

Growth Studies on Tharparkar-Jersey-Holstein (Triple-Cross) Female Calves at Different Levels of Protein Intake*

C. Jagannadham, S. R. Sampath and S. V. S. Setty

Department of Animal Nutrition, Management and Products Technology,
University of Agricultural Sciences, Bangalore.

ABSTRACT

An investigation was conducted to study the effect of different levels of digestible crude protein (DCP) on the growth performance of Tharparkar-Jersey-Holstein (triple-cross) female calves from 4 to 24 weeks of age. Eight female calves were randomly distributed into two groups, out of which one group received the Morrison's standard of DCP and TDN while the other group was fed with 10 per cent more DCP while TDN was maintained at Morrison's standard. Calf starters containing 13 per cent and 14.8 per cent DCP with 71 per cent TDN were fed to calves of groups I and II, respectively. Heart-irth and body length measurements did not show any significant difference between groups, but there was significant difference in height-at-withers. Growth rates (gain in body weight) of the calves in the two groups were not significantly different. The average gain in body weight of calves at 0.418 kg/day and 0.430 kg/day for the control and experimental groups, respectively.

(Received on Nov. 22, 1976)

INTRODUCTION

PROBLEMS REGARDING GROWTH have attracted much attention during the past few years and considerable work has been done to assess the growth rate of calves of various breeds of Zebu cattle. Practically very little work appears to have been carried out to study the same in crossbred calves (*Bos taurus* × *Bos indicus*) raised on different planes of nutrition.

As early as 1922, McCandlish reported the average growth rate for dairy breeds from birth to 3, 6 and 12 months of age. Several workers in the past studied the growth rates of different pure-bred

and crossbred calves in India (Mudgal and Ray, 1965; Naidu and Desai, 1965; Mudgal and Ray, 1955; Bhosrekar *et al.* 1967; Taneja and Bhat, 1971; Tandon and Bhatia, 1971; Ranjhan, 1971; Pachauri and Negi, 1971; Panda and Sadhu, 1973).

Efforts have been made so far to reduce the level of DCP recommended by Morrison for economic rearing of calves in India. Mudgal and Ray (1965) observed that the reduction by 20 per cent in the level of DCP recommended by Morrison does not affect the growth rate if the TDN content is maintained at Morrison's standard.

* Part of M. V. Sc. thesis in Animal Nutrition submitted by the first author to the University of Agricultural Sciences, Bangalore.

Sharma and Mukherjee (1967) reported no significant difference in average daily gain in body weight between two groups of Tharparkar calves fed at Morrison's recommended level of DCP and 24.5 per cent less than Morrison's recommended level. Patel and Anaokar (1971) concluded that lowering the Morrison's level of protein by 10 per cent may not have any ill-effects on the subsequent performance of calves but reduced when both the protein as well as energy levels were lowered by 20 per cent of the NRC recommendations; whereas when the level of either one was lowered, the growth rate remained unaffected.

No work seems to have been reported so far in India on growth performance of calves raised on calf starters containing less than 16 per cent DCP while in other countries it was reported by Brown *et al.* (1958), Brown and Lassiter (1962), Gardner (1968), Daniels and Flynn (1971) and Morrill and Melton (1973)

that calves could be raised successfully without any deleterious effects, on calf starters containing even 13 per cent DCP.

There are many crossbred and triple-crossbred cattle in and around Bangalore city but very little information is available about their performance in growth, reproduction and production. Hence, an investigation was conducted to study these aspects on growth performance from 4 to 24 weeks of age in Tharparkar-Jersey-Holstein (triple-cross) female calves.

MATERIALS AND METHODS

Eight female calves, newly born, were chosen from among the Tharparkar-Jersey-Holstein crosses (triple-cross) for the experiment. A control and an experimental group with 4 calves in each were made by random selection. Control group calves (Group I) were fed with the level of DCP and TDN recommended by Morrison (1956)

TABLE 1

Particulars of triple-cross female calves of the cattle yard, National Dairy Research Institute, Bangalore, used in the trial.

Group	*Calf No.	Date of birth	Weight at birth (kg)	Initial measurements at 4 weeks of age (inches)		
				Girth	Length	Height-at-withers
I (Control)	1210	28-10-73	31	31.5	23.0	30.5
	1214	8-11-73	32	33.0	24.0	30.5
	1218	22-11-73	29	32.5	24.0	31.0
	1222	24-12-73	25	29.0	22.0	27.5
II (Experimental)	1212	31-10-73	18	30.25	21.5	27.5
	1213	7-11-73	30	32.5	25.5	30.0
	1219	29-11-73	28	31.5	24.0	29.5
	1220	7-12-73	28	30.0	24.5	29.0

* All the calves used under this experiment had a blood composition of 50% Holstein, 25% Jersey and 25% Tharparkar.

