EFFECT OF CAFFEINE SODIUM BENZOATE, KETAMINE HYDROCHLORIDE, AND YOHIMBINE HYDROCHLORIDE ON XYLAZINE HYDROCHLORIDE-INDUCED ANOREXIA IN WHITE-TAILED DEER

Authors: Van Der Eems, Karen, and Brown, Robert D.

Source: Journal of Wildlife Diseases, 22(3) : 403-406

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-22.3.403
EFFECT OF CAFFEINE SODIUM BENZOATE, KETAMINE HYDROCHLORIDE, AND YOHIMBINE HYDROCHLORIDE ON XYLAZINE HYDROCHLORIDE-INDUCED ANOREXIA IN WHITE-TAILED DEER

Karen Van Der Eems and Robert D. Brown
Caesar Kleberg Wildlife Research Institute, Texas A&M University, Campus Box 218, Kingsville, Texas 78363, USA

ABSTRACT: Fifteen male white-tailed deer (Odocoileus virginianus) were administered xylazine hydrochloride (1 mg/kg BW i.m.), xylazine hydrochloride (1 mg/kg i.m.) followed by caffeine sodium benzoate (10 mg/kg i.m.), xylazine hydrochloride (0.5 mg/kg i.m.) and ketamine hydrochloride (4.5 mg/kg i.m.), and xylazine hydrochloride (1 mg/kg i.m.) followed by yohimbine hydrochloride (0.125 mg/kg i.m.), in a Latin Square design. Mean dry matter intake (DMI) for 4 days pre-treatment was compared to each of 4 days post-treatment. A significant (P < 0.01) decrease in DMI was found only on the first day following treatment for each of the four drug combinations. The percent decreases in DMI on the first 24-hr period after immobilization were: xylazine hydrochloride 47%, xylazine hydrochloride/caffeine sodium benzoate 36%, xylazine hydrochloride/yohimbine hydrochloride 36%, and xylazine hydrochloride/ketamine hydrochloride 31%. The xylazine hydrochloride/ketamine hydrochloride combination was found to be insufficient to adequately sedate the deer. The use of caffeine or yohimbine hydrochloride is recommended to reduce recumbency time, but offers no improvement in xylazine hydrochloride-induced anorexia.

INTRODUCTION

Xylazine hydrochloride (Rompun, Haver-Lockhart Laboratories, Shawnee, Kansas 66201, USA) is used widely in the chemical immobilization of white-tailed deer (Roughton, 1975; Gibson, 1980; Booth, 1982). Unfortunately, anorexia is often associated with the use of xylazine hydrochloride in ruminants (Knight, 1980). Suppressed appetite in red deer (Cervus elaphus) calves sedated with xylazine hydrochloride was reported by Simpson et al. (1983). Warren et al. (1984) observed a significant decrease in feed intake of white-tailed deer on the day after and for the week following sedation by xylazine hydrochloride. It would be advantageous to find a suitable antagonist to the anorexic effects of xylazine hydrochloride.

Bubenik (1982) reported that caffeine improved the depressed respiration and heart rate seen in xylazine hydrochloride-sedated white-tailed deer. Yohimbine hydrochloride, an α2-adrenergic antagonist (Goldberg and Robertson, 1983) is known to prevent or diminish xylazine hydrochloride sedation in dogs, cattle, mule deer (Odocoileus h. hemionus), and white-tailed deer (Hatch et al., 1982; Kitzman et al., 1982; Jessup et al., 1983; Hsu and Shulaw, 1984). Ketamine hydrochloride (Vetalar, Parke-Davis and Co., Morris Plains, New Jersey 07950, USA) is frequently used in combination with xylazine hydrochloride in deer research (Bubenik, 1982; Jessup et al., 1983). This drug combination is fast-acting, and repeated use does not lead to increased drug resistance (Bubenik, 1982).

