# ELEPHANTS, BUFFALO, KOB, AND RHINOCEROS: IMMOBILIZATION, TELEMETRY AND HEALTH EVALUATIONS

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## Abstract

From 1992 through 1996, African elephants (*Loxodonta africana*), savanna buffalo (*Syncerus caffer*), Ugandan kob (*Kobus kob*), and northern white rhinoceros (*Ceratotherium simum cottoni*) were immobilized for health evaluations or radio-telemetry studies at Garamba National Park in northeastern Zaire.

Thirty-seven elephants were darted for immobilization using either 50 caliber metal darts and 3.1 or 5.0 × 60 mm (Palmer Chemical & Equipment Co, Inc., Box 867, Douglasville, GA 30133 USA) or 3 ml plastic darts and 2.0 × 60 mm needles (Telinject USA, 9316 Soledad Canyon Rd., Saugus, CA 91350 USA). Four calves, 4-6-yr-old were immobilized using 1 mg of carfentanil hydrochloride (Wildlife Pharmaceuticals, Fort Collins, CO 80524 USA). Adults were immobilized with 3 mg of carfentanil mixed with 1500 IU of hyaluronidase. All animals were reversed with naltrexone hydrochloride (Wildlife Pharmaceuticals, Fort Collins, CO 80524 USA) at a rate of 100 mg for every mg of carfentanil used. Failure of the darts to inject properly occurred in 15 cases. For animals responding completely to the first darting attempt, mean minutes elapsed for initial effect or standing still, recumbency, and recovery following reversal were 5.0 ± 1.6, 10.7 ± 3.9, and 5.9 ± 3.9 respectively.

Sixteen adult buffalo were immobilized using 3 ml Telinject plastic darts with 2.0 × 60 mm needles and 5 mg of carfentanil. Failure of the darts to inject properly occurred in 2 cases. For animals responding completely to the first darting attempt, mean minutes elapsed for initial effect or standing still, recumbency, and recovery following reversal were 2.0 ± 0.6, 4.3 ± 2.4, and 3.9 ± 2.6 respectively.

Eleven adult kob were immobilized 3 ml Telinject plastic darts with 1.5 × 38 mm collared needles and 2 mg of carfentanil. Failure of the darts to inject properly occurred in 5 cases. For animals responding completely to the first darting attempt, mean minutes elapsed for initial effect or standing still, recumbency, and recovery following reversal were 2.7 ± 0.7, 6.5 ± 4.1, and 1.2 ± 0.4 respectively.

Nine rhinoceros were darted with 50 caliber metal darts and 60 mm needles made by the South Africa National Parks Board using a combination of etorphine (2-3.8 mg) and detomidine (9-16 mg). Failure of the darts to inject properly occurred in 3 cases. For animals responding completely to the first darting attempt, mean minutes elapsed for initial effect or standing still, recumbency, and recovery following reversal were 5.2 ± 2.5, 8.0 ± 3.0, and 1.7 ± 0.7 respectively.

Packed cell volumes, total protein, and white blood cell counts were conducted in the field and serum

was frozen in liquid nitrogen. Serum chemistries and enzymes were processed on an automated analyzer. Plasma samples were analyzed for vitamin E (α-tocopherol) and vitamin A (retinol) using high-performance liquid chromatography. Plasma samples were analyzed for aluminum, boron, barium, copper, cobalt, iron, magnesium, manganese, molybdenum, and zinc by inductively coupled argon plasma emission spectroscopy. Plasma was also analyzed for polychlorinated biphenyls and the following chlorinated pesticides: aldrin; alpha - BHC; beta - BHC; O, P' - DDD; P, P' - DDD; P, P' - DDE; O, P' - DDT; P, P' - DDT; Dieldrin; endrin; heptachlor; heptachlor epoxide; and Lindane (Gamma - BHC). Serological tests are listed in Table 1.

