

PECULIARITIES OF DAILY MILK PRODUCTIVITY OF PECHORA TAIGA DOMESTICATED COW MOOSE AND THEIR INTERCONNECTION WITH REPRODUCTIVE FUNCTION

Tatyana F. Vasilenko¹, Irine N. Sivoxa², Mikhail V. Kozhykhov², and Patrick R. Lemons II³

¹Institute of Physiology of the Komi Science Centre, Ural Division, Russian Academy of Sciences, Pervomayskaya st., 50, Syktyvkar-GSP-2, Russia, 167982, e-mail: muravyev@online.ru; ²Pechoro-Ilych Nature Reserve, Yakcha Troitsko-Pechorskogo Raiona, Komi, Russia, 169436; ³Department of Range, Wildlife, and Fisheries Management, Texas Tech University, Box 42125, Lubbock, TX 79409, USA

ABSTRACT: Investigations of 17 postpartum lactation periods of 5 domesticated female moose (*Alces alces*) were made over a 4-year period at the Pechoro-Ilych Nature Reserve in the Komi Republic. Duration of domesticated cow moose lactation period averaged 105 days. Maximum milk production averaged 6-7 liters of milk per day on the twentieth day of the postpartum period. A noticeable decline (1-2 liters) in milk production in moose was observed between days 30 and 60. During this period, cow moose exhibited an excited behavior, which is characteristic of estrus activity. This "estrus behavior" and the existence of vaginal mucus in some females were not connected with corresponding cytological changes in the vagina. However, "estrus behavior" was connected with a noticeable decrease in moose daily milk productivity.

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In natural conditions, duration of wild cow moose lactation averages 4 months and lasts from parturition to the rutting period (Kozhukhov 1973). Average milk productivity of cow moose during lactation is 150 liters (Knorre 1961).

Need for milk by calves during development and growth determines wild cow moose daily milk productivity (Knorre 1959, 1961). During the first days of life, calves consume about 1.0 liter of milk per day, and for 2- to 3-week-old-calves, daily milk consumption increases to 1.5-2.0 liters (Knorre 1959). Correspondingly, lactation peaks at 4.0 liters during the same period (Knorre 1961). Daily milk productivity of wild cow moose decreases significantly during the 3 - 4 month lactation period and averages 0.5-1.0 liters. As the rutting period approaches, lactation of wild cow moose ends (Knorre 1959).

The majority of investigators confirm

the appearance of estrus cycles in female moose during the rutting period, which usually occurs from the end of September to the end of October (Knorre 1959, Kheruvimov 1986, Kozhukhov 1989, Schwartz and Hundertmark 1993). Up to 3 estrus cycles have been documented during this period (Kheruvimov 1969, Schwartz and Hundertmark 1993). In farm conditions of the Pechoro-Ilych Nature Reserve, Kozhukhov (1969) established the presence of several estrous cycles that occurred during the rutting period and had an interval of 18-21 days.

Keeping animals in an experimental moose farm represents unique possibilities for studying physiological mechanisms involved in establishment and maintenance of lactation. Adaptive possibilities of lactation and reproductive systems of ungulate female organisms have their own peculiari-

ties. We hypothesize that these peculiarities may change with fluctuating environmental and living conditions as well as intensive anthropogenic influences.

We report on the peculiarities of establishment and maintenance of daily milk productivity and its interconnection with estrus activity in the postpartum period of cow moose.

METHODS

Investigations of domesticated cow moose daily milk productivity and reproductive processes were conducted at the moose farm of the Pechoro-Ilych Nature Reserve. During 4 years, 17 postpartum periods of five 3- to 13-year-old animals were investigated.

Pechora taiga domesticated cow moose were kept in enclosures with conditions similar to their natural environment. Each year from June through September, cow moose were kept on natural pastures in big enclosures, and from October to May moose were kept in taiga.

Five milking periods per day were conducted during the first month of lactation (May through beginning of June) and were gradually reduced (1 or 2 milking periods per day) as rutting season approached. We measured quantity of milk produced in every period and calculated daily milk yield per moose. Average daily milk productivity during 10-day intervals was also determined.

During the 5 months of postpartum, peculiarities of the reproductive function and behavior of cow moose were studied. From 1-3 days of special behavior reactions preceded decreases in daily milk yield of moose. Anxiety, excitation, missing or being late for ≥ 1 milking period, refusal to feed, and decreases in daily milk productivity were all examples of overt behavior reactions that were characteristic of unguulate females during estrus.

