Non-milk constituents in replacers for calf rearing

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ABSTRACT

A milk replacer containing 40% non-milk constituents (V) was compared with a proprietary milk replacer (M) in two calf-rearing systems (H and R) using calves at pasture.

Forty-eight, four week old Friesian calves were allocated to one of four treatments (in two replicates) and offered reconstituted milk replacers (140 g/l) : MH and VH, 8l daily for 3 weeks plus *ad lib* meal for two weeks; MR and VR, 4l daily for 5 weeks.

Replacer M gave significantly ($P<0.01$) greater liveweight gains over the first 3 weeks for calves in treatment H but not in R. Treatment H calves showed a temporary growth check following weaning and again following the termination of meal feeding. Treatment R calves showed a progressive increase in daily rates of gain during the experiment.

By 5-6 months of age the mean body weights of calves in all four groups were similar indicating that there were no adverse carry-over effects of replacer V, or the system of feeding. Significant savings in the cost of calf rearing are therefore possible.

Keywords Calves, soya flour, milk substitutes.

INTRODUCTION

The high cost of milk powders, which form the basis of milk replacers used for calf rearing, has stimulated the search for alternatives. Animal body fats (or vegetable fats) are now widely used in conjunction with skim milk powder to produce milk replacers. However, the substitution of vegetable proteins (eg. soyabean) for casein has proved more difficult because of the occurrence of a wide range of nutritional problems which affect the calf fed non-milk proteins, especially during the first three weeks of life (Stobo, 1983).

The objective of the present study was to examine the efficacy of a new cheaper milk replacer containing vegetable fat and protein which could be used between four weeks of age and weaning, for calves reared outdoors.

EXPERIMENTAL METHODS

48 Friesian calves (16 male and 32 female) which had been fed fresh colostrum and milk *ad lib* from birth, and were "at pasture", were weighed and divided into two similar groups when they reached 23 days of age (range 19-29 days on 6/4/90).

Over a transition period of 6 days the individual groups were gradually introduced to the two experimental rations (M & V) (Table 1).

TABLE 1 Ingredient and chemical composition of milk replacers containing solely milk products (M) or 40% of nutrients from vegetable sources (V).

Ingredients (%)	M (Milk)	V(Vegetable)
Whole milk powder	68	10
Skim milk powder	25	25
High fat (casein/palm oil) powder	-	20
Toasted soyaflour & methionine	-	30
Lactose	5	8
Minerals & vitamins	2	7
Chemical analysis (%)		
Dry matter	96	96
Crude protein	29	31 (50:50)*
Fat	18	19 (84:16)
Carbohydrate	41	36 (26:74)
Minerals	8	10

* Ratio of nutrient from vegetable:milk sources.

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At four weeks of age the calves, within ration groups, were allocated to four groups of 6 calves each, two of which were fed at a high level (H) and two at a restricted level of feeding (R).

The four (replicated) treatment groups were fed reconstituted milk replacers (140 g powder/l) as follows:

MH, VH } 8 l daily/calf for three weeks plus *ad lib* calf meal for two weeks.

MR, VR } 4 l daily/calf for five weeks

The calves (in groups of six) were "group fed", and suckled milk from teats attached to a drum which was replenished with milk replacer daily. Calves were weighed and moved to a new break of mixed ryegrass/clover pasture at weekly intervals.

Calf meal (Harvey Farm, pellets) was made available *ad lib* to the MH and VH groups (in covered feeders) for 1.5 weeks prior to weaning (at 7 weeks of age) and for two weeks following weaning.

The statistical significance of the effects of the ration and level of feeding were tested by analysis of variance at each time period.

RESULTS AND DISCUSSION

A milk replacer needs to be palatable, easily reconstituted (preferably in cold water), remain in suspension when mixed, converted efficiently into body tissues and not cause scouring or any other health problem.

Both milk replacers were palatable and easily mixed but V did tend to settle out when used at the high level of feeding. This problem could be readily solved with the addition of a thickening agent or possibly with acidification using an organic acid.

All calves adjusted readily to both the milk replacers during the transition period (3-4 weeks of age) and there were no signs of scouring at any stage of the experiment.