The purpose of this study was to investigate the effects of xylazine hydrochloride, xylazine hydrochloride/ketamine hydrochloride, xylazine hydrochloride/caffeine sodium benzoate, and xylazine hydrochloride/yohimbine hydrochloride on feed intake in white-tailed deer.
TABLE 1. Dry matter intake (g/kg BW\textsuperscript{0.75}) of fifteen male white-tailed deer on a pelleted ration after administration of various drugs.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Concentration (mg/ml)</th>
<th>Dose (mg/kg)</th>
<th>Pre-inj</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xylazine hydrochloride</td>
<td>100</td>
<td>1.0</td>
<td>84</td>
<td>6</td>
<td>44</td>
<td>5</td>
<td>74</td>
</tr>
<tr>
<td>Xylazine hydrochloride</td>
<td>100</td>
<td>0.5</td>
<td>95</td>
<td>5</td>
<td>65</td>
<td>7</td>
<td>90</td>
</tr>
<tr>
<td>Ketamine hydrochloride</td>
<td>100</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylazine hydrochloride</td>
<td>100</td>
<td>1.0</td>
<td>95</td>
<td>3</td>
<td>61</td>
<td>6</td>
<td>83</td>
</tr>
<tr>
<td>Caffeine sodium benzoate</td>
<td>250</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylazine hydrochloride</td>
<td>100</td>
<td>1.0</td>
<td>90</td>
<td>5</td>
<td>58</td>
<td>7</td>
<td>93</td>
</tr>
<tr>
<td>Yohimbine hydrochloride</td>
<td>1</td>
<td>0.125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\* Administered i.m.  
\* Administered i.v.

MATERIALS AND METHODS

Fifteen pen-raised, male, white-tailed deer were housed in 4 x 4-m covered individual pens. Deer ages ranged from yearlings to mature adults (>3.5 yr). Animals were assigned randomly to one of four groups in a Latin Square design, with three groups of four deer each and one group of three deer. Each group received each treatment once during July and August of 1984. The deer were immobilized biweekly in early afternoon. Treatment one involved immobilization with xylazine hydrochloride (100 mg/ml) at a dose of 1 mg/kg (Table 1). Xylazine hydrochloride and ketamine hydrochloride (both at 100 mg/ml) were used at doses of 0.5 mg/kg and 4.5 mg/kg, respectively, for the immobilant in treatment two (Bubenik, 1982; Jessup et al., 1983). Treatment three consisted of immobilization with xylazine hydrochloride at a dose of 1 mg/kg. Sedation was followed 15-20 min later by injection of caffeine sodium benzoate USP (250 mg/ml) at 10 mg/kg i.m. (Bubenik, 1982). In treatment four, xylazine hydrochloride (1 mg/kg) sedation was followed 15-20 min later by administration of yohimbine hydrochloride (1 mg/ml) at 0.125 mg/kg i.v. (Jessup et al., 1983). Immobilizing drugs were injected with Telinject blow-gun darts (Telinject USA, Inc., Newhall, California 91321, USA).

Deer were fed a pelleted ration of at least 16% crude protein ad libitum (P+M Products, San Antonio, Texas 78204, USA). Dry matter intake (DMI) was recorded daily for a period of 4 days prior to and 4 days following immobilization. Days were defined as 24-hr periods prior to or after the time of injection. Treatments were conducted at biweekly intervals. Body weights were obtained at time of treatment. Means within each treatment were compared using Tukey's Studentized Range Test (Ray, 1982). Daily means of DMI after treatment were compared to the mean of the 4 days previous to treatment. In addition, percent changes in feed intake between treatments were compared.