Changes in organs of moose reproduc-

tive systems were studied using vaginal smears for determination of content of different exfoliated epithelial cell types. Vaginal smears were taken from the most extreme section of the moose vagina. Content of epithelial cell types are correlated with ovarian activity of female moose (Vasilenko 1999, 2000).

Changes in levels of separate exfoliated cell types and cytolysis, or presence of superficial epithelial cell nuclei without cytoplasm, were determined. Exfoliated cell types in vaginal smears were calculated as a percent of 200 cells. Two to three vaginal smears were taken from each cow moose. Vaginal smears were taken from 2 animals on day 7 and 17 during the early postpartum period, and from 3 moose on days 51, 58, and 99 of the overt "behavior estrus" period.

RESULTS

Lactation Indices

Duration of Pechora taiga domesticated cow moose lactation periods were within the limits of 40-130 days and averaged 105 days. Duration of lactation depends on date of parturition, technology of milking, and environmental conditions. An extension of the lactation period was noted when rutting occurred near the farm where additional feedings occurred. After parturition, technology of milking and additional feeding quickly increased daily milk productivity. Maximum milk productivity, which averaged 5.4 liters and ranged from 3.4 - 7.6 liters per day, was reached by day 20 of the postpartum period (Table 1). After achieving maximum milk yield a decrease in moose daily milk productivity of 0.4-2.2 liters first occurred during a 10-day period beginning on day 30 of the postpartum period (Table 2). During the next 10-30 days, a noticeable decrease in daily milk yield occurred. Five animals during 10 lactation periods had a decline of 0.9 - 2.5 liters. Four additional

Table 1. Daily milk yield at peak lactation of Pechora taiga domesticated cow moose.

Experimental Animal	Year of Investigation	Days of Lactation	10-Day Average Daily Milk Yield (liters)
1	1986	30	4.1
	1987	20	4.3
	1988	20	5.0
	1989	30	3.4
2	1986	20	6.2
	1987	20	5.9
	1988	20	5.2
3	1986	20	7.3
	1987	20	7.6
	1988	20	6.9
	1989	20	5.2
4	1986	10-20	4.9
	1987	10-20	5.2
	1988	20	5.9
	1989	20	5.0
5	1988	20	4.9
	1989	30-40	4.7

animals with 5 lactation periods had a decrease of 3.2 - 6.5 liters. All changes occurred on days 50 and 60 of the postpartum period, or approximately the beginning or middle of July (Table 3).

Cell Composition of Vaginal Smears During "Estrus Behavior"

One to three days of special behavioral reactions, or "estrus behavior", preceded the decrease in their milk yield. These behaviors were documented as excessive excitement, missed or late milkings, and aggression towards farm workers. Observations of 3 lactating cow moose, which exhibited excited behavior on days 51, 58, and 99, were correlated with decreases

from peak milk production of 1.2 - 3.2 liters. Two cow moose exhibited signs of vaginal mucus secretions in small amounts on days 51 and 58.

Analyses of cell composition of moose vaginal smears indicated that distinct nuclei of superficial epithelial cells and cytolysis levels were similar to those of cow moose on days 7 and 17 of the early postpartum period (Fig. 1). Hence, we did not observe any changes in the most extreme section of the vagina of female moose that showed increases in content of immature superficial cells with distinct nuclei ranging from 13.7-22.7% and from 24.1-58.8% for cells without cytoplasm. These indices equal 0.8-7.5% and 0.5-1.3%, respectively, of vaginal

Table 2. First days of initial decreases in daily milk yield from peak lactation of cow moose.

Experimental Animal	Year of Investigation	Days of Lactation	10-Day Average Decrease in Daily Milk Yield (liters)
1	1986	40	0.4
	1987	40	0.6
	1988	30	1.0
	1989	50	1.5
2	1986	30	1.1
	1987	30	0.9
	1988	30	0.7
3	1986	30	1.6
	1987	30	1.0
	1988	30	2.0
	1989	30	2.2
4	1986	30	0.6
	1987	30	1.0
	1988	30	0.9
	1989	30	0.7
5	1988	30	0.4
	1989	50	0.7

smears of lactating cows during the 49-67 day period of the postpartum overt estrus cycle (Vasilenko 1999).

