

Chemical immobilisation of red-necked ostriches (*Struthio camelus*) under field conditions

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Sixteen red-necked ostriches (*Struthio camelus camelus*) were darted under field conditions to immobilise them. Combinations of etorphine hydrochloride with either medetomidine or ketamine were used on 13 birds; xylazine hydrochloride and metomidate alone were used, respectively, on one and two birds. The times to recumbency and recovery were recorded and compared. The principal complications encountered during the anaesthetic procedure were myopathy due to over exertion and respiratory collapse. Etorphine combined with medetomidine led to a sedated state of good quality but short duration, which allowed minor procedures to be carried out.

RATITES in general, and ostriches in particular, are difficult to handle. Adult ostriches are heavy birds (almost 120 kg for an adult male of the *Struthio camelus camelus* subspecies), and dangerous to handle. When the birds are free-ranging, manual restraint is often impossible, and it is therefore necessary to anaesthetise them in order to diagnose and treat disorders. Even when they are maintained in captivity, most ostriches tend to panic and chemical immobilisation becomes necessary for safety reasons.

The National Wildlife Research Center in the Kingdom of Saudi Arabia maintains two flocks of free-ranging ostriches within two enclosed areas: one (1 km x 2 km) in the Mahazat as-Sayd reserve (22°15'N, 41°34'E) and the other (170 m x 170 m) at the Taif Center (21°15'N, 40°41'E). The ostriches at the Taif Center are kept for captive breeding purposes, whereas those at Mahazat as-Sayd are part of a reintroduction programme. They all originate from Sudan, and belong to the endangered *S. camelus camelus* subspecies, forming one of the two captive-bred flocks of this subspecies in the world.

During 1993 nine birds at the centre were captured so that they could be blood-sampled and moved, and seven birds in Mahazat as-Sayd were captured to fit them with radio transmitters. This paper presents the results of the immobilisation procedures.

Materials and methods

Different combinations of drugs were used. Three adult males and two adult females aged more than three years were given an intramuscular dose of a mixture of etorphine hydrochloride (M99, 4.9 mg/ml; C-Vet) and ketamine hydrochloride (Imalgène, 100 mg/ml; Rhône Mérieux) (Table 1). Three adult males, one sub-adult male, two adult females and two sub-adult females were given an intramuscular dose of a combination of etorphine hydrochloride and medetomidine (Zalopine, 10 mg/ml; Farnos) (Table 2). One adult male received an intramuscular injection of xylazine hydrochloride (Rompun 5 per cent; Bayer), and two three-year-old birds received an intramuscular injection of metomidate (Hypnodil; Janssen Pharmaceutica).

All the anaesthetic mixtures were delivered in 3 ml darts fitted with unbarbed needles, using a blow gun (Telinject; Telinject). The birds were darted from a distance of 10 to 25 m, from a car or a hide covered with canvas, located close to the feeding place. They were darted in the back quarter of the thigh, which corresponds anatomically to the flexor cruris muscle group. The dose was selected according to the bird's age and size rather than according to bodyweight. Four of the adult birds (three females

and one male) were weighed on a platform scale; their mean \pm sem bodyweight was 124.3 ± 7.6 kg. The other birds were of a similar size. The darting was done early in the morning when it was cooler ($<26^{\circ}\text{C}$). Food was removed 24 hours before the darting, although the birds were able to graze the natural but sparse vegetation inside their enclosures.

A canvas hood was placed over the heads of the birds while they were on the ground. They were kept in sternal recumbency while being manipulated, and their heads were held straight and off the ground, to prevent the aspiration of stomach contents.

Diprenorphine hydrochloride was administered in the brachial vein (M5050, 6 mg/ml; C-Vet) to reverse the effect of etorphine hydrochloride, and atipamezole (Antisedan, 5 mg/ml; SmithKline Beecham) was used to reverse the effect of medetomidine. Adult female 4 received a supplementary injection of 5 mg diprenorphine and adult male 2 received 10 mg diprenorphine, because there was some delay before they stood up.

