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Original article

Activated mammary number and litter size in the mink

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Summary — The dependence of activated mammary number on litter size was studied in standard type farmed mink in an attempt to clarify its effects on early kit mortality. The results showed highly positive correlations between litter size and the number of activated teats at 2 days, 4 weeks and 8 weeks of age. Total kit mortality was rather low and independent of litter size. The body weights of the mothers were independent of either litter size or age during the lactation period. The body weights of male kits were of the same order of magnitude in spite of litter size or age until weaning. In female kits, the body weights in the largest litters were lowest at weaning.

activated teats / litter size / kit mortality / mink

Résumé — Relation entre le nombre de glandes mammaires actives et la taille de la portée chez le vison. *La relation entre le nombre de mamelles actives et la taille de la portée a été étudiée chez 99 femelles d'élevage pour voir son effet sur la mortalité précoce des jeunes. Les résultats montrent une corrélation positive hautement significative entre la taille de la portée et le nombre de mamelles actives chez les mères, 2 jours, 4 semaines et 8 semaines après la parturition. La mortalité des jeunes est assez faible et indépendante de la taille de la portée. Le poids vif des mères au cours de la lactation est indépendant à la fois de la taille de la portée et du délai depuis la parturition. Le poids vif des jeunes males, selon la portée, au cours de la période d'allaitement, est du même ordre de grandeur quelle que soit la taille de la portée; par contre, pour les jeunes femelles, il est plus faible au moment du sevrage chez celles issues des plus grandes portées.*

mamelles actives / taille de portée / mortalité des jeunes / vison

INTRODUCTION

Lactation has been considered to be a crucial factor in the evolution of parental investment and reproductive success in mammals. In particular mammary number may have operated as a selective constraint on litter size over evolutionary time in wild animals (Tuomi, 1980; Gilbert, 1986). In orders and families such as the Rodentia, Muridae, Cricetidae and Sciuridae the mean litter size is normally one-half the number of available teats, while the maximum litter size approximates mammary number (Gilbert, 1986). Some studies on other species have shown a positive correlation between litter size and mammary number, but other studies have disputed this (Jeppesen, 1982; Mansergh and Scotts, 1990; Mahmoud *et al*, 1990).

The mink *(Mustela vison)* is a small-sized carnivore (family Mustelidae) widely farmed for its fur. Under farm conditions kit mortality of the mink has been observed to be rather high, amounting to 15–25% of the total kits born (Einarsson, 1980). The first 10 days seem to be the most critical because losses can reach 15–17% at that time (Udris, 1973). As possible causes of high early postnatal mortality such factors as age and body size of the female, genetic background, feeding, birth weight, litter size, and number and position of teats have been considered (Udris, 1968; Einarsson, 1980). In particular the number of activated teats has been considered of significance, although data on their role is almost totally lacking.

The aim of the present study was to clarify the possible relationships between litter size and the number of activated teats, including their effects on early kit mortality in the mink.

MATERIALS AND METHODS

The experiments were carried out at the Fur Farming Research Station at Kannus, Finland, in 1991. During spring, 99 dark mink females were randomly chosen for the experiments. They were all free from Aleutian disease, and in normal condition. Whelping occurred between April 27 and May 6. The number of live kits as well as the number of activated teats were calculated at 3 time periods: 1), 2 days after whelping; 2), at age 4 weeks (when the kits started partly on solid feed); and 3), at age 8 weeks (at weaning). During the 2 later controls the body weights of kits and their mothers were also measured. Kit mortality was recorded on each occasion.

The results are expressed as mean ± SD. The data were statistically treated by analysis of variance, regression analysis and Pearson's product moment correlation using the SAS program (SAS Institute Inc, Cary, NC, USA).

RESULTS

Kit mortality

Five hundred and seventy-nine kits were born from 99 litters (283 males, 296 females). At 4 weeks of age total kit mortality accounted for 3.3% and at weaning for 8.0% (table I). Litter mortality, which amounted to 3–9 kits, varied non-significantly between 4.5–9.5%. Because of the limited number of mothers studied, kit mortality in the smallest (1–2 kits per mother) and largest (10–11 kits) litters varied from 0–50%. There were no statistically significant differences in kit mortality between yearlings (4.2%) and older (over 1-year-old; 3.8%) mothers ($F = 2.66$, $P < 0.14$).

Table I. Total mortality in relation to litter size in the mink.

Litter size (kits/mother)	*No of mothers*	*Cumulated kit mortality Age 4 wk*		*Age 8 wk*	
		(N)	*(%)*	*(N)*	*(%)*
1	3	0	0	0	0
2	1	1	50.0	1	50.0
3	7	2	9.5	2	9.5
4	11	0	0	2	4.5
5	18	3	3.3	6	6.6
6	26	6	3.8	12	7.6
7	11	1	1.3	6	7.8
8	16	3	2.4	10	8.0
9	4	1	2.8	2	5.6
10	0	0	0	0	0
11	2	2	9.1	5	22.7
	99	19	3.3	46	8.0

Development of body weight

Body weight of mothers varied during lactation; at 4 weeks: 986 ± 106 g, at 8 weeks: 849 ± 109 g ($P < 0.05$). Basic data were also treated by splitting animals into 3 groups according to litter size (1–3, 4–6 and 7–10 kits per mother). The corresponding body weight of mothers (fig 1) was not statistically different within age groups ($P > 0.05$). However, a small but non-significant tendency was noted towards a faster decline in body weight in the large litters than in the smaller litters.

