Artificial rearing of red deer calves

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Red deer calves have been successfully reared on milk replacers from within a few days of birth to weaning at 9–12 weeks. In one experiment, eight female calves individually bottle-fed a simulated deer milk, grew at an average rate of 1.67 kg.week^{-1}. One year later in a second experiment, groups of five male calves were fed either a simulated deer milk or a bovine milk substitute with an average growth rate on both feeds of 2.3 kg.week^{-1}. Two calves fed the high lactose bovine milk replacer frequently suffered from scouring; it is perhaps therefore advisable to feed a milk replacer similar in composition to deer milk. However despite considerable care and effort it is likely that some calves will not achieve good growth rates because of their particular temperament, being either reluctant drinkers or particularly nervous individuals.

Keywords Red deer; *Cervus elaphus;* deer farming; milk replacers

INTRODUCTION

The high price of red deer (*Cervus elaphus* L.) for farming makes successful rearing of orphaned or captured deer calves economically attractive. The aims of artificial rearing are reasonable growth rates and minimal losses. Although red deer calves have been successfully hand-reared (Youngson 1970; Blaxter et al. 1974), growth rates have been inferior to suckled calves, with the exception of calves fed a ewe milk, rather than a cow milk substitute, in one study. This paper reports two studies in which different milk replacers and rearing strategies were used.

EXPERIMENTAL PROCEDURES

Two experiments have been conducted. For each experiment, young calves were located in their paddock hides within a few days of birth, blindfolded, placed in a sack with their heads out, and taken to the deerhouse where they were placed quietly in a pen. During the first few days indoors a considerable amount of time was spent teaching the calves to drink so that all but one (a female) were drinking with some enthusiasm within 3–5 days. All calves were offered warmed (about 30°C) milk *ad libitum* at each feed. At feeding time during the first few days the anal region of each calf was rubbed with a warm wet cloth to stimulate defecation. This practice, which simulates the licking of the calf by the hind during sucking, was discontinued when calves were observed to defecate without such stimulation. Colostrum was not fed and water was available from nipple drinkers at all times.

Experiment 1

Eight female calves (mean weight 7.4 kg, range 6.6–9.0 kg) were separated from their dams at 3–5 days of age. They were housed in individual pens (2.7×1.8 m) and were individually bottle-fed a simulated deer milk (SDM). For the first 6 weeks milk was offered 3 times daily (at 0900, 1500, and 2000 h) and thereafter twice daily (at 0900 and 1500 h) until weaning on to pasture at 9–10 weeks. Individual intakes were recorded throughout the milk feeding period.

The calves had access to various solid feeds which were available *ad libitum*. During weeks 2–5 a proprietary calf meal (Weenemon, W. & R. Fletcher) was offered. However the calves refused to eat it and for this reason freshly cut ryegrass and clover were substituted during Weeks 6 and 7, and chopped lucerne hay during Weeks 8 and 9.

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TABLE 1 — Composition of the experimental diets and of red deer milk.

	DM(%) of milk fed	Milk composition (% of DM) Fat	Protein	Lactose	Ash	Gross energy ($MJ.kg^{-1}$)
SDM[1] Expt. 1	22.6	41.4	34.2	20.5	3.9	27.7
SDM Expt 2	22.0	41.7	34.0	20.5	3.8	27.8
Ancalf Expt 2	24.2	10.2	34.0	49.0	6.8	20.1
Red deer milk[2]	22	40	33	22	5	27

[1] SDM, simulated deer milk: 5.4 l of cows' milk, 1.2 l cream (Otago Milk Industries Co-op Ltd, Dunedin) plus 410 g of protein concentrate (50% soluble whey protein, Solac, and 50% calcium caseinate, N.Z. Co-operative Dairy Co. Ltd, plus minerals at 6 $g.kg^{-1}$ and vitamins at 1 $g.kg^{-1}$; the mineral mixture contained MgO, 426 g; $FeSO_4.7H_2O$, 383 g; $MnSO_4.4H_2O$, 126 g; $CuSO_4.7H_2O$, 40 g; $ZnCO_3$, 24 g; $CoSO_4.7H_2O$, 0.5 g; KI, 0.2 $g.kg^{-1}$ mineral mix and the vitamin mixture contained vitamin A, 20×10^6 iu; vitamin D_3, 3.5×10^6 iu; vitamin E, 20 g; vitamin B_{12}, 30 $mgkg^{-1}$ of vitamin mixture; from Roy 1970). [2] From Arman et al. (1974).