Results

After being darted with the etorphine combinations, the birds opened their bills frequently, trying to swallow. Three to four minutes after they were darted the birds became very excited and broke away from the flock in an uncontrolled run, covering long distances (800 to 1000 m) in less than two minutes. They appeared to have impaired vision and were frightened of solid objects. They then stopped running and walked in circles, often with open wings. At this stage, they became uncoordinated, walking backwards and then collapsing. Their attempts to stand up when approached always failed. The intervals between darting and assuming a prone position are given in Tables 1 and 2: they ranged from six to 16 minutes, with a mean time of 12 minutes for five birds immobilised with etorphine-ketamine and eight minutes for six birds immobilised with etorphine-medetomidine. The level of sedation was deep but of short duration, and made it possible to carry out simple manipulations (mainly blood sampling, tag identification and movement from one area to another one) within a period ranging from eight to 16 minutes. Muscle relaxation was of good quality, and uncontrolled movements were rarely encountered. Manual restraint was not needed for the collection of blood samples and other simple procedures.

The darting of an adult male with 150 mg xylazine led to marked excitation, similar to that observed with the previous combinations, but the bird did not collapse and was impossible to approach. The effects of the drug were observed for more than four hours after it was darted, but the bird recovered well.

The two sub-adult birds darted with a total dose of 2 g of metomidate showed no signs of sedation or behavioural abnormalities.

Two adult ostriches received an unknown amount of the etorphine-medetomidine combination because the dart was not retained at the site of injection. Both of them displayed lesser signs of a lack of coordination. One began to run frenetically, and three hours later, after being re-darted, showed signs of myopathy, lameness and torticollis; it finally assumed a prone position and died 12 hours later. One adult female anaesthetised with a combination of etorphine hydrochloride and medetomidine suffered a sudden and fatal respiratory collapse shortly before the effects of the drugs were to have been reversed.

The administration of the antidotes led to a recovery within one to five minutes. However, the process was very strenuous, the birds' first efforts to rise were always uncoordinated and violent, and on several occasions the birds fell over. No recycling of etorphine, either from enterohepatic circulation or redistribution from adipose depots, was observed.



TABLE 1: The total doses of etorphine and ketamine administered to five ostriches, the interval between darting and handling, the dose of diprenorphine used to reverse their effects and the time at which it was administered

Darted birds	Etorphine (mg)	Ketamine (mg)	Interval between handling and darting (min)	Time of reversal after darting (min)	Diprenorphine (mg)
Adult male 1	5	180	16	25	12
Adult male 2	6	180	11	20	30
Adult female 1	7	150	12	22	16
Adult female 2	8	150	15	26	20
Adult male 3	9	120	6	21	18

TABLE 2: The total doses of etorphine and medetomidine administered to eight ostriches, the interval between darting and handling, the doses of diprenorphine and atipamezole used to reverse their effects, and the time at which they were administered

Darted birds	Etorphine (mg)	Medetomidine (mg)	Interval between handling and darting (min)	Time of reversal after darting (min)	Diprenorphine (mg)	Atipamezole (mg)
Adult male 4	8	5	8	22	20	5
Sub-adult female 1	8	5	8	20	17	20
Adult female 3	8	4	7	15	16	20
Adult male 5	9	8	10	20	18	5
Adult male 6	8	5	9	19	15	20
Adult female 4	9	8	6	22	25	20
Adult female 5	8	4	190	—	—	—
Sub-adult male 1	9	8	—	—	—	—

Discussion

The fasting of birds before the administration of anaesthetics is a controversial topic. Considering the presumed high metabolic rate of ostriches (Jensen and others 1992), severe fasting should not be necessary, and might expose the bird to an acute problem of thermoregulation. Regurgitation was observed in a previous trial (Samour and others 1990), but the ostriches in this study showed no problems of regurgitation and inhalation pneumonia.

The darts frequently bounced off the birds, usually because they were deflected by the primary wing feathers, which partially cover the thigh, at the moment of impact. The direction of the shot should be as perpendicular to the target area as possible. Even when shot perpendicular to the target, the dart can still be deflected by the thigh, which is conical in shape and very resistant to penetration. Samour and others (1990) proposed the flank and part of the lumbosacral area as alternative sites. However, the authors encountered the same problem of deflection in the lumbosacral area. In this study, the back quarter of the thigh was assumed to be the softest and most exposed site.

