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The use of preserved colostrum for rearing replacement dairy calves: calf performance, economics and on-farm practicability in Kenya

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ABSTRACT

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A total of 133 observations on mean daily mass gains from 19 calves reared on either whole milk (control) or preserved colostrum (treatment) were estimated. The control group had a total of 104 observations computed, while the treatment group had a total of 29 observations. There was no significant difference in the overall mean daily mass gains between the treatment and control groups which were 0,2257 and 0,3607 kg, respectively ($P < 0,1$). Partial budgeting analysis estimated that with an annual calf crop of 80 calves, the use of preserved colostrum would result in a direct saving of an estimated US$1,800 per year for the farm.

Keywords: Preserved colostrum, dairy calves, calf performance, economics, on-farm practicability, Kenya

INTRODUCTION

The surplus colostrum produced in cattle in the first few days postpartum has been preserved by various methods (Muller, Ludens & Rook 1975; Otterby, Johnson & Polzin 1976; Kaiser 1977) and has been used for calf rearing as a substitute for whole milk for varying periods of time. Colostrum has been preserved either naturally through fermentation (Rindsig 1976), by controlled fermentation with the use of yoghurt cultures or with the use of preservatives (Muller & Syhre 1975; Otterby, Dutton & Foley 1977). The performance of the calves fed on whole milk or fermented colostrum compares very well with that of the calves showing similar mass gains at weaning (Foley & Otterby 1978). When stored in warm ambient temperatures, fermented colostrum does not preserve well owing to excessive acidity and putrefaction which results in reduced acceptability by calves (Muller & Syhre 1975; Muller & Smallcomb 1977).

The use of formaldehyde as a preservative has been found to maintain a constant pH, reduce protein degradation and retard bacterial growth (Muller & Syhre 1975; Rindsig, Janaecke & Bodoh 1977). This preservation method would seem ideal for tropical conditions where high ambient temperatures prevail and inadequate electricity supplies restrict the widespread use of refrigeration facilities.

This study compares the performance of two groups of calves, one fed on formaldehyde-preserved colostrum and the other raised conventionally on whole, fresh milk. The on-farm practicability of preserving

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colostrum is assessed as well as the economic value of the milk saved.

MATERIALS AND METHODS

This study was carried out at the University of Nairobi veterinary farm at Kabete, approximately 20 km west of Nairobi in Kenya. The dairy herd was composed of Ayrshire and Friesian breeds that were bred by artificial insemination, the semen being obtained from the Central Artificial Insemination Station, Kenya. The general farm-management policy for newborn calves is to allow them to suckle colostrum for the first 5 d postpartum. The excess udder secretion (colostrum) is milked and discarded. The calves are separated from the dams on the sixth day, housed individually (in most cases) or in pairs (rarely) and bucket-fed on pooled, fresh, warm milk soon after milking (while the milk is still warm).

The performance of calves under two treatment regimes, as described below, was monitored by calf growth through daily mass gains. Nineteen calves born with ease at term (natural, easy birth) between March and June 1994 were recruited for the study.

The calves were mass measured as soon as it was practically possible on the first day of birth, and a platform balance was used (Avery Kenya Limited). The calves were allowed to suckle their mothers for the first 5 d postpartum. The excess colostrum (defined as secretion remaining in the udder after the calf had suckled for the first 5 d postpartum) was milked and stored as described below. Dams that lacked full functional quarters, or in which the first udder secretion showed either blood stains or clots, were disqualified from recruitment. On the sixth day, the calves were allocated alternately into two groups, A and B, according to calving order. Calves with an odd calving order were assigned to group A while those with an even calving order were assigned to group B. It was envisaged that the alternate assignment of calves into the two groups would distribute the calves fairly randomly, given the spread of the calving period. Calves in group A (control group) were bucket-fed on pooled fresh milk soon after it had been milked (while it was still warm) at 10% body mass twice per day. Calves in group B (treatment group) were bucket-fed on pooled colostrum, preserved with 0,1% formaldehyde (earlier stored in 20-ℓ plastic containers) at 10% body mass, twice daily. Before it was fed to the calves, the colostrum was shaken thoroughly and diluted with fresh warm water (at approximately body temperature) at a dilution of 2:1.

All calves in the study were housed individually and received fresh water *ad libitum*. The body mass of each calf was then monitored at weekly intervals until the eighth week and recorded in kilograms (to the nearest 0,5 kg). Any clinical diseases/conditions that might possibly occur, had to be recorded at the individual calf level whenever noted, as such an event would confound calf growth and hence calf performance. During the study period the farm personnel were closely supervised to ensure that high standards of cleanliness be maintained in the calf pens and also regarding equipment used for feeding calves.

Statistical analysis

Daily mass gains were calculated for each calf by subtracting the previous week's calf mass from the current mass divided by the number of days between them. When the daily mass gains for the first week of life were computed, the birth masses were taken as the previous masses and were subtracted from the masses at the end of the first week of life. A total of 136 daily mass gains were computed, as one calf died during the fifth week. The control group (receiving fresh milk) had a total of 104 daily mass gains computed while the treatment group (receiving preserved colostrum) had a total of 29 daily mass gains. The mean daily mass gains for the treatment and control groups were compared by use of students t-test adjusted for unequal cluster sizes. As all the calves were raised on the same farm under fairly uniform management procedures such as feeding, housing, personnel and so on, the influence of all other farm-related factors (except for treatment effect) were assumed to be less variable. The minimum, maximum and median mean daily mass gains for each treatment group, and the standard deviations and errors were computed.

