THE GROWTH OF CALVES FED COLOSTRUM, SOUR COLOSTRUM, OR WHOLE MILK ONCE OR TWICE DAILY

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Summary

The utilization of whole milk, colostrum and sour colostrum in calf diets was examined. The liveweight gain of calves reared on whole milk and colostrum did not differ significantly irrespective of whether fed at low or high levels of feeding. While calves gained satisfactorily on sour colostrum, considerable problems were experienced with the fermentations, and these could limit the application of this system at the farm level.

For calves reared on whole milk, the effects of feeding once or twice daily were also examined, at low and high levels of feeding. It was found that feeding frequency could be reduced to once daily at the commencement of the rearing period without impairing calf performance and that there was no advantage in delaying this for three weeks.

I. INTRODUCTION

There are conflicting reports on the relative performance of calves fed whole milk or colostrum (Muller et al. 1974) and it is not known whether this comparison is influenced by level of feeding. If maximum utilisation of colostrum is to be achieved storage of large quantities then becomes a problem. Colostrum can be frozen but this storage method is expensive and these facilities are not usually available on the farm. The fermentation of colostrum to sour colostrum has been tested (Swannack 1971) and there is some evidence that this may be a useful method of storing colostrum at low cost for up to a month or longer. This process relies on a lactic acid fermentation at prevailing atmospheric temperatures and results in a thick, sweet-smelling product, not unlike yoghurt, and of low pH.

A number of studies have shown that calves can be fed milk or milk replacers once daily without adversely affecting calf growth (e.g. White and Radcliffe 1970). However, adoption of this feeding regime by farmers has been slow and has often only been imposed on older calves.

This study was aimed at providing information on the utilisation of colostrum in calf diets, and at comparing once and twice daily feeding of calves reared on whole milk.

II. MATERIALS AND METHODS

The experiment was conducted during the period March to May 1975 and used Hereford cross calves which were purchased from local saleyards when approximately one week old, and trained to drink from open buckets. Apart from balancing each group for sex, calves were randomly allocated to five feeding treatments - (i) whole milk twice daily, (ii) colostrum twice daily, (iii) sour colostrum twice daily, (iv) whole milk once daily, (v) whole milk twice daily for three weeks and once daily thereafter - for a period of seven weeks. Ten calves were allocated to the colostrum treatment, and eight to the other treatments. Within each feeding treatment, one half of the calves were fed at 10% of their live weight (low rate),

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and the other half at 14% of their live weight (high rate). Calves were individually fed, and between feeds were run as one group on nitrogen-fertilized kikuyu grass (Pennisetum clandestinum).

Colostrum was collected from 71 Guernsey cows during the experiment and was bulked on a daily basis. Calves were removed from these cows between 12 and 18h after calving and from this time cows were milked twice daily for seven milkings. Additional colostrum was taken from those cows yielding a protein test greater than 4.0% (estimated using Pro-Milk Mk.II, Foss Electric (Aust.) Pty. Ltd.). The mean composition of the milk, colostrum and sour colostrum were - protein (Kjeldahl nitrogen x 6.38) 3.33%, 4.47% and 4.54%; butterfat (Milko-Tester Mk.III, Foss Electric (Aust.) Pty. Ltd.) 4.74%, 4.44% and 4.47%; ash 0.72%, 0.82% and 0.79%; dry matter 13.71%, 14.54% and 13.96% respectively.

Sour colostrum was produced by placing approximately 41ℓ of colostrum in 46ℓ plastic garbage bins. These bins with lids on, were stored in the calf feeding shed and the contents were stirred twice daily to achieve a uniform fermentation and to prevent the formation of a mould layer. Maximum and minimum temperatures experienced in the storage area during the first half of the experiment were 29.6°C and 19.9°C respectively, and 25.9°C and 14.6°C respectively during the latter half of the experiment.

Calves were weighed weekly and these live weights were used to determine the daily feed ration for each calf. Daily feed intake and the incidence of scouring were recorded for each calf.

The growth of each calf was described by regression, $y=ae^{ct}$, where y is live weight, a and c are constants (c = relative growth rate, daily gain/kg live weight) and t time. Total gains to 31 and 49 days, and relative growth rates were subjected to analyses of variance.

III. RESULTS

Considerable problems were experienced, especially during the earlier part of the experiment, with the production of sour colostrum. As was determined by taste and smell, acetic acid fermentations predominated instead of the desired lactic acid fermentation, and the resultant product was completely rejected by calves. The acetic acid production, excessive foam production in some cases, and the isolation of high numbers of yeasts from the undesirable fermentations all point to yeasts being the causal organisms. Approximately 48% of all sour colostrum produced had to be discarded. The problem lessened during the second half of the experiment but it was found that fermentations took on an acetic flavour after six to seven days and were rejected by calves. Hence calves in this experiment could only be fed sour colostrum which was, on average, approximately four days old.

Owing to the considerable wastage of sour colostrum, it was necessary to reduce the number of calves in the sour colostrum treatment groups to three, and reduce the duration of these treatments from 49 to 31 days. Four other calves were removed from the experiment - reasons were death from bloat (1), continuous bloating after feeding and rejection of rations (2), wasting-type disorder of unknown cause (1).