Sternal recumbency is a bad position for most birds, because they breathe by ventrodorsal movements. However, since all raptures breathe by lateral movements, sternal recumbency in ostriches is appropriate. Injuries can occur as a result of malpositioning and long periods of recumbency. Bruning and Dolensek (1986) described peroneal nerve injuries in the legs of young raptures, and ischaemia and neuropathies of tissues become common when birds are kept in the same position for a long period. These effects are related to pressure injuries. Finally, managing the position of the neck while the bird is sedated is important, because it is long and flexible, and therefore prone to injury.

Different combinations of drugs have been used to immobilise ostriches. Stoskopf and others (1982) successfully used a mixture of 6 mg of etorphine, 25 mg of acepromazine and 200 mg of ketamine in the blue-necked ostrich (*S. camelus australis*). Samour and others (1990) reported adequate sedation of adult ostriches by using 6 mg of etorphine hydrochloride, 25 mg of acepromazine maleate and 200 mg of xylazine hydrochloride.

The interval between the penetration of the dart and the ostriches being handled was markedly longer in the present study than in the study of Samour and others (1990). This difference can be attributed to the fact that they used an anaesthetic mixture containing 200 mg xylazine, a dose which has been used as the sole tranquillising agent when handling ostriches in a crush, or to perform minor surgical operations or examinations (Keffen 1993). Ketamine alone has been used at a dose of 1.5 g to restrain adult ostriches (Robinson and Fairfield 1974).

In the present study, the interval between the impact of the dart and the ostriches becoming recumbent was shorter in the birds injected with etorphine-medetomidine than in those injected with the combination of etorphine and ketamine. Medetomidine has alpha-2 agonist effects, like xylazine; in association with etorphine hydrochloride, it seemed to be more effective, particularly in reducing the time for which the birds were recumbent. However, the immobilisation time was short (Tables 1 and 2).

The doses of etorphine used in ostriches are much higher than those used in mammals (Booth and McDonald 1988). Samour and others (1990) suggested that ostriches can metabolise etorphine rapidly. As a result of a pharmacokinetic study, Jensen and others (1992) considered that ostriches have a high metabolic rate, and this, together with their renal port system (Oelofsen 1977) may explain why renally excreted drugs injected in the thigh are markedly less effective in ostriches.

Four of the birds did not become recumbent. Two were sub-adult birds injected with 2 g of metomidate. According to Keffen (1993), metomidate given alone at a dose of 20 mg/kg induces recumbency in two minutes. However, no signs of sedation were observed after the intramuscular injection, although the body-weight of the birds was estimated at around 110 kg.

One adult male was injected intramuscularly with 150 mg of xylazine, but did not become recumbent. Cornick and Jensen (1992) reported adequate sedation with xylazine at a dose of 0.9 mg/kg bodyweight by intramuscular injection. However, stimulation and stress during the induction stage of tranquillisation with xylazine prevent optimum sedation (Booth and McDonald 1988). It is possible that wild ostriches, which are more easily stressed than domesticated birds, need a higher dose (S. Ostrowski, unpublished data). Finally, one sub-adult male received an unknown amount of an etorphine-medetomidine combination, because the dart bounced off immediately; it displayed signs of sedation, but never became recumbent.

According to Raath (1993), ostriches are very prone to capture myopathy, and every effort should be made not to underdose an ostrich during a capture operation. The case of myopathy induced by over-exertion was most probably linked to accidental under-dosage. The bird, which died after a respiratory collapse, was kicked many times by a dominant male while it was becoming sedated, and before it was possible to intervene. Death was most probably linked to the pre-recumbent state of shock.

