

# Tissue Residue Levels of Butorphanol, Azaperone, Medetomidine, Atipamezole, and Naltrexone in White-tailed Deer (*Odocoileus virginianus*) at 11 and 21 Days Post Intramuscular Injection

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## Abstract

Tissue residues were determined after intramuscular injection of butorphanol, azaperone, medetomidine, atipamezole, and naltrexone in 33 white-tailed deer (*Odocoileus virginianus*). At day 11 post injection (PI), and day 21 PI, none of anesthetics or reversal drugs were detected  $\geq 0.01$  ppm in any of the liver and muscle samples tested.

**Keywords:** *Odocoileus virginianus*; Immobilizations; Drugs; Anesthetics; Azaperone; Atipamezole

## Introduction

Chemical immobilizations are routinely used on free ranging and captive wild animals by wildlife biologists and veterinarians. These anesthetics and reversing drugs are labeled for use in traditional livestock, but in most of the situations with wildlife the same drugs are legally used in off-label procedures. Dosages, clearance times, and tissue residue levels for some of the above drugs have been established for some domesticated species [1-4], however, tissue residues have not been established for these drugs when used in white-tailed deer (*Odocoileus virginianus*). The levels of drug residues in the tissues of game animals like deer and elk that might be consumed by the public after the drug injection could be of some possible public health concern.

A popular drug combination for immobilizing white-tailed deer (and other species) is butorphanol (0.30-0.34 mg/kg) plus azaperone (0.16-0.27 mg/kg) plus medetomidine (0.11 mg/kg-0.20 mg/kg) commonly called BAM [5]. This combination can be effectively and immediately antagonized with naltrexone plus atipamezole. Animals injected with BAM are typically fully immobilized in 11 to 12 minutes (range 4-30 minutes). The combination is known for producing smooth inductions and recoveries (upon administration of antagonists) without lasting changes to physiology or behavior [5].

## Materials and Methods

To address the residue issue, thirty three (33) white-tailed deer were transported to a Texas Parks and Wildlife Department (TPWD) Permitted Private Deer Facility at Triple Threat Ranch, 9228 Triple Ranch Road, in Somerville, Texas 77879. Twenty-three (23) deer (14

males and 9 females) were from the Texas Parks and Wildlife Department captive deer herd on the Kerr Wildlife Management Area, Hunt, Texas, and 10 other female deer were transported to the Triple Threat facility from 5 private captive deer facilities using TPWD transfer permits. After arrival at the Triple Threat facility the 33 white-tailed deer were placed on TPWD Scientific Research Permit # SRP-0814-151. After a two week acclimation period in a 4 acre high fenced enclosure at Triple Threat while being maintained on a commercial 16% protein pelleted ration, ad libitum alfalfa hay, and water, the 33 deer were worked through a deer handling facility with a drop chute (a specific restraint for cervids with a drop-floor system). The anesthetics were delivered by a single 2.0 ml intramuscular (IM) injection in the left shoulder/neck at the following dose: 27.3 mg/ml of butorphanol; 9.1 mg/ml of azaperone; 10.9 mg/ml of medetomidine (BAM formulation provided for research and development for this study by ZooPharm, 1230 West Ash, Winsor, CO 80550). The deer were placed in darkened 3 m X 3 m rooms during drug induction and monitored for 45 minutes, then 4.0 cc (25 mg/ml) of atipamezole, and 0.5 cc (50 mg/ml) of naltrexone were injected IM into the left hip for anesthetic drug reversal. After full recovery, the deer were returned to the outside pen and maintained as before.

At day 11 post injection (PI), 22 deer were transferred from the outside pen into the deer handling facility. They were euthanized by captive bolt and exsanguinated by Texas Parks and Wildlife personnel trained in that procedure. After euthanasia of the deer, veterinarians licensed to practice in Texas collected muscle and liver samples from the carcasses. The muscles collected were the right semimembranosus and semitendinosus; liver samples consisted of the right lobe of the liver. The liver and muscle tissue samples were individually bagged, labeled, refrigerated and then immediately transported on ice to the Texas Veterinary Medical Diagnostic Laboratory (TVMDL), Texas A&M University, College Station, Texas 77843-4467. Tissues were stored in a freezer at -20°C. Tissues were thawed prior to extraction for

drug residue analysis. Tissue residues were analyzed using liquid chromatography-tandem mass spectrometry (LC-MS/MS). At day 21 PI, the remaining 11 deer were transferred from the outside pen into the handling facility and sampled as described above. All carcasses from both groups were burned and buried in the manner required by the TPWD Scientific Research Permit # SRP-0814-151.

## Results

The TVMDL did not detect residues of butorphanol, azaperone, medetomidine, atipamezole, or naltrexone in either muscle or liver samples at any time point PI tested (the limit of detection is 0.01 ppm). The level of <0.01 ppm of the drugs in the muscle and liver tissues in white-tailed deer at day 11 and 21 PI is below that which is allowed by the Federal Drug Administration (FDA) in tissues from cattle, sheep, and swine. Any concentrations below the limit of detection would preclude any pharmacological effects in humans that might consume the venison from white-tailed deer at the drug dosages used 11 days or later post injection.

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