Experimental group calves (Group II) were fed 10 per cent more DCP than Morrison's standard. The calves of both the groups were given an isocaloric diet as per Morrison's TDN level).

All the calves were weaned at 5 days after birth and were kept on a milk feeding schedule upto 4 weeks of age. Beginning from the third week of age onwards, the calves were given a small quantity of calf starter to acclimatise the calves for concentrate feeding. From the fourth week of age calves were put on the experimental diet schedule as in Table II.

The composition of the calf starters fed to calves is given in Table 3.

The nutritive value of the calf starter for group I was 13 per cent DCP and 71 per cent TDN while that for group II was 14.8 per cent DCP and 71 per cent TDN. The nutritive value of

TABLE 3

Composition of calf starters.

Ingredients	Group I (Control)	Group II (experimental)
	%	5
Milo	15.0	18.0
Maize	7.5	9.0
Groundnut cake	15.0	18.0
Wheat bran	30.0	36.0
Ragi (<i>Eleusine coracana</i>)	25.0	10.0
Molasses	5.0	6.0
Salt	2.0	2.0
Mineral mixture	1.0	1.0

Rhodes grass hay given to calves was 6 per cent DCP and 50 per cent TDN (Sen and Ray, 1971).

All calves were weighed every week upto 24 weeks of age. Linear body measurements like heart-girth, body length and height-at-withers were recorded every fortnight.

TABLE 2
Feeding schedule from 4 to 24 weeks of age of triple-cross female calves.

Day light (g)	Group I (control)				Group II (experimental)			
	Whole milk (lit/day)	Skim milk (kg/day)	Calf starter	Hay (kg/day)	Whole milk (lit/day)	Skim milk (lit/day)	Calf starter (kg/day)	Hay (kg/day)
0	1.50	1.00	0.200	—	1.50	1.00	0.250	—
5	1.50	1.00	0.300	—	1.50	1.00	0.350	—
10	1.00	1.00	0.500	0.125	1.00	1.25	0.500	0.125
15	1.00	1.00	0.625	0.125	1.00	1.25	0.625	0.125
20	1.00	1.00	0.750	0.125	1.00	1.25	0.725	0.125
25	0.50	1.00	1.000	0.125	0.50	1.00	1.000	0.125
30	0.25	0.50	1.300	0.125	0.25	0.50	1.300	0.125
35	—	—	1.600	0.125	—	—	1.600	0.125
40	—	—	1.600	0.250	—	—	1.600	0.150
45	—	—	1.600	0.400	—	—	1.600	0.200
50	—	—	1.650	0.500	—	—	1.600	0.300
55	—	—	1.700	0.500	—	—	1.650	0.500
60	—	—	1.750	0.500	—	—	1.700	0.500
65	—	—	1.800	0.500	—	—	1.750	0.500
70	—	—	1.900	0.500	—	—	1.800	0.500

TABLE 2(a)

Milk feeding schedule of triple-cross female calves upto four weeks of age.

Age group	Whole milk (lit/day)	Skim milk (lit/day)
6-15 days	3.25	—
16-28 days	2.75	1.5

All the experimental data were analysed statistically on the lines given by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Linear body measurements: The average heart-girth measurements recorded at the age of 24 weeks were 43.25 ± 0.43 , 43.38 ± 0.25 inches for group I and group II calves, respectively. The overall increase in girth measurements from 4 to 24 weeks of age were 11.65 and 12.31 inches for groups I and II, respectively. The calves under study attained a body-length measurement of 32.50 ± 0.35 inches in control group calves and 32.63 ± 0.38 inches in calves

of the experimental group. The average increase in body length was 9.27 and 8.75 inches for calves of groups I and II respectively. The average height-at-withers recorded at the age of 24 weeks in calves was 37.38 ± 0.31 inches in control group and 36.88 ± 0.24 inches in the experimental group. The average increase in height-at-withers was 7.50 and 7.87 inches for groups I and II respectively. Statistical analysis revealed that there was no significant difference in heart-girth and body-length measurements indicating that there was no significant difference in the above two measurements by providing 10 per cent DCF than that of Morrison's standards. However, there was a significant difference ($P < 0.05$) between the two groups in respect of height-at-withers. This can be attributed to the fact that the group II calves had lower measurements of height-at-withers at the beginning of the experiment. These findings indicate that these triple-cross calves had slightly

TABLE 4

Average linear body measurements of triple-cross female calves.

