Southwest Dairy Management Conference*. http://animal.cals.arizona.edu/swnmc/2008

[3] Mehra, U.R., Tripathi, K.C., Nath, K. and Ranjhan, S.K. 1990. Effect of limited milk intake on growth rate and ruminal development of newly born buffalo calves.*Nutrition Abstracts and Reviews*, 49: 1380.

[4] Franklen, S.T., Amoral-Phillips, D.M., Jackson, J.A. and Campbell, A.A. 2003. Health and performance of Holstein calves that suckled or were hand fed colostrum and were fed one of three physical forms of starter. *Journal of Dairy Science*, 86: 2145-2153.

[5] Misra, A.K. and Singh, D. 1993. Rearing of calf. A Scientific Approach. *Indian Dairyman*. 64: 526-529.
[6] Anderson, K.L., Nagaraja, T.G., Morrill, T.L., Avery, T.B., Galitizer, S.J. and Boyer, J.E. 1987. Ruminal microbial development in conventionally or early weaned calves. *Journal of Animal Science*, 64: 1215.
[7] AOAC. 2005. *Official Method of Analysis*. Association of Official Analytical Chemists, 18th edn. Washington, D.C., USA.
[8] Van Soest, P.J., Robertson, J.B. and Lewis, B.A. 1991. Method for dietary fiber, neutral detergent fiber and non-starch polysaccharides in relation to Animal Nutrition. *Journal of Dairy Science*, 74: 3583-3597.
[9] Snedecor, G.W. and Cochran, W.G. 1986. *Statistical Methods*.7thEdn.Iowa State University Press, Ames, IA.
[10] Ahmad, F., Jabbar, M. A., Ahmad, I., Rafique, M. and Ahmad, I. 2004. Comparative efficiency of calf starter and conventional rations in buffalo suckling calves. *Pakistan Veterinary Journal*, 24(4):169-172.
[11] Thorat, S.B. and Nagpaul, P.K. 1982. Studies on growth rate and economics of rearing crossbred and buffalo female calves. *World Review of Animal Production*, 18(1): 65-71.
[12] Fiems, L.O., Vanopdenbosch, E., Boncque, C.V., Vanoillie, Y. and Cottyn, B.G. 1989. Effect of purified immuno-globulins or pooled colostrum on performance of rearing calves. *Animal Feed Science and Technology*, 26:347-356.
[13] Spears, J.W. 2000. Micronutrients and immune function in cattle. *Proceedings of the Nutrition Society*, 59: 587-594.
[14] Garg, M.R. and Bhanderi, B.M. 2011.Enhancing livestock productivity through balanced feeding.*Proceedings of Biennial National Conference of Animal Nutrition Society of India*, Vol. I, pp.11-21.
[15] Garg, M.R., Sherasia, P.L., Bhanderi, B.M., Phondba, B.T., Shelke, S.K. and Makkar, H.P.S. 2012. Effect of feeding balanced rations on animal productivity, feed conversion efficiency, feed-nitrogen use efficiency, rumen microbial protein supply, parasitic load, immunity and enteric methane emission to milch animals under field conditions. Animal Feed Science and Technology, 179:24-35.
[16] Houdijk, J.G.M. 2012. Differential effects of protein and energy scarcity on resistance to nematode parasites.*Small Ruminant Research*, 103:41-49.
[17] Athanasiadou, A., Kyriazakis, I., Giannenas, I. and Papachristou, T.G. 2009. Nutritional consequences on the outcome of parasitic challenges on small ruminants. Nutritional and foraging ecology of sheep and goats. *Options Meditérranéennes*, 85: 29-40.
[18] Fekete, S.G. and Kellems, R.O. 2007. Interrelationship of feeding with immunity and parasitic infection: a review. *VeterinarniMedicina*, 52:131–143.
[19] Hoste, H., Torres-Acosta, J.F., Paolini, V., Aguilar-Caballero, A., Etter, E., Lefrileux, Y., Chartier, C. and Broqua, C. 2005. Interactions between nutrition and gastro-intestinal infections with parasitic nematodes in goats. *Small Ruminant Research*, 60:141–151.

## AUTHOR'S PROFILE

**Dr. Babulal M Bhanderi**
Ph.D. Animal Nutrition
Scientist-II
Animal Nutrition Division
National Dairy Development Board, Anand, Gujarat-388001
Email: bhanderi@nddb.coop

**Dr. Mangat Ram Garg**
Ph.D. Animal Nutrition
Principal Scientist
Animal Nutrition Division
National Dairy Development Board, Anand, Gujarat-388001
Email: mrgarg@nddb.coop

**Dr. Ajay Goswami**
MVSc. Animal Nutrition
Scientist-I
Animal Nutrition Division
National Dairy Development Board, Anand, Gujarat-388001
Email: agoswami@nddb.coop