The incidence of scouring was very low (0.8 scour days per calf), occurred only during the first 31 days of the experiment, and was unaffected by treatments.

Calves gained more live weight ($P < 0.01$) and had higher relative growth rates ($P < 0.01$) on the high level of feeding (Table 1). There were no significant diet effects on calf growth, and no diet by level of feeding interaction was observed. Frequency of feeding did not influence calf growth on the whole milk diet and did not interactwith level of

feeding. Calves placed on the once daily feeding regime at zero or three weeks from the start of the rearing period had similar liveweight gains.

TABLE 1
Intake and growth of calves fed two levels of colostrum, sour colostrum or whole milk (fed once or twice daily)

Treatment	Number of calves	Total intake (kg)	Liveweight gain (kg)* 0-31 days	0-49 days	Relative growth rate†* (kg/day per kg)
Whole milk- twice daily					
low	4	205	13.9	26.4	0.0127
high	4	353	22.3	40.4	0.0153
once daily-					
low	4	227	13.1	27.1	0.0114
high	4	364	21.8	40.5	0.0142
once daily- after 3 weeks					
low	3	218	13.5	27.3	0.0125
high	3	353	21.8	40.5	0.0157
Colostrum - twice daily					
low	5	224	15.3	27.1	0.0112
high	3	309	19.0	35.8	0.0147
Sour colostrum twice daily‡					
low	3	120	12.3	-	0.0107
high	3	193	21.8	-	0.0148
Standard deviation of an observation		-	±3.4	±5.1	±0.0018

* Level of feeding effects significant ($P < 0.01$). Other treatment effects non-significant.
† Daily gain per kg live weight (regression coefficient, c).
‡ Treatment terminated at 31 days.

IV. DISCUSSION

Large quantities of colostrum are produced on dairy farms and could be used for rearing calves. In this study, the growth and health of calves reared on the colostrum diets were similar to those of calves reared on whole milk. Hence, these results indicate that, when available, colostrum can be substituted for whole milk in calf feeding programmes without altering calf performance. Similar performance of calves reared on whole milk and colostrum has been observed by other workers (e.g. Jacobson et al. 1951) but the response to colostrum has been quite variable (Muller et al. 1974). One aim of this current study was to determine if the variability of the response to colostrum was due to an interaction with level of feeding. However no such interaction was observed. In contrast with some other studies (Muller et al. 1974) a higher incidence of scours was not observed in calves fed colostrum.

The fermentation of colostrum did not appear to affect its feeding value for calves. However, the considerable problems experienced with fermentations cast doubt on the reliability of this method of utilising

colostrum in this environment. The more favourable reports from overseas were based on studies conducted in cool environments where colostrum was stored at 10 to 15°C (Muller 1975). However Muller (1975) reported undesirable fermentations during warm weather. In my study there was considerable wastage of sour colostrum, and even when a satisfactory product resulted, it had a storage period of no more than a week. After this time the characteristics of the fermentations changed and undesirable flavours developed, predominantly acetic acid, which were unpalatable to calves. The acetic acid was probably produced by yeasts, this being supported by the isolation of large numbers of yeasts from the affected fermentations. As yeasts are widespread, and warm conditions prevail over large areas of Australia for much of the year, the problems experienced in this study may not be isolated to this- environment. It is likely that yeast contamination may remain a problem even when sour colostrum is produced by inoculation or direct acidification (Hall and Daniels 1975) as yeasts thrive at low pH.

Frequency of feeding did not affect calf gain and this result is in agreement with other studies (Willett, Albright and Cunningham 1969; White and Radcliffe 1970). Despite the large difference between the intakes of calves fed at the low and high levels of feeding (total intakes of 217 kg and 357 kg respectively), level of feeding did not interact with frequency of feeding. A similar result was obtained by White and Radcliffe (1970) on a milk replacer diet. Their high level of feeding for once daily fed calves was considerably lower than that used in this study (maximum daily intake of 4.5 kg and 9.7 kg respectively). Hence this study increases the range of feeding levels over which once and twice daily feeding have been compared.

The similar liveweight gain of calves placed on the once daily feeding regime at zero and three weeks indicates there is no advantage in delaying the reduction of feeding frequency. This is contrary to the routine adopted by many farmers. The introduction of a once daily feeding regime at the commencement of the rearing period would simplify management procedures and reduce the labour required for calf rearing.

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VI. REFERENCES

HALL, J.R., and DANIELS, L.B. (1975). Journal of Dairy Science 58: 743.

JACOBSON, W.C., CONVERSE, H.T., WISEMAN, H.G., and MOORE, L.A. (1951). Journal of Dairy Science 34: 905.

MULLER, L.D. (1975). Hoard's Dairyman 120 75.

MULLER, L.D., OWENS, M.J., BEARDSLEY, G.L., and SCHINGOETHE, D.J. (1974). Journal of Dairy Science 57: 319.

SWANNACK, K.P. (1971). Animal Production 13: 381.

WHITE, B.R., and RADCLIFFE, J.C. (1970). Proceedings of the Australian Society of Animal Production 8: 247.

WILLETT, L.B., ALBRIGHT, J.L., and CUNNINGHAM, M.D. (1969). Journal of Dairy Science 52: 390.