EFFECT OF DIETARY BUTYRIC ACID ON DIGESTIBILITY OF NUTRIENTS AND GROWTH RATE IN CROSSBRED CALVES ON RESTRICTED MILK FEEDING

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The studies were carried out on 11 days old crossbred calves alloted in 3 groups of 5 each to study the effect of inclusion of butyric acid and replacing the whole milk with skim milk in the normal diet as well as restricting the milk feeding upto two months of age. The studies revealed that the apparent digestibility of DM, OM, CP, EE, NDF and ADF and total N intake, N outgo and N retention were not affected by the treatments. Body weight gain was observed higher in control group calves as compared to treated diet at early age. DM, CP and TDN intake per kg live weight gain also did not differ significantly between groups.

INTRODUCTION

Butyric acid has been found most effective in stimulating early development of rumen (Vidyarathi and Kurar, 1994). In the present studies attempt has been made to restrict the milk feeding and then observe the effect of butyric acid feeding on digestibility and growth rate. The basic objective of studies was to save the milk for the human beings by enhancing the early development of rumen so that the calf should take the required nutrients from the concentrate mixture and green fodder rather than milk.

MATERIALS AND METHODS

Fifteen male crossbred calves of 11 days of age were selected and allotted randomly on body weight basis to 3 groups of 5 each. The calves of group I (control) were fed as per milk feeding schedule followed at N.D.R.I., cattle farm that include feeding of colostrum upto 5 days of age at the rate of 1/10th of the body weight. From 6 to 30 days the calves are fed whole milk at the rate of one tenth of the body weight; from 31 to 60 days the calves are fed whole milk at the rate of one fifteenth of the body weight and skim milk one 1/25th of the body weight. Thereafter calves were fed only calf starter and green fodder. The calves of group II were fed same feeding schedule as in group I upto one month of age alongwith 6 ml butyric acid per day. Thereafter, whole milk was completely

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replaced with skim milk and ground maize grain alongwith same dose of butyric acid. This schedule was continued upto second month of age. The amount of maize flour added to the skim milk was calculated considering gross energy content present in same amount of milk. After second month, butyric acid was fed only with water (1/20th of body weight) and calf starter and green fodder was fed as in group I. Calves of group III were fed skim milk, ground maize grain and 6 ml butyric acid per day from the very beginning of experiment upto two months of age. Thereafter, butyric acid was only fed with water, calf starter and green fodder were fed as in group I upto 15 weeks of age. The calf starter contained maize 40 parts, wheat bran 16 parts, groundnut cake 40 parts, mineral mixture 2 parts and salt 2 parts. The calves were weighed at weekly intervals. To determine the digestibility of nutrients metabolism trials of 7 days collection periods was conducted at 3 months of age.

The samples of whole milk and skim milk were ananlysed for total solids, protein, fat and ash adopting IS (1982) procedure. Samples of maize flour, concentrate mixture, green fodder and faeces were analyzed for proximate principles and cell wall constituents as described in AOAC (1984) and Goering and VanSoest (1970) methods. The statistical methods of Snedecor and Cochran (1968) were followed.

RESULTS AND DISCUSSION

The average chemical composition (percent Dry Matter Basis) of concentrate mixture and green berseem was : dry matter 94.8 and 23.97; crude protein 27.04 and 13.17; etherextract 4.25 and 2.47, neutral detergent fibre 41.97 and 56.14; acid detergent fibre 21.9 and 47.98 and ash 9.96 and 8.84, respectively. The dry matter intake and crude protein intake (Table 1) were similar among different treatment groups.

Data presented in Table 1 showed that there was no significant ($P>0.05$) effect of treatment on DM and OM digestibility. Non-significant effect of treatments on the dry matter digestibility showed that restricted milk feeding alongwith butyric acid did not effect the digestibility adversely and the rumen equally functioned in all the 3 groups of calves.

Effect of treatment on CP digestibility was non-significant ($P>0.05$). Almost similar digestibility of CP in the three groups indicated that the rumen equally developed whether the calves were on only milk feeding schedule or on restricted milk feeding schedule alongwith butyric acid.

Average EE digestibility was slightly higher in group III followed by group I and group II though the difference was non-significant ($P>0.05$). Slightly higher EE digestibility though non-significant in group III was due to more intake of concentrate mixture as compared to groups II and I. It was quite evident that EE from concentrate could be digested more efficiently by the young calves than EE from green fodder (Kellner, 1905).

Table 1
Daily dry matter and crude protein intake and apparent digestibility coefficient

	Group I	Group II	Group III
DM intake (kg)			
a) Through green fodder	0.803 ± 0.157	0.604 ± 0.104	0.412 ± 0.087
b) Through conc. mix	0.687 ± 0.189	0.550 ± 0.086	0.853 ± 0.085
DM intake (kg)	1.49 ± 0.15	1.15 ± 0.14	1.27 ± 0.06
CP intake (kg)	0.28 ± 0.04	0.21 ± 0.02	0.27 ± 0.02
Digestibility Coefficient			
Dry matter	62.03 ± 2.18	62.54 ± 2.18	60.52 ± 2.99
Organic matter	64.91 ± 2.26	67.60 ± 2.57	65.30 ± 1.68
Crude protein	70.95 ± 3.04	70.73 ± 2.68	70.04 ± 2.36
Ether extract	71.61 ± 2.89	66.42 ± 3.75	73.76 ± 2.18
Neutral detergent fibre	50.47 ± 2.65	52.05 ± 3.62	46.47 ± 2.77
Acid detergent fibre	45.24 ± 1.33	45.40 ± 2.24	41.52 ± 1.29

Slightly higher NDF digestibility though non-significant (P>0.05) in group II might be due to early development of rumen as compared to other groups (Vidyarathi and Kurar, 1994). Digestibility of neutral detergent fibre depends upon the functional rumen development (Bondi, 1987). On the contrary, where rumen is less developed, the breakdown of NDF is limited. The trend in the apparent digestibility of ADF was observed similar as in case of apparent digestibility of NDF.