Experiment 2

Ten male calves (mean weight 9.4 kg, range 7.4–12.0 kg) were separated from their dams at 1–2 days of age. They were fed either SDM or a proprietary bovine milk replacer (Ancalf). The calves were housed in groups of 5 in pens (2.7×3.6 m). The calves were bottle-fed individually while being taught to drink but thereafter each group was fed from a suspended bucket fitted with teats. The milk was offered at least 4 times daily for the first week and then 3 times daily (0900, 1400, and 2000 h) for the following 7 weeks until the calves were turned out to pasture at 8 weeks. Consequently only group intakes were recorded during the indoor feeding period. For the first 4 weeks at pasture the calves were fed once daily from bottles and individual intakes recorded.

The calves were offered small quantities of freshly cut lucerne from 3 weeks of age and a high quality pelleted feed (55% barley, 35% lucerne, 10% linseed meal) was offered *ad libitum* from 5 weeks. Since young deer had been observed eating soil in paddocks, a piece of turf was placed in each pen and was replaced at intervals; the calves were seen to lick the soil frequently.

Hygiene and animal health

In Experiment 1, the pens were scrubbed and cleaned weekly with a disinfectant solution. However, since health problems were thought likely in Experiment 2 (as a result of group feeding and the high lactose content of the Ancalf) pens were scrubbed and washed daily with a disinfectant solution and the hay bedding replaced.

Calves which scoured were treated with the antibiotics Strinacin (May & Baker (N.Z.) Ltd, Wingate) or Neo-sulphentrin (2 $g.day^{-1}$) (A. M. Satterthwaite & Co. Ltd, Christchurch). In some situations an electrolyte solution (0.4 $l.day^{-1}$ containing 6 $g\ l^{-1}$) (Trolyte, Ethical Agents Ltd, Auckland) was also administered. Faecal samples taken from the scouring calves in Experiment 2 were examined for the presence of pathogenic bacteria by staff at the Invermay Animal Health Laboratory.

Milk replacers

The SDM was formulated to approximate the composition of red deer milk (Arman et al. 1974). The composition of SDM and Ancalf are given in Table 1. In an attempt to improve the palatability of SDM, sucrose (40 $g.l^{-1}$) was added, but this caused scouring within 12 h so the practice was discontinued. Such scouring would suggest that the calves failed to digest the sucrose.

RESULTS AND DISCUSSION

Intake and liveweight gain

Experiment 1: One calf refused to suck and so was force-fed milk for the entire indoor-rearing period. The data for this calf have been omitted from the results. The weekly mean voluntary milk intakes for the seven calves are given in Table 2 together with the mean values for liveweight gain. Except for one calf, which drank well from the second day, milk intakes were low for the first week. Over the 9-week period the fastest growing calf averaged 2.2 kg liveweight gain per week while the slowest averaged 0.6 $kg.week^{-1}$ (this calf never drank freely and consequently its milk intake was very low). The calf mean growth rate of 1.76 $kg.week^{-1}$ for the 9-week period was 30% lower than the growth rate of naturally reared female calves at Invermay (2.6 $kg.week^{-1}$ from birth to weaning at 14 weeks). There was no relationship between the initial weight of the calves and their subsequent milk intake or liveweight gain.

From Weeks 2 to 8, the mean milk intake of the calves increased at a rate of 6.4±1.0 (SE) % per week

TABLE 2 — Mean milk intakes and liveweight gains for seven female calves fed the simulated deer milk during the 9 weeks of Experiment 1[1].

Week	Mean	SE	Range
	MILK DM INTAKE (kg per week)		
1	1.16	0.18	0.59 – 2.04
2	1.84	0.16	1.18 – 2.28
3	1.98	0.17	1.08 – 2.49
4	2.11	0.20	0.97 – 2.48
5	2.28	0.22	1.13 – 2.97
6	2.32	0.20	1.26 – 2.96
7	2.47	0.25	1.01 – 2.96
8	2.67	0.22	1.43 – 3.11
9	2.61	0.22	1.66 – 3.35
Overall Mean	2.16	0.18	1.19 – 2.72
	LIVEWEIGHT GAIN (kg per week)		
1	0.5	0.48	–1.00 – 2.70
2-3	1.90	0.14	1.10 – 2.25
4-5	1.94	0.27	0.40 – 2.45
6-7	1.82	0.24	0.45 – 2.10
8-9	1.94	0.19	1.10 – 2.45
Overall Mean	1.76	0.20	0.60 – 2.25

[1] The eighth calf which was force-fed throughout had a mean growth rate of 1.1 kg per week over the 9 weeks.

