A COMPARISON OF WEANING TECHNIQUES IN FARMED WAPITI (*CERVUS ELAPHUS)*

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Twenty-one wapiti calves, born between 24 May and 4 July were weaned on 5 September. They were weighed, divided into two groups (10 and 11 calves) and either moved to a familiar paddock, adjacent to their dams and allowed fence-line contact (contact wean - CW), or moved to a familiar paddock which was visually obscured, and separated from their dams by approximately 50m (remote wean - RW). For the next two days after weaning the calves were observed from dawn until dusk. All observations were done using a 10-minute instantaneous scan sampling technique. Activities recorded included the number of calves standing, walking, lying, fence-line pacing, running, grazing, and feeding at a trough. On day 4 the observation time was reduced to 9 hours and 20 minutes. Observations were continued for a further six days during 2-hour periods after dawn and before dark. The calves were held in these separate paddocks for 10 days and during that time were weighed. After that they were held together in the remote wean paddock and weighed again at 31 and 63 days. There were no significant differences in the amount of time spent grazing between the two groups and there were no differences in weight gains between the groups throughout the trial. The CW calves vocalized less and spent less time standing, walking, fence-line pacing and running compared to RW calves. The CW calves were also observed spending more time lying and feeding at the trough. Overall, the CW calves displayed fewer behaviours indicative of the distress following weaning.

Keywords: *animal welfare,* Cervus elaphus, *deer farming, wapiti, weaning*

Introduction

The natural weaning of any mammalian species is an event marked with some conflict between parent and offspring (Trivers 1985). Natural weaning occurs at a time when a female balances the need to end the current lactation (or risks jeopardizing future fitness) against the offspring's need to maximize its own fitness by extending its mother's lactation. Despite the parent-offspring conflict, the offspring is not denied social contact or maternal protection by the dam during natural weaning, only access to the udder and milk.

In livestock operations, weaning is artificially imposed at a date which reduces the length of the normal lactation by 24 to 77 per cent, depending upon the species (Gonyou & Stookey 1987). In wapiti (*Cervus elaphus*) milk yield normally peaks between 3 and 4 litres daily at about 25 days of lactation and declines steadily thereafter to less than 1 litre daily by 200 days post-partum (Haigh & Hudson 1993; Kozak *et al* 1995). In farmed wapiti the weaning process is normally accomplished by physically placing the offspring and dam in separate pens. Producers commonly wean calves either just before the rut (at about 100 days post-partum) or just after it in early November at about 160 days post-partum (Haigh & Hudson 1993; Friedel & Hudson 1994). In this situation the calf is denied access to the udder, but unlike the natural weaning process the calf is also denied social contact with the hind. Because the weaning is premature, from the animals' perspectives, a great deal of vocal and physical effort is exerted by the hind and calf in attempts to reunite. Acting somewhat in empathy for their animals, livestock producers believe that the inevitable physiological and psychological stress of weaning is lessened and recovery is quickened if there is visual and auditory isolation between the dam and offspring. This may be counter-intuitive, if the pair are programmed to accept the nutritional separation but not the disruption of the maternal bonds. It is possible that the separation between dam and offspring during the traditional weaning process impacts upon the performance and well-being of the young to a greater degree than necessary.

We report the behavioural observations and the performance of two groups of wapiti calves weaned under two different conditions in an attempt to identify the more 'welfare friendly' weaning strategy.

Materials and methods

Twenty wapiti (*Cervus elaphus*) calves born between 24 May and 18 June (plus one additional calf born on 4 July in a different paddock), were kept with their dams in a 5 hectare paddock for one month from 28 July until 28 August and were then moved to another field a week prior to weaning. This was a 2 hectare paddock that had been used during the calving period, so all animals except the one late calf were familiar with the paddock.

At 0900h on 5 September (day 1 of the trial) all hinds and calves were brought into a handling system, weighed, treated with anthelmintics to control internal parasites and vaccinated for protection against clostridial infections. The hinds were separated into two groups based on their calf's treatment group and were moved, without their calves, to two different paddocks for breeding. The calves were divided into two groups based on a predetermined random assignment. One group, designated the contact wean (CW) group, were returned to the paddock from which they had come. This was immediately adjacent to a similar paddock in which their dams were held. The intervening woven-wire fence was calf proof. The other group, designated the remote wean (RW) group, was placed in the paddock that they had occupied from 28 July until 28 August, which was separated by three fences (two paddocks) and a distance of 50m from their dams and other adult females. Two of these fences were covered in a heavy shade cloth that reduced visibility between the groups.