At the start of the experimental period, at 4 weeks of age, the calves had an average liveweight of 60.5 kg (SD 6.3), ranging between 42 and 73 kg, and had previously grown at a rate of approximately 700g/d from birth.

The average rates of gain for calves during each week of the experiment are provided in Table 2. Over the whole of the first three weeks of the experiment, during which the milk replacers can be compared most directly, replacer M resulted in significantly ($P<0.01$) greater gains, than those receiving V, for calves at the high level of feeding (H) but not at the restricted level (R) (MH 832; VH 629; MR 570; VR 524 g/d).

These results suggest that the nutritive value (conversion efficiency) of V is about 25% poorer than M when the replacers are the main component of the ration. While the reason(s) for this difference was not apparent from the measurements made the results are in agreement with many published reports that the use of soyflours, which can contain several anti-nutritional substances (eg. anti-trypsin factor, haemaglutinins, oligosacharides and antigens) result in poor calf performance (Stobo, 1983). Extreme symptoms such as scouring, or mortality, were avoided presumably because not even small amounts of V was fed to calves under 19 days of age.

The lack of a significant difference between the replacers at the restricted level of feeding (Table 2) was probably due to the fact that the calves which received less milk were encouraged to eat significant amounts of pasture (measured in other experiments at approximately 300g dry matter, at $5^1/_2$ weeks of age). Over the following two weeks, within the R treatments, all groups of calves (M & V) progressively increased their growth rates and there were not significant differences between the replacers.

TABLE 2 Average daily gains (g/d) and total weight gain (kg) for calves between 4 and 10 weeks of age.

	Age (Weeks)						Total gain
	4-5	5-6	6-7	7-8	8-9	9-10	4-10
Treatments							
VH	446	571	869	631	1123	481	28.9
MH	899 *	673	928	679	1251	220	32.5 *
VR	316	643	613	578	923	931	28.0
MR	500	524	685	696	816	821	28.3
SE	108	83	41	44	67	94	0.7

* $P<0.05$

The calves on the H treatments showed a temporary check in growth following weaning in spite of the considerable consumption of dairy meal (Table 3) which was provided with the objective of easing the transition from a high milk intake to pasture alone. The subsequent removal of this meal at 9 weeks of age in the VH and MH groups induced a further temporary check in growth rates (Table 2).

The overall effect of the treatments by 10 weeks of age was that the MH calves were between 3.6 kg and 4.5 kg heavier than the calves in the other three treatment groups (Table 2).

Subsequent to the experimental period, the 32 female calves were managed as a single group and were weighed at monthly intervals. By 30 August 1990 ($5^1/_2$ months of age) the mean body weights were MH 158.6, VH 163.7, MR 160.6 and VR 160.3 kg, which suggests that there were no adverse carry-over effects of the milk replacers, or the system of feeding, on performance.

TABLE 3 Average weekly consumptions of calf meal (kg) by calves in the VH and MH treatments (weaning at 7 weeks).

Age (Weeks)				
5-6	6-7	7-8	8-9	Total
0.3	1.2	5.1	10.4	17.0

Apart from palatability, convenience and feeding value, the most important feature of a milk replacer is its cost. As illustrated in Table 4 a 10% lower cost for V compared with M would result in a considerable saving in the cost of calf rearing, particularly if large numbers of calves were involved. Therefore from a practical viewpoint the disadvantages of having to use two different replacers (before and after 4 weeks of age) would have to be balanced against the price differential between the replacers. In addition, the system involving a restricted level of feeding was much cheaper than the *ad lib* system.

TABLE 4 Costs ($) of feeding calves to weaning using M and V in two alternative systems.

	MH	VH	MR	VR
Colostrum + 150 l milk to 4 weeks	35.00	35.00	35.00	35.00
Milk replacer M @ $2.50/kg	58.80	-	49.00	-
Milk replacer V @ $2.25/kg	-	52.92	-	44.10
Calf meal 17 kg @ $0.50/kg	8.50	8.50	-	-
Totals	102.30	96.42	84.00	79.10

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REFERENCE

Stobo I.J.F. (1983) Milk Replacers for Calves In *Advances in Animal Nutrition*, pp 113-140 Butterworths.