DISCUSSION

A specific feature of the lactation function of Pechora taiga domesticated cow moose was achievement of maximum daily milk productivity of 3.4-7.6 liters on day 20 of the postpartum period. A noticeable decrease occurred in moose daily milk yield of 0.4 - 2.2 liters on day 30 of lactation, and of 0.5 - 6.5 liters on day 60 of the postpartum period. The lactation function of Pechora taiga domesticated cow moose was similar to that of wild moose (Knorre 1961). First, there was an increase in daily

milk yield on day 20 correlated with an increase of milk consumption by 2- to 3-week-old calves. Then, with transfer of 1.5- to 2.0-month-old calves to forest feeding, there was a noticeable decrease in their milk needs, which led to an eventual elimination of milk from their diet. This decline was correlated with a noticeable decrease of moose daily milk yield on day 50 and 60 of the postpartum period, or the beginning to middle of July.

Average levels of domesticated cow moose milk production were more than double that of wild moose. Knorre (1961) found that milk productivity of wild cow moose during 1 lactation period was about 150 liters, while milk production in our study of

Table 3. Decreases, from peak lactation, in daily milk yield of cow moose.

Experimental Animal	Year of Investigation	Days of Lactation	10-Day Average Decrease in Daily Milk Yield (liters)
1	1986	50	1.4
	1987	50	3.2
	1988	50	3.2
	1989	60	0.5
2	1986	50	4.1
	1987	40	2.2
	1988	40	0.9
3	1986	60	1.5
	1987	60	2.5
	1988	60	4.2
	1989	60	1.3
4	1986	30	0.6
	1987	60	6.5
	1988	30	2.0
	1989	40	1.0
5	1988	50	1.4
	1989	70	1.2

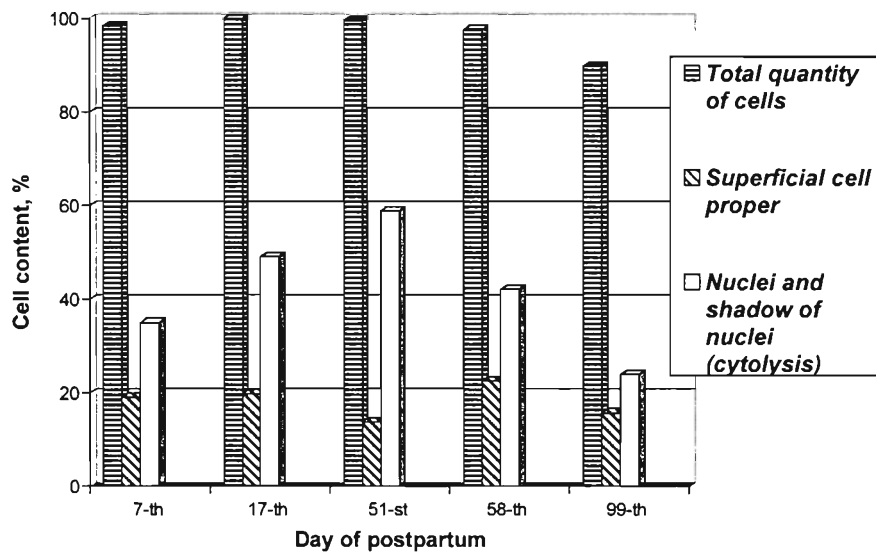


Fig. 1. Cell content of moose vaginal smears at different intervals after calving.

domesticated cow moose ranged from 225 to 368 liters. Decreases in average daily milk yield of moose in farm conditions were preceded by changes in behavior, namely the occurrence of reactions that were peculiar for ungulate females during estrus intervals. Detected peculiarities in moose vaginal cell composition of domesticated moose indicated that the appearance of overt behavior characteristics of estrus activity were not correlated to corresponding changes of ovarian functional activity. This result was confirmed by cell content of vaginal smears, or the early desquamation of immature superficial cells with distinct nuclei and high indices of nuclei without cytoplasm which were taken on days 51, 58, and 99 of the postpartum period.

Appearance of "estrus behavior" in domesticated moose causes a noticeable decrease in their daily milk productivity. It is possible to consider the occurrence of "estrus behavior" as a characteristic that accompanies the process of domestication of animals with seasonal reproduction.

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