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ORAL ADMINISTRATION OF DIAZEPAM AND PROMAZINE HYDROCHLORIDE TO IMMOBILIZE PRONGHORN

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Abstract: Oral tranquilizers were mixed with a grain bait and fed to pronghorn *(Antilocapra americana)* in an attempt to immobilize and thus facilitate their capture. Diazepam, administered at 6 mg/kg body weight immobilized a tame pronghorn fawn within 30 min. Tranquilization was still apparent after 8 h. A minimum dose of 23 mg/kg body weight was necessary to immobilize a wild adult pronghorn. Immobilization occurred after 60 min and tranquilization was apparent 24 h post ingestion. Excitement severely impeded the effect of the drug and although easily captured, the animal struggled wildly when handled. Wild pronghorn fawns showed moderate tranquilization when administered diazepam at 23 mg/kg body weight but were unapproachable. Doses of diazepam between 13 and 23 mg/kg body weight were used to capture tame yearling and adult pronghorn held in a 132 ha enclosure. A dose of 23 mg/kg body weight was excessive in that the animals did not recover for 48 to 54 h post ingestion and had difficulty maintaining a sternal bedding position. Diazepam at 13 mg/kg body weight failed to tranquilize the animals sufficiently for easy capture. Promazine hydrochloride at doses of 2 to 17 mg/kg body weight, given orally to wild pronghorn fawns and an adult, did not produce visible signs of tranquilization. Animals refused to eat bait containing doses of promazine hydrochloride greater than 17 mg/kg body weight.

INTRODUCTION

High mortality associated with current drive-trapping and transportation techniques[1,3,7,12] has stimulated a search for a tranquilizer which can be administered orally in bait to capture and safely handle pronghorn *(Antilocapra americana).* Diazepam[1] has been used in conjunction with the steel leg-hold trap to reduce injury while capturing coyote *(Canis latrans)* and red fox *(Vulpes fulva).*[2] White-tailed deer *(Odocoileus virginianus),*[6,10,11,15] mule deer *(Odocoileus hemionus),*[15] axis deer *(Axis axis),*[15] sika deer *(Cervus nippon)*[15] and fallow deer *(Dama dama)*[15] held in enclosures of varying sizes have been administered diazepam orally in bait and successfully captured. There is a wide safety margin associated with the use of diazepam[11,15] and mortality due to the effects of the drug alone is low.[6,11] By continual observation, predation on sedated animals or bloat resulting from animals falling on their side can be prevented.[15]

Promazine hydrochloride administered orally in feed has functioned well in quieting belligerent and aggressive horses and domestic cattle, thus facilitating handling.[4,5,8] In wild ungulates, promazine hydrochloride has seen limited use as an oral tranquilizer. Injected intramuscularly into zebra and five species of wild ungulates, promazine hydrochloride produced good tran-

[1] Valium. Roche Laboratories, Nutley, New Jersey.

[2] Promazine granules. Fort Dodge Laboratories, Inc., Fort Dodge, Iowa.

quilization.[9] Kangaroos and wallabies fed promazine hydrochloride on vegetables and fruit were easily approached and restrained.[14] A wide safety margin and apparent lack of toxicity[8,13] is associated with promazine hydrochloride. This paper describes the use of diazepam and promazine hydrochloride in the capture and handling of tame and wild pronghorn.

MATERIALS AND METHODS

Diazepam

Tame fawn pronghorn. Two female pronghorn fawns were raised and maintained in captivity. The dominant fawn (101) weighed 23 kg; the other fawn (102) weighed 26 kg. Both were previously infected with contagious ecthyma and had active lesions in the mouth. Between 23 and 27 February 1980, increasing doses of diazepam were administered to the fawns in a series of trials (Table 1). Diazepam tablets were ground and added to 1 l of grain per animal, using approximately 10 ml clear Karo syrup to facilitate adherence of the diazepam. In subsequent trials, this was reduced to 0.5 l grain per animal and 20 ml clear Karo syrup. Fawn 101 was euthanized before the final trial. Post ingestion, the fawns were observed at 30 min intervals. Clinical signs of tranquilization, approachability, specific reactions to handling, time to immobilization, and recovery time were recorded.