Age in weeks	Heart girth (inches)		Body length (inches)		*Height-at-withers (inches)	
	GI	GII	GI	GII	GI	GII
4	31.50 ± 0.89	31.06 ± 0.57	23.25 ± 0.48	23.88 ± 0.85	29.88 ± 0.80	29.00 ± 0.50
6	32.63 ± 0.55	32.00 ± 0.35	24.50 ± 0.35	24.25 ± 0.78	30.63 ± 0.59	29.25 ± 0.60
8	33.63 ± 0.24	33.00 ± 0.50	25.25 ± 0.63	25.13 ± 0.71	30.88 ± 0.47	29.88 ± 0.30
10	34.50 ± 0.20	33.63 ± 0.38	27.00 ± 0.84	26.15 ± 0.66	31.36 ± 0.24	30.63 ± 0.40
12	35.13 ± 0.24	34.62 ± 0.47	27.63 ± 0.83	27.13 ± 0.47	32.50 ± 0.29	31.38 ± 0.50
14	36.00 ± 0.20	35.75 ± 0.32	28.00 ± 0.61	27.50 ± 0.50	33.38 ± 0.51	32.00 ± 0.50
16	37.50 ± 0.46	37.25 ± 0.48	28.63 ± 0.31	28.25 ± 0.29	34.13 ± 0.60	32.63 ± 0.30
18	39.00 ± 0.54	38.88 ± 0.38	29.25 ± 0.32	29.13 ± 0.51	33.50 ± 0.61	34.13 ± 0.30
20	40.38 ± 0.55	40.88 ± 0.24	30.60 ± 0.54	29.75 ± 0.68	35.50 ± 0.61	34.13 ± 0.30
22	42.00 ± 0.35	42.13 ± 0.24	31.88 ± 0.51	31.00 ± 0.46	36.50 ± 0.46	35.00 ± 0.00
24	43.25 ± 0.43	43.48 ± 0.25	32.50 ± 0.35	32.63 ± 0.38	37.38 ± 0.31	36.88 ± 0.20

Significant at
* $P < 0.05$

superior body measurements when compared to some of the pure-bred and crossbred calves of the same age reported earlier (Bhosrekar and Daniel, 1965; Gill *et al.* 1971; Panda and Sadhu, 1973).

Growth rate: The regression coefficient of growth per week was 3.1644 and 3.2800 for the groups I and II calves, respectively. The rate of gain in body weight per day was slower from birth to 12 weeks (0.307 kg in group I and 0.323 kg in group II) than that from 12 to 24 weeks (0.530 kg in group I and 0.537 kg in group II). This is in conformity with the findings of McCandlish (1922), Mudgal (1965, 1966), Taneja and Bhat (1971) and Panda and Sadhu (1973). Calves of experimental group showed better average daily gain in weight than the calves of control group, but statistically the finding was not significant. This indicated that feeding of 10 per cent more DCP than Morrison's standard had no beneficial effect on the average daily gain in body weight of calves from birth to 24 weeks of age. These results are in agreement with those of Lofgreen and Loosli (1947), Lofgreen *et al.* (1951), Mudgal and Ray (1965), Sharma and Mukherjee (1967), Rathee and Yadava (1970), Patel and Anaokar (1971) and Talpada *et al.* (1973).

In this study, control group calves received a calf starter containing 13 per cent DCP while those of group II received 14.8 per cent DCP. In spite of the low content of DCP in the calf starters, calves of both the groups had good growth rates: 0.418 kg/day and 0.430 kg/day

for control and experimental calves, respectively. Similar findings were reported by Brown *et al.* (1958) and Brown and Lassiter (1962) that calf starters containing 16 per cent crude protein gave slightly better results than either higher or lower content of crude protein in calf starters. These results were later supported by Gardner (1967) and Gardner (1968) who concluded that calf starters containing 16 per cent DCP did not give better results than those starters containing less protein.

Daniels and Flynn (1971) and Morill and Melton (1973) had a similar view and they observed that good growth can be obtained in calves with starters containing 12 to 15 per cent crude protein. The present findings are in agreement with all the above observations.

Compared with the findings of others cited earlier and considering the effects and changes in linear body measurements and growth rate, it may be concluded that these Tharparkar-Jersey-Holstein cross calves are superior to the other purebred and crossbred calves in their growth performance.