Economic analysis

Partial budgeting analysis (Blagburn 1967; Putt, Shaw, Woods, Tyler & James 1987) was applied to derive incremental costs and benefits. The incremental costs include the cost of labour required to determine the mass of the calves, that of purchasing colostrum containers and formaldehyde, and that of extra transport and labour required to handle the extra milk and to deliver it to the market. Incremental benefits accrued from value added to colostrum used to feed the calves and the income realized from the extra milk that was available for sale. The potential on the whole farm enterprise was estimated from the benefits accruing from each calf reared over the year and the costs incurred to rear it.

RESULTS

The amount of colostrum harvested per cow in the first 5 d postpartum ranged from 2–43,5 kg (mean 22,98 ± 11,83 kg). Table 1 shows the summary of the results for descriptive statistics and the t-test for the treatment and control groups. There was no significant difference between mean daily mass gains for calves that had received colostrum as substitute to

TABLE 1 Descriptive statistics for 133 mean daily mass gains (in kg) from 19 calves from birth to 8 weeks, for two treatment regimes

Treatment[a]	N	Mean	Minimum	Maximum	Median	Standard deviation	Standard error
Colostrum group	29	0,2257	–0,286	0,833	0,300	0,257	0,05
Milk group	104	0,3390	–0,200	1,010	0,342	0,223	0,02

[a] Differences between mean daily mass gains not significant (t-test, $P < 0,1$)

fresh milk and those that had continued to receive fresh milk (t-test, $P < 0,1$). The mean daily mass gains, expressed in kilograms, for the treatment and control groups were 0,2257 and 0,3607 kg, respectively. One interesting observation was that calves from both treatment and control groups had lower mean daily mass gains during the first 2 weeks of life (mean 0,168 and 0,192, respectively) and that the overall mean rose from the third to the seventh week of life and remained high. One calf in group A failed to learn how to bucket-feed and was therefore bottle-fed. This calf died the fifth week following severe scouring. Data from this calf was excluded from final statistical analysis. The calves in the treatment group (N = 10) consumed an average of 41,2 kg (range 16,5–64,8 kg) each of the diluted colostrum for an average of 13,4 d (range 8–20 d) on separation from the dam. They consumed an average of 170,4 kg (range 130–182 kg) each of the whole milk up to the eighth week of life.

The calves in the control group (N = 9) were fed on an estimated range of 222,2 ± 21,46 ℓ of whole milk each between day 6 and 56, valued at Kenya shillings (KSh) 3,555.20 ± 343.36 (US$100) (the price of milk being KSh16.00/ℓ). In comparison, calves in the treatment group (N = 10) consumed 16,5–64,8 (41,16 ± 14,18) ℓ of colostrum each and 130–210 (170,4 ± 21,08) ℓ of whole milk valued at KSh2,726.40 ± 337.30 over and above their preserved colostrum. This represented a saving of KSh828.80 per calf (or KSh8,288.00 for the ten calves) and KSh658.90 or (KSh6,589.00 for the ten calves), the latter representing an added value of the colostrum fed to the calves. The additional costs incurred, included labour, estimated at one man per hour per day (KSh560.00), the price of formaldehyde (KSh1,270.00), six containers (KSh780.00), detergents (KSh200.00) and disinfectants (KSh100.00). Other costs which should be borne in mind but were difficult to evaluate accurately, included the cost of handling and storing the extra milk and transporting it to the market.

DISCUSSION

The results from this study show that the use of preserved colostrum as a substitute for fresh milk is not associated with lowered calf productivity as indicated by mean daily mass gain. Although these are preliminary results and a longer-term detailed study will follow, the above indicators show that preserved colostrum can serve as a suitable substitute for fresh milk. Calves raised on preserved colostrum after the usual 5 d of feeding on dams' colostrum, showed growth patterns similar to those that were raised in the conventional way, on fresh milk. This finding was in agreement with some past studies (Foley & Otterby 1978).

One interesting observation from this study is that calves from both treatment and control groups had lower mean daily mass gains during the first 2 weeks of life. Whether this observation is normal for calves at birth or was influenced by the farm-management procedure, is worth investigating.

Feeding the ten calves on colostrum, resulted in a direct saving of KSh8,288.00 and an indirect added value of KSh6,590.00 in used colostrum. The low yield of colostrum harvested (mean 22,98 ± 11,83 ℓ, range 2–44) in the present study, was due to pilferage from the third day of calving by the workers for their own consumption.

The farm on which this study was carried out has an annual crop of about 80 calves, which would result in a direct saving of KSh66,336.00 (approximately US$1,800) in addition to the added value of full colostrum utilization, KSh52,680.00 (approximately US$1,500). These savings are based on the current rate of harvesting colostrum which could have been improved had there been no pilferage. The cost incurred to produce this high profit would remain approximately 10% of the direct and indirect benefits. Other costs that would have to be considered, would be those of handling and storage of the extra milk and the cost of transporting it to the market.

In a related trial, conducted by Karioki, Mbuthia, Kiragu & Gitau (unpublished data 1994), similar benefits were realized on feeding Sahiwal calves on colostrum preserved naturally or artificially with formaldehyde and formic acid.

The results from this study indicate that formaldehyde-preserved colostrum is a practical and economical diet for young calves. This observation is supported by the fact that there was no reduction in the acceptability to calves of formaldehyde-preserved colostrum nor any reduction in calf performance. This preservation method can easily be exploited and adopted in the rural areas of the tropics as it is sim-

ple and the minimal technology required, is readily available.

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