Wild pronghorn. Two wild pronghorn fawns, each weighing approximately 45 kg and a wild adult doe, weighing approximately 54 kg, were maintained in a 0.66 ha enclosure. Between 7 and 15 March 1980, increasing doses of diazepam were administered in a series of trials (Table 1). Diazepam tablets were ground and added to 1 l of grain per animal using approximately 40 ml of dark Karo syrup to facilitate adherence of the diazepam. It was necessary to increase the amount of dark Karo syrup per liter of grain to accommodate increasing amounts of ground diazepam.

Because these animals were wild, they were observed with binoculars from a blind about 200 m away. Time spent feeding, visible signs of tranquilization, and general movement were recorded. The animals were approached at approximately 1 h intervals post ingestion. Approachability, amount of bait consumed, time to immobilization, and recovery time were recorded.

Tame yearling and adult pronghorn. Information gained from previous trials was used to capture animals from a group of 15 pronghorn kept in a 132 ha enclosure on the Central Plains Experimental Range. This area is shortgrass prairie and is located about 19 km northeast of Nunn, Colorado. Six of those animals were considered tame in that they would take grain from a handheld bucket. As in previous trials, diazepam tablets were ground and bound to grain using clear karo syrup.

Two separate efforts, trial 4 to capture four and trial 5 to capture two tame pronghorn, were made on 28 February and 3 March 1980, respectively (Table 1). In each effort, the bait (consisting of 1 l of grain and 600 mg diazepam per animal) was placed in buckets in an area where the animals were accustomed to feeding. Observers then watched from vehicles about 50 m away. Time until approachable, subsequent effects, and recovery time were recorded. After capture, the pronghorn were placed in darkened carrying crates and taken to the animal maintenance facility near Fort Collins.

Promazine

Wild pronghorn. Between 21 March and 6 April 1980, increasing doses of promazine hydrochloride were administered in a series of trials (Table 2) to two pronghorn fawns and an adult doe. During trials 1 through 4 the animals were maintained in a 0.66 ha enclosure. They were released into a larger area

TABLE 1. Summary of tranquilizing effects of diazepam on pronghorn *(Antilocapra americana)*.

	Animal Type[a]	Approx. Weight (kg)	Date	Dosage Prescribed (mg/kg)	Dosage Prescribed (mg/head)	Dosage Estimated[b] (mg/kg)	Dosage Estimated[b] (mg/head)	Time post ingestion to capture (min)	Time post ingestion to recovery (h)	Degree of Tranquilization[c]
Trial 1										
101	TF ♀	23	23 Feb 80	7	170	9	200	180	8+	good
102	TF ♀	26	23 Feb 80	7	170	5	140	-	5.5	poor
177	WF ♀	40	7 Mar 80	13	600	23	1000	-	24	moderate
182	WF ♀	40	7 Mar 80	13	600	23	1000	-	24	moderate
180	WA ♀	50	11 Mar 80	11	600	6	300	-	-	none
Trial 2										
101	TF ♀	23	24 Feb 80	9	200	10	240	30	24+	good
102	TF ♀	26	24 Feb 80	8	200	6	160	30	8+	good
177	WF ♀	40	15 Mar 80	27	1200	19	850	-	8+	moderate
182	WF ♀	40	15 Mar 80	27	1200	19	850	-	8+	moderate
180	WA ♀	50	15 Mar 80	23	1200	23	1200	60	24	good
Trial 3										
102	TF ♀	26	27 Feb 80	15	400	15	400	30	30	good
Trial 4										
201	TY ♂	45	28 Feb 80	13	600	27	1200	43	48	good
225	TY ♀	45	28 Feb 80	13	600	18	800	60	54	good
Trial 5										
224	TY ♀	45	3 Mar 80	13	600	13	600	240	24	moderate
223	TA ♀	35	3 Mar 80	17	600	17	600	90	24	moderate

[a]WF=wild fawn WA=wild adult TF=tame fawn TY=tame yearling TA=tame adult

[b]Amount of prescribed dosage ingested

[c]none=no visible sign of tranquilization poor=visible sign of tranquilization, unapproachable, may be hyperexcitable moderate=loss of coordination, stumbling, unapproachable, calm, good-bedded, approachable, easily captured

TABLE 2. Summary of tranquilizing effect of Promazine in pronghorn *(Antilocapra americana)*.