TABLE 3 — Mean liveweight gains and milk intakes for the calves during the 8 week indoor feeding period. (Experiment 2).

	SDM (n=5)	ANCALF (n=5)
Liveweight gain (kg per week):		
Mean (SE)	2.29±0.13	2.33±0.22
Range	1.91–2.48	1.86–3.14
Weekly milk intake:		
DM (kg)	2.5	3.0
GE (MJ)	70	60

TABLE 4 — Total milk energy intake, liveweight gain, and the number of days on which milk was consumed for each calf over the first 4 weeks at pasture (Experiment 2); (a) self-weaned

Calf	GEI (MJ)	LWG (kg)	Days
	SDM		
727	90	7.3	17
729	16	5.4	4[a]
733	60	5.2	9[a]
751	110	6.4	26
753	8	6.9	2[a]
	Mean (SE)	6.2 (.41)	
	ANCALF		
728	52	9.1	17[a]
732	88	8.9	28
740	155	8.8	28
750	178	9.4	28
752	97	8.6	28
	Mean (SE)	9.0 (.30)	

while the rate of liveweight gain was similar throughout. The calves consumed only small quantities of solid feed with milk being the sole energy source during the first 5 weeks of the period. Although calves had access to a solid meal supplement they refused to eat it. However pasture and lucerne hay proved more acceptable with average daily intakes of 25 g pasture DM during Weeks 6 and 7 and 130 g of lucerne hay (DM) during Weeks 8 and 9. The regression relationships between milk gross energy intake (GEI, $MJ.day^{-1}$) and liveweight gain (LWG, $kg.day^{-1}$) are as follows (n=7):

$$LWG(Weeks\ 2–5) = 0.0393\ GEI – 0.0443,\ r^2 = 0.86,\ RSD = \pm 0.0305$$

$$LWG(Weeks\ 6–9) = 0.0294\ GEI – 0.0224,\ r^2 = 0.72,\ RSD = \pm 0.0441$$

$$LWG(Weeks\ 1–9) = 0.0374\ GEI – 0.0632,\ r^2 = 0.92,\ RSD = \pm 0.0236$$

Although the intake of solid feed is disregarded in these equations its contribution to energy intake was small amounting to no more than 10% of the total metabolisable energy intake during Weeks 6–9.

Using the above equations the milk requirements of a female calf growing at a rate of 0.37 $kg.day^{-1}$ (the growth rate of naturally reared calves) can be calculated. Thus the required GE intake from milk over Weeks 2–5 would be 10.5 MJ.GE. day^{-1} and over Weeks 6–9, 13.3 MJ.GE. day^{-1} with an average over the 9 week period of 11.6 MJ.GE. day^{-1}. This is about 35% higher than the mean intake recorded in the present work.

Experiment 2: The mean liveweight gains for the calves fed the SDM and Ancalf for the 8 weeks of indoor feeding are given in Table 3. Weight gains of the calves were about 30% higher in this than in the previous experiment (2.31 ± 0.06 (SE) compared with 1.76 ± 0.20 $kg.week^{-1}$). There are several possible reasons: (i) more time was spent with the calves, handling them and encouraging them to drink especially over their first week indoors; (ii) the calves were males with a higher growth potential than females; (iii) the calves may have been advantaged socially by being held in groups rather than in individual pens; and (iv) the male calves were apparently more efficient at converting milk energy into liveweight gain with efficiencies over Weeks 2–5 of 29.6 MJ.GE per kgLWG in Experiment 1 and 23.3 MJ.GE per kgLWG in Experiment 2. There was no relationship between the initial weight of the calves and their subsequent rate of liveweight gain.

For the first 5 weeks intakes of solid feed were negligible, but from Weeks 6 to 8 DM intakes increased from about 10 to 100 g per head per day.

During Week 8 this would amount to about 10% of the metabolisable energy intake.