It can be stated at this juncture that dairy calves can be raised successfully and economically on calf starters containing 13 per cent and 14.8 per cent DCP with limited amounts of whole milk and skim milk. The two calf starters used in this experiment can successfully be fed to calves without any detrimental effect on the growth of the calves.

The ragi millet (*Eleusine coracana*) grown mostly in Karnataka state can be

TABLE 5

Average body weights (kg) and regression coefficient ($^{\circ}\text{byx}$) values.

Age in weeks	Group I (control)		Group II (experimental)	
	Average body weight (Mean $\pm$ S.E)	Estimated value (Y)	Average body weight (Mean $\pm$ S.E)	Estimated value (Y)
Birth	29.25 $\pm$ 1.55		26.00 $\pm$ 2.71	
4	37.88 $\pm$ 1.34	36.8890	34.88 $\pm$ 2.31	30.2060
5	39.88 $\pm$ 1.36	36.8890	36.88 $\pm$ 1.98	33.4860
6	41.75 $\pm$ 1.27	39.2530	39.25 $\pm$ 1.79	36.7660
7	43.75 $\pm$ 1.27	42.4170	41.50 $\pm$ 1.37	40.0460
8	46.13 $\pm$ 1.31	45.5810	43.38 $\pm$ 1.14	43.3260
9	48.38 $\pm$ 1.28	48.7450	45.75 $\pm$ 1.11	46.6060
10	50.75 $\pm$ 1.25	51.9090	48.13 $\pm$ 1.28	49.8860
11	52.38 $\pm$ 1.25	55.0730	50.50 $\pm$ 1.37	53.1660
12	55.00 $\pm$ 1.24	58.2370	53.13 $\pm$ 1.30	56.4460
13	57.50 $\pm$ 1.10	61.4010	56.50 $\pm$ 1.44	59.7260
14	60.63 $\pm$ 1.14	64.5650	59.63 $\pm$ 1.60	63.0060
15	63.63 $\pm$ 1.09	67.7290	63.25 $\pm$ 1.71	66.2860
16	67.50 $\pm$ 1.29	70.8930	66.88 $\pm$ 1.60	69.5660
17	71.38 $\pm$ 1.39	74.0570	71.00 $\pm$ 1.37	72.8460
18	75.88 $\pm$ 1.39	77.2210	75.25 $\pm$ 1.51	76.1260
19	80.38 $\pm$ 1.53	80.3850	79.50 $\pm$ 1.37	79.4060
20	84.75 $\pm$ 1.71	83.5490	84.00 $\pm$ 1.02	82.6280
21	89.25 $\pm$ 1.88	86.7130	88.00 $\pm$ 0.87	85.9660
22	93.38 $\pm$ 2.09	89.8770	92.00 $\pm$ 0.96	89.2460
23	96.38 $\pm$ 2.61	93.0410	95.50 $\pm$ 1.22	92.5260
24	99.50 $\pm$ 3.12	96.2050	98.25 $\pm$ 1.38	95.8060
$a = 20,2691$			$a = 17,0855$	
$b = 3.1644$			$b = 3.2800$	
$*Y = 20.2691 \pm 3.1644 \times$			$*Y = 17.0855 + 3.2800 \times$	

* The average body weights of the two groups have been fitted into a linear regression on age using the equation $Y = a + b \times$ where a (a constant) is the slope of the curve, b is the coefficient of regression, Y is the dependent variable (body weight) on an independent variable $\times$ (age).

incorporated in the calf starters to an advantage. Finally, it can be said that there is no beneficial effect of feeding 10 per cent more DCP over that recommended by Morrison for dairy calves from birth to six months of age as is evident from the results of the present investigation.

ACKNOWLEDGEMENT

The senior author is greatly indebted

to Dr. C. P. Ananthakrishnan, Officer-in-charge, S.R.S. of the National Dairy Research Institute, Bangalore, for having permitted him to carry out this work at the NDRI, Bangalore. He wishes to express his deep sense of gratitude to the Indian Council of Agricultural Research for the award of Junior Fellowship in Animal Nutrition during the period of this study.