	Animal Type[a]	Date	Dosage Prescribed (mg/kg)	Dosage Prescribed (mg/head)	Dosage Estimated[b] (mg/kg)	Dosage Estimated[b] (mg/head)	Degree of Tranquilization
Trial 1							
177	WF ♀	21 Mar 80	2	70	1	26	none
182	WF ♀	21 Mar 80	2	70	1	53	none
180	WA ♀	21 Mar 80	1	70	1	26	none
Trial 2							
177	WF ♀	23 Mar 80	3	140	4	187	none
182	WF ♀	23 Mar 80	3	140	3	140	none
180	WA ♀	23 Mar 80	3	140	2	93	none
Trial 3							
177	WF ♀	24 Mar 80	6	280	9	420	none
182	WF ♀	24 Mar 80	6	280	7	323	none
180	WA ♀	24 Mar 80	5	280	2	92	none
Trial 4							
177	WF ♀	25 Mar 80	12	560	8	374	none
182	WF ♀	25 Mar 80	12	560	12	560	none
180	WA ♀	25 Mar 80	10	560	4	187	none
Trial 5							
177	WF ♀	4 Apr 80	12	560	6	253	none
182	WF ♀	4 Apr 80	12	560	3	154	none
180	WA ♀	4 Apr 80	10	560	3	154	none
Trial 6							
177	WF ♀	6 Apr 80	17	750	0	0	none
182	WF ♀	6 Apr 80	17	750	3	150	none
180	WA ♀	6 Apr 80	14	750	0	0	none

[a]WF=wild fawn WA=wild adult
[b]Amount of prescribed dosage ingested

during the final two trials. Promazine hydrochloride granules were ground and added to 1 l of grain per animal using approximately 40 ml of dark Karo syrup to facilitate adherence of the promazine hydrochloride. As the dose of promazine hydrochloride was increased, the amount of grain was reduced and the amount of Karo syrup increased to concentrate the drug on the bait. The animals were constantly observed from a blind and approached at 1 h intervals. Time spent feeding, signs of tranquilization, approachability, and amount of bait consumed were recorded.

In both the diazepam and promazine hydrochloride trials, the degree of tranquilization was classified as none, no visible signs of tranquilization; poor, some sign of tranquilization but the animal is unapproachable and may be hyperexcited; moderate, animal is calm, uncoordinated, stumbling, but still unapproachable; and good, animal is immobilized, bedded, approachable, and easily captured.

RESULTS

Diazepam

Tame pronghorn fawns given diazepam at doses of 6-15 mg/kg body weight were tranquilized effectively (Table 1). As doses were increased, recovery time lengthened. In wild pronghorn, the maximum dose of 23 mg/kg body weight failed to successfully immobilize the fawns, while good tranquilization was seen in the adult within 60 min (Table 1). The yearling and adult pronghorn showed initial signs of tranquilization 20 min post ingestion. Good tranquilization and approachability was reached at 45 to 60 min (Table 1).

The sequence of immobilization was fairly consistent in both tame, and wild pronghorns. During the first 15 min, ears, eyes, head, and neck gradually dropped. Subsequently, the animals lost coordination and spread their legs for balance. The animals tend to bed quickly but did not lose their ability to remain in a sternal position. Once bedded, the tame pronghorn fawns seemed lethargic, were unwilling to rise without help, and when assisted to their feet, were uncoordinated and easily guided. The wild adult was sedate until touched, struggled moderately when restrained, and showed a strong capability to overcome the sedative action of the drug when excited. Upon release she thrashed wildly until gaining her feet, dashed off, and was not captured again.

Moderately tranquilized wild fawns reacted similarly to the immobilized wild adult, but were less sedate and approachable. All three were notably calmer when moderately effected. One of the wild fawns was reluctant to bed, preferring to stand with head braced on the fence and rear legs spread. All the animals had trouble regaining their feet after lying down.

An inadequate dose of tranquilizer in the tame fawn 102 resulted in an excitable state characterized by bristled body hair, twitching tail and eyelids, and an erratic, stiff-legged gait. This state was observed 30 min post ingestion and continued for 1.5 h.

The tame and wild animals were observed grinding their teeth during tranquilization. The tame fawns ingested gravel and all fed as the drug began to wear off. Return of coordination was gradual unless the animal was unduly excited.

Promazine hydrochloride

Oral promazine hydrochloride in doses ranging from 2 to 17 mg/kg of body weight appears to have no effect on wild pronghorn. The bitter taste of promazine hydrochloride imposes an upper limit on the dose administered. As the dose increases, the drug becomes so concentrated on the bait the animals refused to eat.