Average N intake, outgo, absorption, retention during metabolism trial are presented in Table 2. N intake through green fodder and concentrate did not differ significantly in different groups but total N intake in group II was slightly less due to less intake of concentrate mixture as compared to groups I and III.

Average N outgo through faeces (g/day) was significantly (P<0.05) higher in groups I and III as compared to group II. This might be due to higher DM intake in group I and group III. Due to higher DM intake, MFN loss might also be more in groups I and III as compared to group II. However, when N outgo through faeces were expressed on per cent of total nitrogen intake basis or per kg metabolic body size basis it did not differ significantly between different groups. N loss through urine also did not differ significantly between different groups. N absorption among different groups did not differ significantly (P>0.05).

Nitrogen retention in groups I and III was higher as compared to group II although not significant (P>0.05). N retention in group II was less due to more loss of nitrogen through urine in

Table 2
Nitrogen retention in male crossbred calves as affected by the treatments

Parameter	Group I	Group II	Group III
N-intake (g/day)			
a) Through fodder	16.90±3.30	12.38±2.41	8.20±1.64
b) Through conc.mix	28.15±7.71	21.50±2.53	35.05±3.49
Total N intake (g/day)	45.05±6.18	33.88±3.71	43.25±2.92
% of total N intake			
a) Through fodder	40.02±8.72	36.31±5.08	19.39±4.29
b) Through conc.mix	59.98±8.72	63.39±5.08	80.62±4.29
N outgo (g/day)			
a) Voided in faeces	12.63±0.96^{b}	9.88±1.28^{a}	12.75±0.09^{b}
b) Voided in urine	21.40±1.77	17.80±1.45	20.07±2.65
Total N outgo (g/day)	34.03±2.09	27.67±2.25	32.83±2.68
N outgo (% of total intake)			
a) Voided in faeces	29.05±3.04	29.27±2.68	29.96±2.36
b) Voided in urine	49.40±6.23	53.14±3.07	46.06±4.06
N absorbed (g/day)	32.42±5.69	24.00±2.81	39.50±2.95
N retained (g/day)	11.03±4.66	6.20±1.47	10.43±2.04
N retained (% of total intake)	21.54±8.44	17.59±2.20	23.98±3.89

* Significant at 5% level of significance
NS Non significant
a,b Figures bearing different superscripts in a row differ significantly

group II. Nitrogen retention was observed almost similar in groups I and III calves and higher than group II. The average live weight gain was observed as 343, 180 and 304 g/day during the metabolism trial which directly corresponds to the nitrogen retention in different groups of animal. The reason for lower intake of nitrogen in calves of group II were unknown. The digestibility of crude protein was almost equal in all the three groups of calves. Same was the case for NDF and ADF digestibility that means the rumen was fully developed and functional although milk feeding was restricted.

Effect of different treatment on live weight gain (kg/day) and feed conversion efficiency are presented in Table 3. Weight gain of calves of group I was significantly ($P<0.01$) higher in calves of group I as compared to group II and III but no significant difference between group II and group III was observed. More TDN intake possibly improved supply of true protein to small intestine which might lead to higher body weight gain in calves of group I as compared to groups II and III. DM, CP and

Table 3
Average live wt. gain per day and nutrients utilization efficiency in calves in different groups

	Group I	Group II	Group III
Total DM intake	105.16±15.45	93.71±11.68	98.73±10.12
DM/kg live weight gain	3.88±0.27	5.81±0.74	6.17±0.91
Total CP intake	17.81±4.09	16.97±2.07	18.58±1.71
CP/kg live weight gain	0.59±0.08	1.05±0.13	1.18±0.19
Total TDN intake	86.31±10.41	72.83±8.93	73.35±7.13
TDN/kg live weight gain	3.14±0.25	4.53±0.60	4.60±0.70
Live wt. gain (kg)	28.60±5.72	17.58±3.25	17.76±3.38
Av. live wt. gain (kg/d)	0.287±0.044	0.170±0.066	0.178±0.026

TDN intake per kg live weight gain did not differ significantly (P>0.05) though it were higher in case of groups II and III as compared to group I.

From the result of present study, it was evident that the rumen became functional even though the limited milk feeding was practised. As is evident from Table 4, 124 litres of milk or skim milk can be saved by feeding skim milk along with butyric acid. The rumen became equally functional in all the three groups after 3 months. It was also apparent that growth rate in restricted milk feeding groups of calves was lesser

Table 4
Total consumption of different feeds during experiment (upto 12 wks of age) in different groups (on fresh basis)

Particulars	Treatment groups		
	I	II	III
Milk (litres)	124.08±16.61	62.82±9.29	-
Skim milk (litres)	67.70±12.12	113.71±7.09	162.92±13.48
Ground maize grain (kg)	-	8.47±0.48	11.49±1.04
Butyric acid (ml)	-	596.60±43.62	591.80±37.87
Conc. mix (kg)	42.04±8.95	31.64±5.61	48.07±4.52
Green fodder (kg)			
Oat	28.87±7.58	21.21±6.45	22.10±5.43
Berseem	59.01±19.61	63.17±13.71	40.16±2.39
Maize	116.62±18.74	108.37±12.61	86.20±17.16

than the whole milk fed groups. So milk was saved at the expense of live weight at the early stage of growth of calves. It is concluded that VFA, particularly butyric acid may be fed to the calves along with milk or without milk to develop the rumen at an early age and can save the milk but at the expense of live wt. gain in calves.

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