Four elephants were fitted with standard VHF radio transmitters (Advanced Telemetry Systems, Inc., 470 1st Ave. North, Box 398, Isanti, MN 55040 USA) mounted on collars made of 75-mm-wide machine belting. One elephant was fitted with a transmitter utilizing the ARGOS satellite system (Telonics, 932 East Impala Dr., Mesa, AZ, 85204 USA). Four rhinoceros were fitted with VHF radio collars (Telonics) and five had VHF radio transmitters (Advanced Telemetry Systems) implanted in their horns. This was accomplished by drilling a 35-mm-diameter hole transversely near the base of the horn and a 5-mm hole from the horn tip down to meet the transverse hole. The transmitter was inserted in the larger hole with the antenna being fed up through the lengthwise hole. Dental acrylic was used to fill and seal the cavities.
No ectoparasites were found on the elephants or kob. No evidence of gastrointestinal parasites was found in fecal samples from the elephants. Samples from kob showed coccidia, strongyles, or trematodes. All buffalo were heavily invested with ticks (*Amblyomma cohaerens* and *Rhipicephalus longus*). Fecal samples from buffalo showed coccidia, strongyles, and/or trematodes. Rhinoceros were found to have light infestations of ticks (*Amblyomma cohaerens, Dermacentor rhinocerinus,* and *Rhipicephalus senegalensis*), about 20-100 ticks/animal. Fecal samples from the rhinoceros revealed strongyles, strongyloides-like larvae, coccidia, and in one individual sample, ascarid ova.

Hematologic, biochemical, vitamin and mineral tests results for buffalo and kob, and for elephant and rhinoceros in Tables 2 and 3 respectively. Levels for Al (<1.66 ppm), B (<1.66 ppm), Co (<0.167 ppm), Mn (<0.083 ppm), and Mo (<0.33 ppm) were below accurate detectable limits. All chlorinated pesticide and polychlorinated biphenyl analyses were below detectable limits (0.001-0.007 ppm and 0.05 ppm respectively). Infectious disease serology results are provided in Table 1.

**Table 1.** Serological tests performed, the number of positive animals, and the number of animals tested in the evaluation of infectious disease agent exposure in free-ranging buffalo, kob, elephants, and white rhinoceros in Zaire.

| Agent | Buffalo | Kob | Elephant | Rhinoceros |
|---|---|---|---|---|
| African horse sickness | | | 15/16 | 0/5 |
| Anaplasmosis | 0/16 | 0/8 | | 0/5 |
| Bluetongue | 4/7 | | 9/16 | 0/5 |
| Bovine viral diarrhea | 7/16 | 0/8 | | |
| Brucellosis | 4/16 | 2/8 | 4/16 | 0/5 |
| Epizootic hemorrhagic disease virus | 10/10 | 8/8 | | |
| Equine adenovirus | | | | 0/5 |
| Equine herpes virus (-1,-2,-3) | | | | 0/5 |
| Equine influenza | | | | 0/5 |
| Equine rhinovirus (-1,-2) | | | | 0/5 |
| Foot-and-mouth disease | 14/16 | 1/8 | 0/16 | 0/5 |
| Infectious bovine rhinotracheitis | 16/16 | 8/8 | | |
| Johne's disease | 0/7 | | 0/16 | 0/5 |
| *Leptospira interrogans* | 7/16 | 3/8 | 16/16 | 5/5 |
| Parainfluenza 3 | 16/16 | 2/8 | 0/16 | 0/5 |
| Rift Valley fever | | | 0/16 | |
| Rinderpest | 0/16 | 0/8 | 0/16 | 0/5 |

**Table 2.** Hematology, serum chemistry, enzyme, mineral, vitamin and metal values for free-ranging buffalo and kob in Zaire.

