# Husbandry and immobilization of captive porcupines *Hystrix africaeaustralis*

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A single intra-muscular injection of a mixture of fentanyl citrate and xylazine hydrochloride or ketamine hydrochloride and xylazine hydrochloride at mean dose rates of 0,16 ± 0,06 mg/kg fentanyl citrate plus 0,66 ± 0,14 mg/kg xylazine hydrochloride or 5,4 ± 0,64 mg/kg ketamine hydrochloride plus 1,5 ± 0,23 mg/kg xylazine hydrochloride was effective for the immobilization of porcupines (12 – 18 kg). Handling and immobilization at intervals of two to seven days over extended periods did not impair reproductive activities.
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'n Enkele binnespierse inspuiting van 'n mengsel van fentanielsitraat en xylazienhidrochloried of ketamienhidrochloried en xylazienhidrochloried teen 'n gemiddelde dosis van 0,16 ± 0,06 mg/kg fentanielsitraat plus 0,66 + 0,14 mg/kg xylazienhidrochloried of 5,4 ± 0,64 mg/kg ketamienhidrochloried plus 1,5 ± 0,23 mg/kg xylazienhidrochloried was effektief vir die immobilisasie van ystervarke (12 – 18 kg). Hantering en immobilisasie met tussenposes van twee tot sewe dae oor lang tydperke het geen effek gehad op voortplantingsaktiwiteite nie.
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## Introduction

The successful maintenance of wild mammals kept in captivity for experimental purposes, depends on the quality of housing facilities and the adaptability to captive and/or experimental conditions of the individual animals. Various species of porcupines (Fam. Hystricidae) have been kept successfully in Zoological Gardens (see Mohr 1965; Weir 1967) and at research institutions (Gosling 1980; Tohmè & Tohmè 1980) and successful breeding programmes under these captive conditions suggest that they can be housed in captivity with little difficulty.

Cape porcupines, *Hystrix africaeaustralis,* have been kept in semi-outdoor enclosures at the Experimental Farm of the University of Pretoria (25° 45'S / 28° 12'E) for experimental purposes since 1980. This communication provides information on the husbandry of the colony and describes an efficient immobilization procedure for handling purposes.

## Housing and Feeding

The colony was established with porcupines donated by the curators of the Johannesburg Municipal Zoological Gardens ($n$ = 12), the National Zoological Gardens, Pretoria ($n$ = 4), from porcupines caught and trapped in the Grahamstown ($n$ = 5) and Loxton districts ($n$ = 24), and their descendants.

The number of porcupines kept at any specific time during the study period (April 1980 – December 1983) varied from six to 45. Owing to inter-individual aggression, porcupines obtained from different sources had to be housed separately and intermingling was only allowed after a period of habituation. They were accommodated in groups of two to five in semi-outdoor concrete enclosures. Each enclosure was surrounded by a 1 m high brick wall and had an outdoor and roofed area with a concrete floor area of 7,2 $m^2$ and 11,3 $m^2$ respectively. Porcupines were allowed free access to the total area and were exposed to natural conditions of illumination, ventilation and temperature.

Following cleaning and disinfection of their enclosures with Germotol (Cremark Chemicals (Pty) Ltd, Johannesburg, South Africa), the porcupines were fed daily on a mixture of fresh fruit and vegetables (about 1,0 kg/ind.). Their diet was intermittently supplemented by commercial pellets (Antelope Cubes, Epol (Pty) Ltd, Vereeniging, RSA). Fresh drinking water was available *ad libitum* and dry wood to gnaw on was occasionally placed in the enclosures. No bedding or additional shelters such as nest boxes, were provided.

Individuals were identified by a system of holes and notches clipped into the left and right ear pinnae of males and females respectively, and by fitting a colour-coded Stercolite collar

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around the neck of each porcupine. Ear-clipping served as a back-up in cases where collars were lost, usually due to one porcupine severing the collar of another by nibbling.

### Handling and immobilization

Handling of porcupines within their enclosures during cleaning operations, when transferring them from one enclosure to another, or into a crush, was facilitated by holding a wooden board, approximately 60 × 80 cm, between the handler and the animal. Handling, except when weighing, was not possible without immobilization. All porcupines were starved for a 12-h period before immobilization, returned to their enclosures before recovery, and rewarded with food after recovery.