The most common complications that developed during the period of anaesthesia included apnoea in three birds, bradycardia in five birds, and voluntary movements and respiratory collapse in two birds. When a bird is down, it is necessary to monitor its pulse, respiration and temperature, and the colour of the mucous



membranes. According to Keffen (1993), the heart and respiration rates after immobilisation in the wild will be approximately 120 and 13/minute, respectively. A respiration rate below 10/minute and cyanotic mucous membranes of the mouth are abnormal, and respiratory assistance should be provided.

A pulse rate of over 200 or below 80/minute is abnormal. Cornick and Jensen (1992) consider bradycardia to be treatable if the heart rate is less than 30 beats/minute; the intravenous administration of an anticholinergic agent, such as glycopyrolate at 0.011 mg/kg, can be effective, and attempts should be made to revive the bird.

After the deaths of two birds, all the anaesthetised birds systematically received, at the beginning of the period of sedation, intravenous injections of 3 mg/kg methylprednisolone succinate (Solumedrol; Upjohn), and intramuscular injections of a mixture of 8 mg/kg vitamin E and 0.1 mg/kg selenium (Sélépherol; Vétoquinol), to reduce the shock of capture. The ostriches experiencing respiratory distress received 5 mg/kg of doxapram hydrochloride (Dopram V 1 per cent; Vétoquinol) administered intravenously or directly into the tongue, and they were ventilated mechanically. In the event of respiratory collapse, intravenous injections of doxapram hydrochloride and diprenorphine hydrochloride are recommended, in order to remobilise the bird. Anaesthetised birds should be intubated to prevent the inhalation of food and to facilitate assisted respiration. A 14- or 18-mm internal diameter cuffed endotracheal tube can be used for all adult birds. Finally, as recovery is always very strenuous, it is recommended that the hooded birds are restrained for a few minutes after the administration of the reversal drug to prevent falls due to premature attempts to stand up.

The results of these trials show that ostriches are difficult to immobilise safely under field conditions. Excessive exertion during capture and underdosage must be avoided. When the bird is immobilised, it is important to monitor its physiological state closely. Of the two anaesthetic mixtures described, etorphine-medetomidine provided a short period of recumbency and a good

level of sedation, and myorelaxation adequate for minor procedures to be carried out.

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Short Communications

A postal survey of tail biting in pigs in south west England

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TAIL biting in pigs has been reported in the UK since the 1940s. It is thought to be a maladaptive behaviour (Ewbank 1968) where one pig in a group chews the tail of another; initially the victim does not respond but if the biting continues the bitten pig starts to take avoiding action. Once the tail bleeds it becomes attractive to other pigs in the group (Fraser 1987) and may precipitate cannibalism. The results of tail biting may be death from septicaemia or cannibalism, paralysis secondary to a spinal abscess, reduced growth rate or full recovery. Farmers can suffer economic loss because of on-farm deaths, casualty slaughter or condemnations at the abattoir (Norval 1966).

Previous publications on tail biting have primarily been case

reports of an outbreak on a farm (Jericho and Church 1972) or from abattoir findings (Penny 1972, Penny and Hill 1974). One or two factors have been suggested to have caused the problem in each outbreak but these vary from case to case. Suggested factors include: overstocking, poor ventilation, breakdown in the food or water supply, poor quality diets, absence of straw or the presence of wet straw, and breed types (Arey 1991). Two attempts were made to precipitate an outbreak of tail biting in an experimental situation (Van Putten 1969, Ewbank 1973). Both authors reported great difficulty in getting pigs to bite tails.

From the literature and from empirical evidence tail biting appears to be a behavioural problem which may be triggered by more than one adverse environmental factor. The present study was designed as a pilot investigation to estimate the proportion of farms which experience tail biting, the prevalence of affected pigs on farms and to identify farm level associations with tail biting.

A postal questionnaire, covering letter and reminder slip were designed following suggestions from Vaillancourt and others (1991). To keep the questionnaire simple it was targeted at farm level factors and only at finishing pigs. Farmers were asked about nutrition, water supply, lighting, ventilation, temperature, flooring and stocking density. Information was also requested on herd size and breed, the practice of tail docking and the occurrence of tail biting in the previous year. The three page questionnaire consisted of 22 closed questions, where all possible options were listed.

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