Prior to weaning the calves had been exposed to an oats ration fed daily to the entire group of hinds and calves. Alfalfa hay had also been offered. After weaning the oats were continued, at first in small quantities of approximately 0.25kg per calf and rising to 1kg per calf by day 7 post-weaning. Good quality alfalfa hay was made available ad libitum in a round-bale feeder. In addition, calves were able to graze on the legume/grass forage that was present throughout the paddock.

By 1600h on day 1 the calves had been released to their respective paddocks. Observations of activity were started in each paddock by a team member seated in a vehicle that had been previously parked there. The observation point provided visibility to almost the entire paddock. In each case a patch of trees obscured vision to a small area (< 15%) of the paddock unless the vehicle was moved. Only two observers were used throughout the study and they alternated between the group they were observing on a daily basis.

Until 2000h, at dark on day 1, and from 0630 until 2000h on the next two days the observations occurred throughout the day. On day 4 observations were made from 0640 until 1200h and from 1600 to 2000h. For the next six days the observations were restricted to two observation periods that corresponded to peak activity periods: a 2-hour period just after dawn and a 2-hour period preceding dark.

Observations were conducted using an instantaneous scan sampling technique at 10-minute intervals (Lehner 1979). The frequency at which behaviours occurred was used to estimate the time (on a per head basis) that calves spent engaged in the following behaviours: standing, walking, running, fence pacing, lying, feeding at the trough, and grazing. Behaviours were defined according to the following criteria and were considered mutually exclusive:

Standing – animal standing anywhere in the paddock and not engaged in other recorded behaviours

Walking – animal walking, but is not included in this category if within 2m of a fence, or grazing

Running – animal moving at any pace faster than a walk; closeness to a fence not considered separately

Fence pacing – generally characterized by movement back and forth along the fence line and included any walking within 2m of a fence

Lying – animal lying down

Trough eating – eating grain from the trough or hay from the round-bale feeder

Grazing – animal is actively grazing

Also on day 1 the number of squeaking vocalizations made by the calves were counted for 2 minutes during the 2–4 minutes following each sampling time. On day 2 to day 10 vocalizations were only counted for 1 minute during the 2-3 minutes following the sampling time.

On day 11 from 0640 to 0820h the two observers made simultaneous observations of the behaviours and recorded the number of vocalizations made by the CW group. This was used in testing the inter-observer reliability on visual and auditory data. After the observation period on day 11 all calves were combined and run together in the remote wean paddock.

The calves were weighed 10 days after weaning and again at 31 and 63 days. The anthelmintic and vaccination treatments were repeated on day 31. Weights were recorded to the nearest 0.5kg.

Vocalizations and behavioural differences between the two weaning groups were statistically analysed by comparing the daily frequencies of each behavioural category (on a per head basis) over the 10-day observation period using a paired t test. To test for inter-observer reliability a Spearman rank correlation coefficient was calculated on the observational and vocalization data that was collected simultaneously by the two observers on day 11. Weight changes between groups were compared using the student's t test. All statistical analysis was carried out using Statistix (Statistix Version 4.1, Analytical Software, Tallahassee, USA).

Results

The amount of time the weaned calves spent grazing was similar between the two groups, over the 10-day period (Figure 1) and was the only behaviour that did not differ between the two groups. The CW group spent on average 15.65 per cent of their time eating from the trough, while the RW calves were observed only 4.92 per cent of the time eating from the trough ($P < 0.01$) (Figure 2).

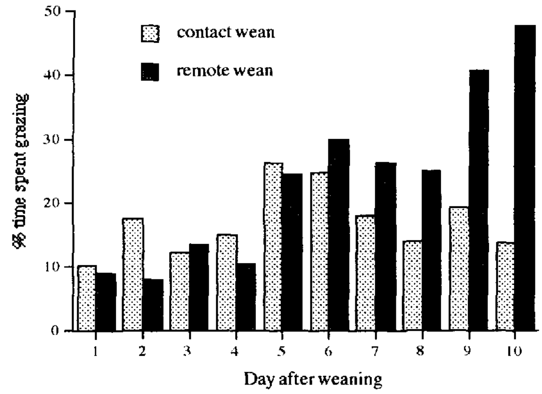

Figure 1 **Comparative grazing activity of two groups of wapiti calves during a 10-day period post-weaning. (In this and all subsequent figures observations on day 1 were from 1600h to 2000h and on days 2–3 were made for 13.5 hours from dawn to dusk. Observations on day 4 were for 9.3 hours. On days 5–10 observations were for 2 hours after dawn and for 2 hours preceding dusk).**