REFERENCES

- Bhosrekar, M. and S. J. Daniel. 1965. Estimation of body weights of calves from body measurements. *Indian J. Dairy Sci.*, 18: 144.
- _____, _____ and D. N. Mullick. 1967. The growth rates of Red Sindhi, Sahiwal and Tharparkar female calves maintained under experimental feeding schedules. *Indian J. Dairy Sci.*, 20: 57.
- Brown, L. D., C. A. Lassiter, J. P. Everett (Jr), D. M. Seath. and J. W. Rust, 1958. Effect of protein levels in calf starters on the growth rate and metabolism of young calves. *J. Dairy Sci.*, 41: 1425.
- _____, _____ and C. A. Lassiter. 1962. Protein energy rations for dairy calves. *J. Dairy Sci.*, 45: 1353.
- Daniels, L. B. and C. Flynn. 1971. Evaluation of protein levels in calf starter rations. *J. Dairy Sci.*, 54: 788 (Abstr.)
- Gardner, R. W. 1967. Acceptability and nutritional response comparisons between calf starters. *J. Dairy Sci.*, 50: 729.
- _____, 1968. Digestible protein requirements of calves fed high energy rations *ad lib*. *J. Dairy Sci.*, 51: 888.
- Gill, R. S., H. Ranjit Singh and C. P. Ananthakrishnan, 1971. Correlation between the body weights and the linear body measurements of growing Zebu and crossbred animals. *Indian J. Dairy Sci.*, 24: 1-6.
- Lofgreen, G. P. and J. K. Loosli. 1947. Effect of protein level on the nitrogen metabolism and gains in weight of growing Holstein heifer. *J. Dairy Sci.*, 30: 589.
- _____, J. K. Loosli and Maynard, L. A. 1951. The influence of energy intake on the nitrogen retention of growing calves. *J. Dairy Sci.*, 34: 911.
- McCandlish, A. C. 1922. Studies on the growth and nutrition of dairy calves. *J. Dairy Sci.*, 5: 301-320.
- Morrill, J. L. and S. C. Melton. 1973. Protein requirement in starters for calves fed milk once or twice daily. *J. Dairy Sci.*, 56: 927.
- Morrison, F. B. 1956. *Feeds and Feeding*. 22nd Edn., Morrison Publishing Co., Ithaca, N. Y.
- Mudgal, V. D. and S. N. Ray. 1965. Studies on the nutrients required for growth: I. Different levels of DCP on Sahiwal calves. *Indian J. Dairy Sci.*, 18: 21.
- _____, _____ and _____. 1965. Growth studies on Sahiwal cattle. *Indian J. Dairy Sci.*, 18: 65.
- _____, _____ and _____. 1966. Growth studies on Indian breeds of cattle: III. Studies on the growth of Red Sindhi calves. *Indian J. Vet. Sci.*, 36: 80.
- Naidu, K. N. and R. N. Desai. 1965. Characters of growth and age at first calving. *Indian J. Vet. Sci.*, 35: 204.
- Pachauri, V. C. and S. S. Negi. 1971. Studies on the growth rate of Jersey local crossbred calves on two planes of nutrition. Scientific Report of Animal Nutrition Research Centre, IVRI, Palampur (UP), 1971. p. 7.
- Panda, P. B. and D. P. Sadhu. 1973. Rate of growth of crossbred heifers. *Indian J. Dairy Sci.*, 26: 270.
- Patel, B. M. and S. L. Anaokar. 1971. Effect of different levels of digestible protein on the growth rate of cow and buffalo calves. *Indian J. Anim. Sci.*, 41: 804.
- Ranjhan, S. K., 1971. Effect of limited milk intake on the growth rate of Holstein × Haryana, Brown Swiss × Haryana and Jersey × Haryana crossbred calves. Scientific Report of the Division of Animal Nutrition for the year 1971. IVRI, Izatnagar, p. 17.
- Rathee, C. S. and I. S. Yadava. 1970. Effect of different levels of DCP on the performance of Haryana calves. *Indian J. Dairy Sci.*, 23: 95.
- Sen, K. C. and S. N. Ray. 1971. Nutritive value of Indian Cattle Feeds and the Feeding of Animals. 6th Edn.
- Sharma, G. N. and D. B. Mukherjee. 1967. Studies on the growth rate and chemical composition of blood of Tharparkar calves on two levels of protein feeding. Proc. Anim. Nutr. Res. Workers Conf., 1967. Trichur-Kerala.
- Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods. Iowa State Univ. Press, Ames, Iowa.
- Talpada, P. M., P. C. Shukla, and B. M., Patel. 1973. Effect of feeding different levels of digestible protein and energy on the growth rate of calves. *Indian J. Dairy Sci.*, 26: 3.
- Tandon, O. B. and S. S. Bhatia. 1971. Growth of suckling Haryana calves in relation to their milk intake and their dam's production potential. *Indian J. Anim. Sci.*, 41: 1015.
- Taneja, V. K. and P. N. Bhat. 1971. Genetic parameters of growth in Sahiwal cattle. *Indian J. Anim. Sci.*, 41: 987.