RESULTS AND DISCUSSION

The ANOVA comparison of the average DMI (g/kg BW\textsuperscript{0.75}) for the 4-day period previous to immobilization and DMI (g/kg BW\textsuperscript{0.75}) for the first, second, third and fourth days following injection was significant (P < 0.01) on the first day following immobilization for all four treatments (Table 1). No significant difference in DMI (g/kg BW\textsuperscript{0.75}) was found between the 4-day pre-treatment mean and the second, third or fourth day after sedation for any of the treatments. The percent decreases in DMI on the first day after treatment were as follows: xylazine hydrochloride 47%, xylazine hydrochloride/caffeine sodium benzoate 36%, xylazine hydrochloride/yohimbine hydrochloride 36%, and xylazine hydrochloride/ketamine hydrochloride 31%. There was no difference (P > 0.05) in these percent differences between groups. No significant (P > 0.05) effect was found due to date of treatment.
for any of the treatments. DMI in those deer receiving only xylazine was significantly different ($P < 0.05$) from the other three treatments for the 4-day average before treatment and for the first and second day after treatment. There is no apparent biological explanation for this.

It is important to consider the physiological changes associated with use of xylazine hydrochloride in research (Warren et al., 1984). In nutritional investigations, changes in intake and digestive efficiency pose a major concern. The significant decrease in feed intake (38%) of red deer calves sedated with 0.8 mg/kg xylazine hydrochloride reported by Simpson et al. (1983) is similar to that seen in the present study. Warren et al. (1984) reported a significant reduction in feed intake of white-tailed deer for the day and the week after sedation with xylazine hydrochloride. Doses used in the Warren study were 3.3 mg/kg (April–October) and 1.7 mg/kg (November–February). In a study by Card (1981), white-tailed deer required 3 days to return to pre-injection feed intake following xylazine sedation at 0.5 mg/kg. Frequency of xylazine sedation, sex, age, dose, temperature, and season are just some of the variables which might account for the variation between studies (Bubenik, 1982; Warren et al., 1984).

In our study, observations were not quantified, but there was a noticeable decrease in recumbency time when yohimbine hydrochloride was used as an antagonist. Some deer were standing within minutes after administration of this drug. Jessup et al. (1983) and Hsu et al. (1984) both report a decrease in recumbency time with use of yohimbine hydrochloride.

Xylazine hydrochloride/ketamine hydrochloride used at concentrations of 0.5 mg/kg and 4.5 mg/kg respectively was not practical. The volume required to sedate a deer was generally too large for use in a single blow-gun dart. In addition, many of the animals which received the xylazine hydrochloride/ketamine hydrochloride combination were not recumbent and often had to be restrained manually. This drug can be lyophilized to decrease the required volume (Bubenik, 1982). The acidic nature of this drug may, however, limit its usable concentration.

In conclusion, our data indicated that neither ketamine hydrochloride, caffeine sodium benzoate, or yohimbine hydrochloride, when used in combination with xylazine hydrochloride will completely alleviate the reduced feed intake found in xylazine hydrochloride-sedated white-tailed deer. The xylazine hydrochloride-induced anorexia found in this study was statistically significant only on the first day following sedation. Irrespective of treatment, the deer were off feed only for the 24-hr period after sedation. There is apparently no advantage in using any of these treatments to alleviate the xylazine hydrochloride-induced anorexia. Use of antagonists such as caffeine and especially yohimbine hydrochloride may be beneficial in reducing the period of recumbency in xylazine hydrochloride-sedated deer. These antagonists may also be useful in counteracting hyperthermia and/or hypothermia associated with sedation in extreme climates, in counteracting overdoses of xylazine hydrochloride, or in avoiding predation of sedated animals in the wild.

ACKNOWLEDGMENTS

The authors would like to thank Mike Abbott and Virginia Ramirez for assistance with animal handling, Dr. Ralph Bingham for statistical analyses, and Dr. George Bubenik for review of this manuscript. Funding for this project was provided by the Caesar Kleberg Wildlife Research Institute and N.I.H. grant S06-RR08107-12.

LITERATURE CITED


BUBENIK, C. A. 1982. Chemical immobilization of captive white-tailed deer and the use of auto-