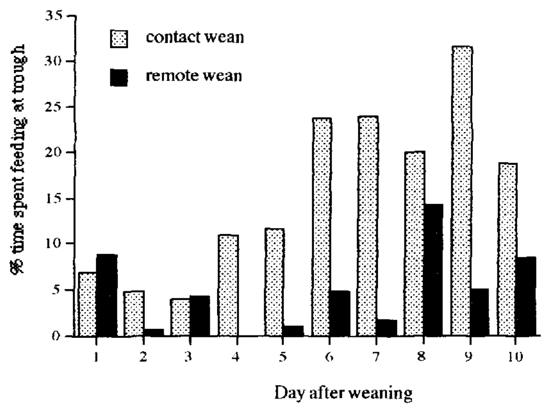

Figure 2 **Comparison of time spent feeding at troughs for two groups of wapiti calves during a 10-day period post-weaning.**

It proved difficult to differentiate between running and fence pacing, therefore the data on these two categories were combined (Figure 3). There were clear behavioural differences between the two groups in the amount of time the calves spent running and fence pacing for the CW and RW calves (4.84% vs 12.57%, respectively; $P = 0.054$). In addition, CW calves spent less time standing (Figure 4) and walking (Figure 5) compared to the RW calves (13.62% and 3.60% vs 25.91% and 12.05%, respectively; $P < 0.01$). The reverse was found for lying behaviour. The CW calves were observed lying more often than RW calves (45.29% vs 22.06%, respectively; $P < 0.001$) (Figure 6).

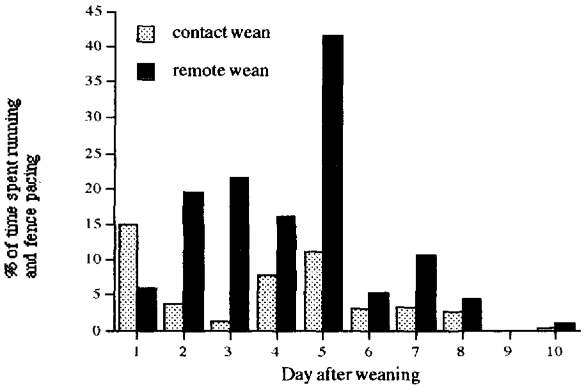

Figure 3 **Comparative running and fence pacing activity of two groups of wapiti calves during a 10-day period post-weaning.**

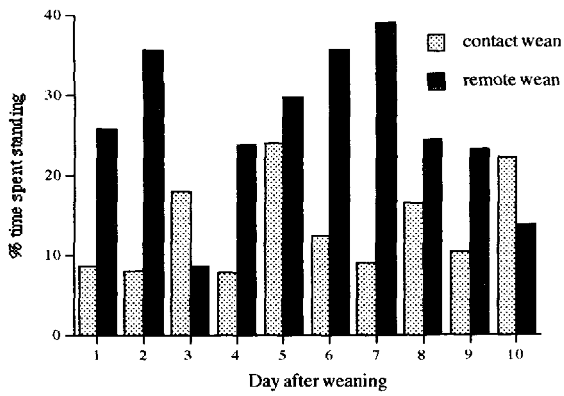

Figure 4 **Comparative time spent standing of two groups of wapiti calves during a 10-day period post-weaning.**

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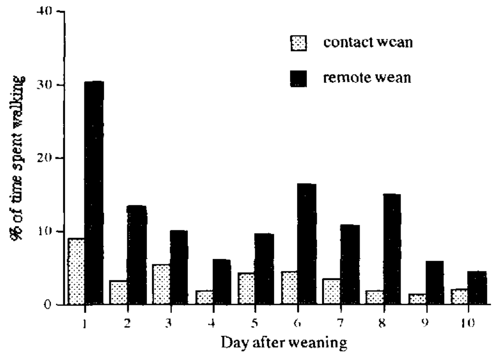

Figure 5 **Comparative walking activity of two groups of wapiti calves during a 10-day period post-weaning.**

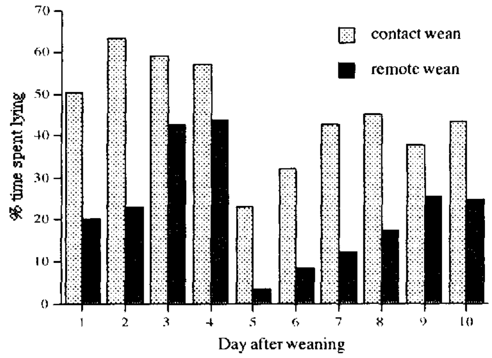

Figure 6 **Comparison of time spent lying down between two groups of wapiti calves during a 10-day period post-weaning.**