The body weight of kits were of the same magnitude ($P > 0.05$) for each litter size group at 4 weeks of age (fig 2). At 8 weeks (weaning) the same was still the case for the male kits but in female kits, the mean body weight decreased significantly with increasing litter size ($P < 0.05$; fig 2).

Number of activated teats

The number of activated teats in the total material varied between 1–10. In litter sizes ranging from 1–7, the number of activated teats up to the age of 4 weeks was on each occasion higher than the number of kits (table II). In litter sizes over 7, the number of activated teats amounted to 7–10. When all the data are considered, the average number of activated teats at 2 days (6.64 ± 1.4 teats) was similar ($P > 0.05$) to that at 4 weeks (6.55 ± 1.5 teats). From 4 to 8 weeks, however, there was a significant decline ($P < 0.05$) in the total number

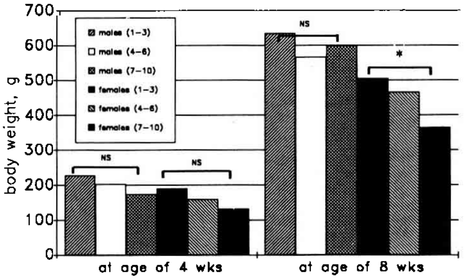

Fig 2. Body weight of male and female kits in relation to litter size. Statistical significance: NS = non-significant; * = $P < 0.05$.

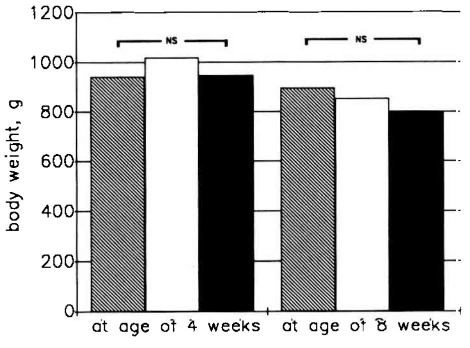

Fig 1. Body weight of mothers in relation to litter size. The original data were divided into different size groups (shaded columns: 1–3; white columns: 4–6; dark columns: 7–10). NS = non-significant difference between groups for a given age.

Table II. Number of activated teats (mean ± SD) in relation to litter size.

Litter size	*At birth*	*Age 4 weeks*	*At weaning*
1	3.3 ± 1.2	3.0 ± 1.0	2.3 ± 1.0
2	4.0	6.0	2.5
3	6.4 ± 0.8	5.6 ± 1.2	3.8 ± 1.2
4	6.0 ± 0.8	6.3 ± 1.3	5.5 ± 1.3
5	6.1 ± 1.3	6.3 ± 1.5	5.3 ± 1.5
6	6.7 ± 1.2	6.7 ± 0.9	5.2 ± 1.5
7	7.4 ± 0.8	7.3 ± 0.6	5.7 ± 1.3
8	7.7 ± 0.8	7.3 ± 0.6	6.5 ± 1.3
9	8.3 ± 0.5	8.3 ± 1.3	8.0 ± 1.2
10	–	7.5 ± 1.3	–
11	7.5 ± 0.7	–	–

of activated teats (5.29 ± 1.7 teats at 8 weeks). The number of activated teats was significantly explained by litter size at 2 days ($F = 56.97$, $P < 0.001$), 4 weeks ($F = 66.29$, $P < 0.001$) and 8 weeks ($F = 49.78$, $P < 0.001$). Pearson's correlation coefficients between litter size and number of activated teats at 2 days, as well as at 4 and 8 weeks were 0.60 ($P < 0.001$), 0.64 ($P < 0.001$) and 0.58 ($P < 0.001$), respectively. The linear regression of activated mammary number *(y)* and litter size *(x)* was also significant; at 2 days, 4 weeks and 8 weeks of age the equations were $y = 4.11 + 0.43x$, $y = 3.9 + 0.46x$ and $y = 2.36 + 0.54x$, respectively ($P < 0.001$).

DISCUSSION

The results indicate that the number of activated teats in a normal situation is not sufficient to explain the high kit mortality previously observed in farmed mink (Einarsson, 1980): for litter size up to 7, each kit typically has at least one teat at its disposal. Thus, if milk is yielded normally there will be no strong competition for teats among kits in a litter. Thus, according to the present data, mammary number should not present any important limitation to high litter size in the mink because even a maximum of 10 activated teats is possible.

The relationship between litter size and number of activated teats was highly significant. This suggests that mink kits utilize only that amount of teats required to provide them with sufficient milk, but that all 10 teats are not necessarily activated if the litter size is smaller.

At 4 weeks of age, mink kits normally start to ingest some solid feed, although they are still in the process of suckling teats (Einarsson, 1980). As consequence, the number of activated teats significantly declined from 4 to 8 weeks. Our results additionally indicate that at birth and at 4 weeks, mean active teats outnumber kits for litter sizes > 8. At 8 weeks this drops to litters of > 6. This suggests that the number of active teats can be potential limiting factor for large litters (> 8). However, it is known that in the polecat, a similar-sized farmed mustelid, the maximum number of teats is only 8; nevertheless, the litter size of the polecat is often larger than that of the mink (Fox, 1988).

Although the present study does not test Gilbert's (1986) rule, it can be calculated from the data that mean litter size at birth for the mink is 5.8, while mammary number is 10. This is in relatively close agreement with the 5.0 predicted by Gilbert's rule.

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