The administration of an intramuscular injection of a combination of fentanyl citrate (Ethnor (Pty) Ltd, New Road, Halfway House, Transvaal, RSA) and xylazine hydrochloride (Rompun; Bayer Pharmaceuticals (SA) (Pty) Ltd, Johannesburg, RSA) or ketamine hydrochloride (Ketalar, Parke-Davis Laboratories (Pty) Ltd, Isando, RSA) and Rompun was effected by herding the individual intended for immobilization into a specially designed crush box (120 × 60 × 30 cm). Dosage rates (mg/kg), mean length of the induction period and the mean period to total recovery for females immobilized at intervals of two to seven days are presented in Tables 1 & 2. Repetitive immobilization for periods up to 15 months did not affect induction time or time to recovery for a specific

**Table 1** Dosage rates (mg/kg) and reaction times (min) for captive female porcupines immobilized with a mixture of fentanyl citrate (Ethnor (Pty) Ltd, New Road, Halfway House, Transvaal, RSA) and xylazine hydrochloride (Rompun, Bayer Pharmaceauticals (SA) (Pty) Ltd, Johannesburg, RSA). All values are given as means ± one standard deviation of the mean

| Animal's code number (sample size) | Dosage rate (mg/kg) | | | Mean time to recumbency (min) | Mean time to recovery (min) |
|---|---|---|---|---|---|
| | Body weight (kg) | Fentanyl citrate | Xylazine hydrochloride | | |
| A ($n$ = 16) | 13,2 ± 0,6 | 0,20 ± 0,06 | 0,65 ± 0,12 | 7,5 ± 4,2 | 105,6 ± 33,3 |
| B ($n$ = 14) | 12,9 ± 0,3 | 0,15 ± 0,06 | 0,64 ± 0,10 | 5,6 ± 2,7 | 94,6 ± 37,0 |
| C ($n$ = 19) | 12,5 ± 0,4 | 0,15 ± 0,06 | 0,64 ± 0,10 | 3,7 ± 1,9 | 103,8 ± 43,1 |
| D ($n$ = 14) | 11,1 ± 0,4 | 0,20 ± 0,07 | 0,74 ± 0,13 | 5,6 ± 2,0 | 145,8 ± 44,0 |
| E ($n$ = 10) | 12,0 ± 0,9 | 0,19 ± 0,07 | 0,79 ± 0,12 | 4,0 ± 2,2 | 173,6 ± 69,8 |
| F ($n$ = 15) | 10,9 ± 0,4 | 0,17 ± 0,06 | 0,72 ± 0,10 | 5,1 ± 1,5 | 159,3 ± 64,7 |
| G ($n$ = 12) | 13,0 ± 0,8 | 0,20 ± 0,05 | 0,67 ± 0,11 | 5,2 ± 2,2 | 168,7 ± 52,6 |
| H ($n$ = 11) | 12,1 ± 0,4 | 0,13 ± 0,04 | 0,61 ± 0,09 | 3,5 ± 1,0 | 84,0 ± 45,7 |
| I ($n$ = 19) | 14,1 ± 0,9 | 0,15 ± 0,05 | 0,64 ± 0,16 | 4,8 ± 2,7 | 187,2 ± 54,0 |
| J ($n$ = 21) | 13,0 ± 0,6 | 0,14 ± 0,04 | 0,60 ± 0,06 | 4,7 ± 2,4 | 135,8 ± 67,8 |
| K ($n$ = 16) | 13,5 ± 0,5 | 0,16 ± 0,09 | 0,58 ± 0,05 | 5,0 ± 2,9 | 214,3 ± 18,0 |
| All animals combined ($n$ = 167) | 12,4 ± 1,2 | 0,16 ± 0,06 | 0,66 ± 0,14 | 5,0 ± 2,7 | 135,8 ± 59,2 |