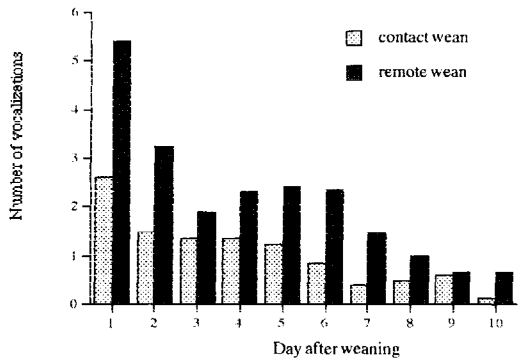

Figure 7 **Average number of vocalizations recorded per minute of sampling (on a per head basis) for two groups of wapiti calves during a 10-day period post-weaning.**

The greatest number of vocalizations (Figure 7) were recorded on the day of weaning in the RW calves. Overall they vocalized more than CW calves over the 10-day period following weaning ($P < 0.001$).

The inter-observer reliabilities (reported as Spearman's rank correlation coefficients) for the behavioural data and the vocalizations were 0.87 and 0.90 respectively.

The weights of calves at weaning ranged from 63 to 107kg. Based upon assumed birth weights of 17kg for hind calves and 18kg for stag calves, this represented a daily weight gain from birth between 0.71 to 1.0 kg (mean 0.85 ± 0.09kg (SD)). Weight gains from weaning to 63 days are shown in Table 1. There was no significant difference between the groups at any of these stages.

Table 1 **Mean (±SD) weights and weight changes (kg) of contact and remote weaned wapiti calves weaned before the rut on 5 September. (Weight range on day 0 was 63-107kg).**

Day of trial	Contact weaned calves		Remote weaned calves	
	Mean wt (kg)	Gain/day (kg)	Mean wt (kg)	Gain/day (kg)
Day 0	94.9±9.83		91.9±14.05	
Day 10	97.6±12.60	0.41±0.22	96.1±15.62	0.42±0.23
Day 31	111.4±12.18	0.49±0.16	107.9±15.61	0.47±0.12
Day 63	120.4±10.57	0.26±0.16	115.4±15.50	0.26±0.15

Discussion

Weaning is generally recognized as a stressful time for the juvenile (Wood-Gush *et al* 1975; McCall *et al* 1985; Ensminger 1987; Houpt 1991), especially if it is induced by human management practices before it would naturally occur. Several stressors, besides separation stress, such as transportation, change of location, change of diet and regrouping with unfamiliar conspecifics often accompany the weaning procedure. In this observational study all the calves were familiar with each other and they were familiar with the location in which they were subsequently penned and observed. In addition, the calves had previously been offered the oat ration prior to weaning, so there was no change of diet and no need for transportation following weaning. Therefore, the main stressor imposed upon the two groups was likely to be psychological, due to the physical separation of the calves from the hind (and in the RW calves, the visual separation could also contribute to the psychological stress).

Physiologically, the calves were able to withstand the weaning process at the age it was imposed. Weaning of wapiti and red deer is usually conducted before or after the rut, either in early September or early November (in the northern hemisphere). There is evidence to show that the earlier weaning practice will advance calving dates in the following year as the hinds may come into oestrus a few days earlier than they would otherwise (Haigh & Hudson 1993; Friedel & Hudson 1994). Pre-rut weaning also has positive effects upon weaning rates, calf mortality and growth to 200 days (Friedel & Hudson 1994).

Beef calves are usually weaned in a manner similar to the remote wean system that we used, although they may be held in yards and given shelter for a few days after the event (Ensminger 1987). Recent interest in pre-conditioning beef calves before sale involves methods that attempt to minimize the stressors associated with the weaning, change of diet, transportation, mixing and relocation (Karren *et al* 1987). Though pre-conditioning methods are an improvement over the traditional weaning process at sale time, they make no attempt to minimize the separation stress between dam and offspring, as we have done with the CW procedure in this experiment.

In weaning studies conducted on four-week-old pigs it was shown that the removal of piglets to a new type of environment adversely affected four and seven day weight gain relative to piglets left in their own, or even another farrowing crate environment from which the sow had been removed (Csermely & Ballarini 1988). These authors concluded that from the welfare point of view and also with a regard to productivity, the retention of animals in the same (known) pen for longer periods is likely to be a better husbandry method.

Mares and foals have been separated at weaning by a variety of methods. In a study of differing weaning practices that ranged from abrupt weaning through to a system closely resembling our contact-wean to no weaning at all, McCall *et al* (1985) found that the abruptly weaned foals showed the most signs of stress.

