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The effect of premature weaning on reproductive output of female Cape porcupines *Hystrix africaeaustralis*

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Introduction

With Darwinian fitness also considering the number of viable offspring produced (Fisher, 1930), selection should conceivably optimize the efficiency with which available time as a relative limited resource is invested in the raising of offspring. In the case of Cape porcupines, annual reproductive output is limited by seasonal breeding, the occurrence of sterile oestrous cycles, the extended length of the oestrous cycle (30 days), small litter size, extended gestation period (93 days) and lactational anoestrus with young being suckled for some four months (van Aarde, 1985a).

These constraints, as well as social suppression of reproduction with only one pair in a group producing offspring (van Aarde & van Wyk, 1991), results in the annual reproductive output of groups varying from 2–14 individuals being limited to 1–3 young. Sixty percent of litters comprised singletons and 30% twins. However, first year survival under free-ranging conditions in the absence of predation is extremely high ($I_x > 0.836$; van Aarde, 1987). Considering these constraints on annual reproductive output, the existence of a mechanism to compensate for the loss of young prior to weaning would optimize life-time reproductive output. The present paper is based on a colony of porcupines maintained in captivity at the University of Pretoria from 1982 to 1991 (van Aarde, 1985b).

Methods

The 8 females included in the present analysis were multiparous, born in captivity and their ages ranged from 2–8 years. Cages were inspected daily for the presence of young and the young stayed in their natal colony throughout the period of observation. Records were kept of the date of all births and mortalities. The 14 incidences of pre-weaning removal of young resulted from mortalities within the colony ($n = 8$ litters) and the planned removal ($n = 6$ litters). Females were immobilized at 2–7 day intervals and plasma collected and analysed as described by van Aarde & van Wyk (1991). The length of the oestrous cycle was taken as the interval from the first day of vaginal opening in one cycle up to, but not including, the first day of opening in the following cycle (van Aarde, 1985a). A sterile cycle is defined as a cycle characterized by a distinct follicular and luteal phase followed by a follicular phase as suggested by plasma progesterone profiles (van Aarde & van Wyk, 1991).

Results and discussion

Conception intervals in females rearing their young to weaning ranged from 210 to 500 days

($\bar{x} = 340 \pm 64.8$ days; $n = 25$), with the interval being characterized by an extended lactational anoestrus lasting 101 ± 37.8 days (van Aarde, 1985a), followed by the occurrence of 3–11 ($\bar{x} = 6.5 \pm 1.8$) sterile oestrous cycles. Conception interval in females losing their young before weaning ranged from 110 to 216 days ($\bar{x} = 148 \pm 36.5$ days; $n = 14$) and the number of sterile cycles experienced by these females ranged from 0 to 1 ($\bar{x} = 0.3 \pm 0.5$ days; $n = 14$). The mean conception interval for these two groups of females did differ significantly ($t = 9.95$; $P < 0.05$; $d.f. = 18$).

The time intervals between litters (y) increased linearly ($y = 0.722x + 33.26$) and significantly ($r = 0.738$; $t = 3.692$; $d.f. = 12$) with an increase in the suckling period (x).

It follows that the reproductive cycle of individual female Cape porcupines is affected by the presence of suckling young. The suckling stimulus is known to influence ovarian activity and the shortening of the conception intervals of females losing their young prior to weaning may result from the sudden interruption of milk flow causing endocrinological changes which initiates follicular development, ovulation, and conception.

Lactational anoestrus is common amongst hystricomorph rodents (Weir, 1974) and can be considered advantageous to their offspring, since it limits inter-litter competition for nourishment in the form of milk. The ability to conceive soon after the young have been removed from the mother, provides an opportunity to optimize annual reproductive output by compensating for postnatal and pre-weaning mortality.

The mechanism(s) responsible for the difference in the number of sterile cycles experienced by females suckling their young to weaning, and those exposed to pre-weaning mortality, is as yet unknown. Porcupines are polyoestrus and in captivity breed throughout the year (van Aarde, 1985a). Litter intervals in mothers suckling their young to the cessation of lactation are governed by the extended period of gestation, lactation, and the occurrence of sterile cycles, resulting in their usually conceiving only once annually (van Aarde, 1987). The loss in maternal body weight over the first 60 days ranges from 4–20 g per day (van Aarde, 1985a), and the inability to conceive soon after having suckled surviving young may in such cases be ascribed to relatively poor body condition. This implies that the ability to conceive one surviving litter in a breeding season is the consequence of physiological limitations.

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