DISCUSSION

Diazepam

Signs of tranquilization due to diazepam in tame fawn, tame yearling and adult, and wild fawn and adult pronghorn are similar to those seen in white-tailed deer,[9,15] although a protruding tongue which limited intake in cervids[15] was not seen. Tame animals required less drug per kg body weight than wild animals for effective immobilization. Failure to immobilize wild pronghorn fawns with diazepam at 23 mg/kg body weight while finding good tranquilization in the wild adult doe may indicate a higher tolerance to diazepam in younger animals. However, in using diazepam on cervids, individual animals showed a wide variation in response, and age was not as important as the excited state of the animal.[15] Excitement was an important facotr in the animal's ability to overcome the sedative effect of the drug as was seen in the capture of the adult doe. Examination of the animals at hourly intervals may have been a flaw in the experiment in that excitation before the drug reached maximum effectiveness could have increased the animal's resistance. Because of extended recovery times at high doses and arousal caused by excitement, moderate doses (diazepam at 20 mg/kg body weight) combined with a 4-8 h period before attempted capture may prove more effective.[15]

As a capture technique for wild pronghorn, diazepam administered orally in bait showed some possibilities, but potential problems were evident. Finding an attractive bait the animals will accept poses a problem. Dark Karo syrup mixed with grain strongly attracted animals accustomed to feeding on grain and worked well as an adherent for the powdered drug. Yet, as vegetation began to green up, the animals showed little interest in the grain bait.

The dominance hierarchy established by the gregarious pronghorn makes the capture of large groups (10 or more) unfeasible. Dominant animals consistently ingested the greater portion of the bait. Because no self-limitation was observed in the pronghorn, nothing would prevent dominant animals from ingesting three to four times the intended dose. When severely tranquilized, the animals require constant attention to maintain a sternal position and may lapse into a coma.[10] The varying degrees of tranquilization occurring in a large group would also create problems. For example, the poorly tranquilized pronghorn fawn showed signs of hyperexcitability, unduly exciting the other animal. Both poorly and moderately tranquilized animals had difficulty gaining their feet when bedded and stumbled and lurched when approached. Warnings blown by non-tranquilized animals and attempts at capture could cause incapacitated animals to injure themselves attempting to avoid capture, as was seen in the capture of white-tailed deer.[10,15]

Extended recovery periods of up to 30 h also pose problems in using diazepam. In the wild, tranquilized animals require constant observation to prevent bloat, exposure and predation. At excessive doses tame yearling and adult animals taken into captivity needed constant observation during the recovery period. When attempting to rise they would sometimes lose their balance, falling down in a prone position unable to return to a sternal position without assistance. Another important consideration is economic feasibility. During the course of experimentation, the price of diazepam increased three-fold, bringing the price of tranquilization to approximately 30 to 60 dollars (U.S.) an animal.

Based on the information gained from this study diazepam should be administered in varying dosages depending on the disposition of the animal and the reasons for capture and handling. Apparently diazepam at 10-15 mg/kg

body weight is adequate for routine capture and handling of tame fawns. The effective handling period is approximately 8 to 16 h after good tranquilization is reached. Since diazepam has such a wide safety margin,[11 15] tame yearling and adult animals should be given 18 to 23 mg/kg body weight. The higher dosage would help ensure that the animals would not be able to overcome the tranquilizing effects of the diazepam when excited. In capturing and handling wild animals in captivity, the minimum dose of diazepam would probably have to be greater than 23 mg/kg body weight as this dose was inadequate in the handling of a wild adult pronghorn. Diazepam as an oral tranquilizer has extremely limited utility in the capture and handling of free ranging wild animals and as was illustrated with the wild pronghorn, requires further experimentation for reliable use in capturing and handling wild animals in captivity. The maximum safe dose for wild pronghorn was undetermined. However, a pregnant 54 kg white-tailed deer dosed with 3000 mg (56 mg/kg body weight) diazepam became comatose and paralyzed in the hind legs, dying 5 days later never recovering from the effects of sedation.[10]

Promazine hydrochloride

Oral promazine hydrochloride did not prove effective in the tranquilization of wild pronghorn. Doses up to three times that recommended for a 544 kg horse were administered and produced no signs of tranquilization. The possibility of inactive promazine was eliminated by using drugs purchased from two different distributors and with different lot numbers, and by administering the drug to a horse which was effectively sedated. Trial number four was repeated to negate the possibility of a building resistance to the drug during consecutive trials.

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