It seems clear that methods which reduce the stress associated with weaning are advantageous to the young of our domestic livestock species. Though we did not detect a difference in weight gain between the two groups, overall the CW wapiti calves displayed less stress related behaviours such as running, fence pacing, walking and standing than did the RW calves. The CW calves also spent more time lying down and feeding at troughs. This observation was similar to that seen in piglets and foals weaned into environments with which they were familiar (McCall *et al* 1985; Csermely & Ballarini 1988). In our study both groups were familiar with their surroundings so that differences in the behaviour patterns were most likely due to the visual or lack of visual contact with adults. Surprisingly, the CW calves spent less time running and fence pacing even though they could see their mothers directly across the fence, but could not physically interact with them. Therefore, the common belief that it is better for young to be visually separated and moved away from their mothers to help facilitate weaning was not supported by the differences in behavioural patterns that emerged between the two groups, since RW calves spent more time apparently searching for a way to reunite with their mothers.

It is possible that RW calves were stimulated by auditory cues to search for their mothers even though they could not see them. The high-pitched call of both adults and calves carries over long distances and can clearly be heard from at least 1km away, making it difficult for producers, even if they want, to block both visual and auditory cues between dam and offspring. Wapiti calves and their dams communicate by squeaking and it is common to hear them during the course of the summer when at pasture. Our attempts to accurately gauge vocalization were confounded by the nature of the squeaking sound made by calves (which was very similar to that made by adults) and also by variable winds and the fact that both observers could hear sounds from considerable distances but could not be sure of their exact origin. Though both observers admitted difficulty in obtaining the vocalization data they were remarkably similar in their frequency counts when tested for inter-observer reliability. Even so, it is likely that our data on calf vocalizations includes calls made by adults, particularly for the CW data since both hinds and calves were in such close proximity. Therefore, it is even more surprising that the CW group recorded the lowest frequency of vocalizations between the two groups, since the CW vocalization data are potentially inflated.

The vocalization data, like the behavioural activity data, suggest that the CW calves in our study were more content with the weaning situation than the RW calves. This is logical from a biological perspective considering that the natural life history of a wapiti calf would include a natural weaning process, but not a complete separation from the mother and all adults. It is possible that the CW procedure more closely simulates the natural weaning process. We believe the difference seen in behavioural patterns between the groups favours the CW method as the less stressful procedure.

Given these behavioural differences we were surprised to find that there were no differences between the groups in weight gain 10 days after weaning. During the early post-weaning period (2–5 days), our subjective assessments of calf condition gave the impression that the RW group might even have lost weight, as they appeared gaunt. However, we did not weigh them during this period. Piglets weaned into strange environments and also mixed with animals from other litters gain almost no weight for four days post-weaning and are significantly lighter than those left in their farrowing crates, even when the latter are moved into a farrowing crate other than the one in which they were born and also mixed with strange piglets (Csermely & Ballarini 1988). Over the last five days of the behavioural study period we noted that the RW calves spent 30 to 50 per cent of their observed time grazing, whereas the CW group spent between 12 and 25 per cent. Although this difference in behavioural patterns over the last five days did not result in an overall difference in grazing time between the two groups, this brief period of extra feeding activity in the RW group could account for the similarity in weight gain over 10 days between the groups.

Though the CW calves were similar to RW calves in average daily gain over the 10-day period, the performance results should not detract from the potential benefit of using contact weaning as a weaning method for wapiti or other deer species. Measured solely by behavioural criteria related to animal welfare this method could be recommended providing the same behavioural patterns emerge in replicated studies. The contact weaning procedure would be relatively easy to carry out for species in which fencing is of a high quality and netting prevents any attempt by the animal to break through.

Animal welfare implications

In domestic livestock species the traditional weaning procedure of visually and physically separating the dam and offspring may unnecessarily be compounding the stress associated with weaning. Weaning that allows visual and nose-to-nose contact, but prevents nursing, may have a more calming effect on offspring which are physiologically old enough to withstand milk deprivation but who are still psychologically dependent upon their dams and the presence of adults.

In a study of weaning techniques for red deer Pollard *et al* (1992) found that the addition of even a strange hind to a group of weaned calves had a calming effect. They also showed that the presence of a hind or the holding of weaned calves indoors improved weight gain over the seven-day period following weaning. The behavioural observations and the numbers of vocalizations recorded in our study suggest that the contact weaning procedure may be a less stressful and more welfare friendly method.

Acknowledgements

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