Over the 8-week milk feeding period the average weight gain of the calves in the two groups was 2.3 $kg.week^{-1}$ which is about 18% lower than the mean growth rate of maternally-reared male calves at Invermay (2.8 $kg.week^{-1}$ from birth to weaning at 14 weeks).

The individual milk intakes and the liveweight gains of the calves over Weeks 9–13 when grazing pasture are given in Table 4; four of the calves (three on SDM and one on Ancalf) weaned themselves before the end of this period. Although the Ancalf-fed calves had higher milk intakes and higher liveweight gains than the calves fed SDM during this period, there was no evidence of any relationship between weight gain and milk intake within either of the milk groups. Since all calves were in the same paddock with access to high quality ryegrass-white clover pasture and lucerne-barley-linseed pellets *ad libitum*, the reason for the faster gain of the Ancalf fed animals is not obvious.

Post-weaning gains:

The liveweight gains (kg) over the 14 week period post-weaning until early June were 12.4 ± 1.2 (SE) for the 8 female calves in Experiment 1 (June weight of 40 kg) and 12.5 ± 0.7 for the 10 male calves in Experiment 2 (June weights of 46 kg for SDM and 49 kg for Ancalf-fed calves). These weights are lower than the average June weight of maternally-reared calves at Invermay, i.e., about 48 kg for females and 52 kg for males.

Animal health and behaviour

Experiment 1: One calf refused to drink so had to be force-fed, an extremely time-consuming operation Another calf was flighty and never drank freely; consequently its intake and rate of weight gain during the indoor feeding period were poor. During the first week one calf started to scour so the quantity of milk offered was reduced to a maximum of 0.5 $l.day^{-1}$ and the calf treated with the antibiotic Strinacin (2 $g.day^{-1}$) for 5 days. During the third week indoors its intake was similar to the other calves.

Experiment 2: Of the two calves with the lowest rate of gain (1.9 $kg.week^{-1}$), one was an extremely slow drinker while the other was flighty and nervous. It therefore seems likely that low milk intakes were mainly responsible for their below average performance. Serious health problems occurred in two other calves (both on Ancalf). These calves scoured persistently during the indoor feeding for periods of up to 2 weeks. During this time they were isolated and treated with the antibiotics Strinacin or Neo-Sulphentrin. During the first bout of scouring, calves were taken off milk for 24 h, and given glucose (40 g), Strinacin (2 g), and an electrolyte solution (Trolyte, 2.4 g). Restricted quantities of milk were then offered the next day. However, during later bouts of scouring, milk intake was not restricted. No significant pathogenic bacteria were isolated from the faeces of the affected calves and it seems likely that a dietary factor was the cause of scouring. In this respect, high lactose intakes were implicated as the cause of an outbreak of severe sickness, diarrhoea, and death in red deer calves fed a cow milk substitute at Glensaugh in Scotland (Blaxter et al. 1974). These workers implied that the feeding of the cow milk substitute at a high DM concentration was the problem. However, if good growth rates are to be achieved, calves must have high energy intakes so that the problem lies with the actual lactose content of the substitute and hence total lactose intake rather than with the concentration at which it is fed. The Scottish workers actually had more success with the feeding of a ewe-milk sustitute (higher fat and lower lactose). Generally the growth rates in the Scottish work were similar to those recorded in the present experiment.

CONCLUSIONS

This work has shown that it is possible to artificially rear red deer calves successfully from within a few days of birth with good growth rates and minimal health problems. Although the growth rates of the calves fed on SDM and the Ancalf were similar, the persistent scouring of two of the calves fed the Ancalf caused concern. Based on this observation and on the Scottish work it would seem advisable to feed milk substitutes which are as similar as possible in composition to that of deer milk. Consequently the very high lactose bovine calf milk replacers should be avoided. If fresh whole bovine milk is to be fed then that from Jersey cows (with a lower lactose content on a dry weight basis) could be a better choice than that from Friesian cows. Calves should have access to solid feed (e.g. pasture, lucerne hay) from a few weeks of age, even though the actual intakes of such feeds may not be very high.

The temperament of the deer is also likely to be an important factor in artificial rearing. Since red deer tend to be flighty and nervous animals, a considerable amount of time and patience must be invested in the calves in the early stages. As well it would be advisable to leave the deer in the care of only one person wherever possible to minimise stress. However, despite such precautions and effort it is likely that some calves will not achieve good growth rates because of their particular temperament, being either reluctant drinkers or particularly nervous individuals.

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