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Short communication

Effect of age and breeding season on sperm acrosin activity in the arctic fox (*Alopex lagopus* L.)

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Abstract

The objective of this study was to determine the effect of age and reproductive season on selected properties of semen from the arctic fox, *Alopex lagopus* L. The experiment used 40 ejaculates collected manually from 6 animals (3 foxes aged one year and 3 foxes older than three years). Statistically less semen (0.39 cm^3) was collected from the young compared to the older animals, and the ejaculates obtained were characterized by higher concentration of spermatozoa (195.04 x $10^6/cm^3$). In turn, sperm acrosomal extracts from the older animals contained statistically more acrosin (6,4 mU/10^6 spermatozoa). In the sperm acrosomal extracts prepared during the first semen sampling, the mean acrosin activity did not exceed 2.3 mU/million spermatozoa. At subsequent semen sampling dates, the activity of the analysed enzyme increased to reach 7.72 mU/million spermatozoa. In the extracts obtained from the semen collected at the end of the breeding season of arctic foxes, the acrosin activity again reached a value obtained at the beginning of the season.

Key words: semen, spermatozoa, acrosin, season, arctic fox

Introduction

Arctic foxes reach sexual maturity at the age of 10 months and maintain high reproductive capacity for 7 years. The mating season in herds of arctic foxes depends on climatic conditions and usually lasts from mid-February to late April (Wierzbicki et al. 2005). Because foxes are monestrous, they produce offspring once a year. This is why it is important to breed healthy animals with best semen parameters, because poor quality semen may exclude females from breeding in a given year.

One of the basic indicators of the biological value of semen is the acrosin content of sperm acrosomal extracts. According to Marí et al. (2003), acrosin plays an important role in mammalian fertilization as it catalyzes hydrolytic breakdown of the zona pellucida of the oocyte and is involved in the dispersion of the acrosomal matrix and in the binding of spermatozoa to the zona pellucida. Bronicka and Dembiński (1999) suggest that the presence of acrosin in seminal plasma may be indicative of acrosome damage or even breakdown.

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Table 1. Effect of age on the quality of arctic fox semen.

Sperm feature		Juvenile animals	Older animals
N			
foxes		3	3
ejaculates		28	12
Sperm concentration ($x10^6$/ cm^3)	x ±SD	195.04^a ± 101.1	90.57^b ± 41.53
	min – max	42.5 – 425.0	42.0 – 190.0
Ejaculate volume (cm^3)	x ±SD	0.39^a ± 0.22	0.52^a ± 0.31
	min – max	0.15 – 1.0	0.20 – 1.0
Acrosin activity (mU/10^6 spermatozoa)	x ±SD	2.6^a ± 1.5	6.4^b ± 3.4
	min – max	0.48 – 6.7	2.44 – 11.8

Note: different letters designate significant differences at $p \leq 0.05$

The objective of this study was to evaluate the effect of age and breeding season in arctic foxes on the acrosin activity.

Materials and Methods

The experiment used semen collected from six arctic foxes (*Alopex lagopus* L.): 3 year-old foxes in the first breeding season (juvenile animals) and 3 foxes older than three years (older animals). The selected animals originated from a fur farm in Łachowo near Szubin, the Kujawsko-Pomorskie province (Poland). Semen samples were collected manually from males throughout the period of increased sexual activity, i.e. between mid-February and mid-April, five times at 10- to 12-day intervals. The experiment was approved by the Local Ethics Committee in Bydgoszcz (1/2010). The acrosin activity was determined using a modified version of the clinical method that had been developed for human spermatozoa (Stasiak et al. 2012). The data were analysed using STATISTICA 8.0 program (StatSoft, USA).

Results and Discussion

The results of our study suggest that the age of arctic foxes has a significant effect on the quality of their semen (Table 1). One year-old animals produced less semen with a twice as high sperm concentration. An important biochemical parameter used for assessing the sensitivity of acrosomal membrane is the acrosin activity. The sperm acrosomal extracts from one year-old animals contained twice less acrosin. This provides evidence that the membranes of male reproductive cells from this group of animals are highly stable. Meanwhile, the increased activity of the analysed enzyme in sperm extracts from older animals suggests a high susceptibility to damage. Probably this is due to 3-year utilization of the males.

In the acrosome extracts obtained from fox semen collected at the start (first and second sampling) and at the end of the season (fifth sampling), the acrosin activity ranged from 2.3 to 2.5 mU/10^6 spermatozoa. The activities of this enzyme, determined in the extracts from different semen samplings, did not differ significantly. It is therefore safe to assume that spermatozoa in the collected semen samples were characterized by high cell membrane stability. For reasons not fully understood, the quality of sperm cell membranes deteriorated midway through the mating season when three times as much acrosin flowed from damaged sperm acrosomes than from sperm at the start of the season. Also spermatozoa from the ejaculates collected 12 days later (fourth sampling) were highly susceptible to damage (mean acrosin activity of 4.35 mU/10^6 spermatozoa). The considerable fluctuations in the activity of this enzyme may be due to disturbed spermatogenesis. In turn, sudden disturbances may be caused by high ambient temperature (Ciereszko et al. 2000).

In summing up the results of our study, it should be noted that the age of males has a significant effect on the quality of their semen. Ejaculates collected from the juvenile animals had a high concentration of spermatozoa, the cell membranes of which were less susceptible to acrosomal damage. Our findings also make it possible to determine, to a certain extent, the stage of the breeding season in which arctic fox spermatozoa have the highest cell membrane stability. This information could be an important indicator when assessing the suitability of semen samples for insemination.

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