**Table 2** Dosage rates (mg/kg) and reaction times (min) for captive female porcupines immobilized with a combination of ketamine hydrochloride (Ketalar, Parke-Davis Laboratories (Pty) Ltd, Isando, RSA) and xylazine hydrochloride (Rompun, Bayer Pharmaceuticals (SA) (Pty) Ltd, Johannesburg, RSA). All values are given as means ± one standard deviation of the mean

| Animal's code number (sample size) | Dosage rate (mg/kg) | | | Mean time to recumbency (min) | Mean time to recovery (min) |
|---|---|---|---|---|---|
| | Body weight (kg) | Ketamine hydrochloride | Xylazine hydrochloride | | |
| A ($n$ = 17) | 14,1 ± 0,6 | 5,21 ± 0,06 | 1,42 ± 0,06 | 4,6 ± 1,9 | 105,8 ± 44,5 |
| B ($n$ = 14) | 13,4 ± 0,7 | 5,71 ± 0,11 | 1,52 ± 0,11 | 4,5 ± 2,4 | 152,4 ± 41,4 |
| C ($n$ = 18) | 14,9 ± 0,8 | 4,92 ± 0,07 | 1,35 ± 0,07 | 4,0 ± 1,5 | 106,8 ± 27,5 |
| D ($n$ = 14) | 13,8 ± 0,3 | 5,75 ± 0,32 | 1,62 ± 0,32 | 4,8 ± 2,4 | 92,4 ± 37,9 |
| E ($n$ = 11) | 13,9 ± 0,6 | 5,44 ± 0,20 | 1,51 ± 0,20 | 5,3 ± 2,1 | 187,5 ± 64,2 |
| L ($n$ = 6) | 13,7 ± 0,9 | 5,20 ± 0,10 | 1,46 ± 0,10 | 3,7 ± 1,2 | 200,8 ± 70,0 |
| M ($n$ = 9) | 14,3 ± 0,6 | 5,23 ± 0,48 | 1,61 ± 0,48 | 5,4 ± 1,3 | 144,6 ± 61,5 |
| N ($n$ = 14) | 12,1 ± 0,6 | 5,75 ± 0,16 | 1,68 ± 0,16 | 5,3 ± 2,7 | 179,7 ± 57,7 |
| K ($n$ = 2) | 14,3 ± 0,4 | 5,27 ± 0,04 | 1,41 ± 0,04 | 8,5 ± 0,7 | Not recorded |
| O ($n$ = 3) | 14,1 ± 0,2 | 5,63 ± 0,13 | 1,51 ± 0,13 | 4,7 ± 2,1 | Not recorded |
| All animals combined ($n$ = 108) | 13,9 ± 1,0 | 5,40 ± 0,64 | 1,51 ± 0,23 | 4,7 ± 2,1 | 147,2 ± 57,1 |

individual. Induction time and time to recovery were also similar for the two different combinations of immobilization agents (Tables 1 & 2). None of the treated animals showed evidence of respiratory depression.

Minimal changes in body weight over the periods of experimental handling, normal cyclic ovarian activity and the relatively high reproductive rate, with 16 litters being produced over a period of four years, suggests that the intensive immobilization schedule to which these females were exposed did not affect them adversely.

High infant and adult survival rates under the conditions to which these porcupines were exposed furthermore implies that the semi-outdoor concrete accommodation is ideal for porcupines. Reproductive performance was best in groups comprising an adult male and adult female and the number of reproducing females per group depended on the number of adult males within the group; this can be ascribed to the monogamous breeding system of this species (van Aarde 1984).

No incidences of incest were recorded and porcupines never reproduced within the natal groups. Group members never showed signs of overt aggression towards each other but intergroup aggression occurred whenever the opportunity arose.

The use of fentanyl citrate, which produces narcosis with analgesia, in combination with xylazine hydrochloride as a sedative to immobilize porcupines has not been recorded to date. Relatively low dosage rates and the short induction and recovery times suggest that this drug combination is ideal for the immobilization of porcupines.

Similar results were obtained when using ketamine hydrochloride in combination with xylazine hydrochloride. Ketalar and Rompun did not induce immobilization when used separately. The dosage rate for the latter combination were however much lower than those reported by Alkon (1984) who immobilized Indian porcupines *H. indica* using 300 mg Ketamine and 20 mg Rompun.

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