| Test Name (units) | Buffalo | | | Kob | | |
|---|---|---|---|---|---|---|
| | Mean | SD | n | Mean | SD | n |
| PCV | 36.9 | 7.25 | 16 | 49.1 | 4.2 | 9 |
| Total solids | 9.3 | 1.0 | 16 | 8.3 | 0.7 | 8 |
| Glucose (mg/dL) | 99.0 | 38.4 | 16 | 112 | 48.8 | 8 |
| BUN (mg/dL) | 12.8 | 3.8 | 16 | 23.5 | 2.8 | 8 |
| Albumin (g/dL) | 2.3 | 0.5 | 16 | 3.9 | 0.2 | 8 |
| Globulin (g/dL) | 5.8 | 1.0 | 16 | 3.1 | 0.5 | 8 |
| Albumin/globulin ratio | 0.4 | 0.1 | 16 | 1.3 | 0.3 | 0.3 |
| Total bilirubin (mg/dL) | 0.1 | 0.0 | 16 | 0.4 | 0.2 | 8 |
| Alkaline phosphatase (IU/L) | 78.3 | 56.5 | 16 | 60.8 | 24.3 | 8 |
| Alanine aminotransferase (IU/L) | 22.0 | 5.0 | 16 | 36.2 | 12.1 | 8 |
| Aspartate aminotransferase (IU/L) | 139 | 37.7 | 16 | 99.7 | 11.7 | 8 |
| Lactate dehydrogenase(IU/L) | 464 | 65.7 | 16 | 685 | 123 | 8 |
| Cholesterol (mg/dL) | 53.6 | 13.7 | 16 | 37.6 | 8.3 | 8 |
| Calcium (mg/dL) | 8.5 | 0.8 | 16 | 8.6 | 0.4 | 8 |
| Phosphorus (mg/dL) | 5.3 | 1.2 | 16 | 6.2 | 1.0 | 8 |
| Sodium (mEq/L) | 136 | 3.4 | 16 | 144 | 4.4 | 8 |
| Potassium (mEq/L) | 5.3 | 0.9 | 16 | 5.1 | 0.6 | 8 |
| Chloride (mEq/L) | 95.6 | 8.5 | 16 | 104 | 2.7 | 8 |
| Copper (µg/ml) | 0.56 | 0.13 | 16 | 0.87 | 0.06 | 8 |
| Iron (µg/ml) | 1.2 | 0.5 | 16 | 2.2 | 0.7 | 8 |
| Magnesium (µg/ml) | 29.1 | 2.8 | 16 | 35.5 | 6.1 | 8 |
| Zinc (µg/ml) | 1.1 | 0.2 | 16 | 1.1 | 0.2 | 8 |
| Alpha-tocopherol (µg/ml) | 1.86 | 0.47 | 15 | 1.61 | 0.4 | 8 |
| Retinol (µg/ml) | 0.25 | 0.08 | 15 | 0.70 | 0.11 | 8 |

**Table 3.** Hematology, serum chemistry, enzyme, mineral, vitamin and metal values for free-ranging elephants, and white rhinoceros in Zaire.

| Test Name (units) | Elephant | | | Rhinoceros | | |
|---|---|---|---|---|---|---|
| | Mean | SD | n | Mean | SD | n |
| PCV | 42.8 | 2.5 | 15 | 40.2 | 4.8 | 5 |
| Total solids | 8.9 | 0.6 | 15 | 7.9 | 0.3 | 5 |
| WBC ($\times 10^3$) | 12.2 | 2.5 | 14 | 8.8 | 0.6 | 5 |
| Neutrophils ($\times 10^3$) | 5.0 | 2.0 | 14 | 3.2 | 1.4 | 5 |
| Lymphocytes ($\times 10^3$) | 4.7 | 1.7 | 14 | 4.9 | 1.6 | 5 |
| Monocytes ($\times 10^3$) | 0.4 | 0.4 | 14 | 0.2 | 0.2 | 5 |
| Eosinophils ($\times 10^3$) | 1.2 | 1.0 | 14 | 0.5 | 0.4 | 5 |
| Basophils ($\times 10^3$) | 5.1 | 4.2 | 14 | 0 | 0 | 5 |
| Glucose (mg/dL) | 70.1 | 18.1 | 15 | 94.8 | 36.5 | 5 |
| BUN (mg/dL) | 9.0 | 4.0 | 15 | 14.8 | 3.3 | 5 |
| Albumin (g/dL) | 2.9 | 0.4 | 15 | 2.1 | 0.05 | 5 |
| Globulin (g/dL) | 5.5 | 0.8 | 15 | 6.0 | 0.2 | 5 |
| Albumin/globulin ratio | 0.58 | 0.1 | 15 | 0.34 | 0.05 | 5 |
| Total bilirubin (mg/dL) | 0.17 | 0.1 | 15 | 0.16 | 0.13 | 5 |
| Alkaline phosphatase (IU/L) | 150.6 | 85.4 | 15 | 69.2 | 23.3 | 5 |
| Alanine aminotransferase (IU/L) | 10.2 | 6.1 | 15 | 12.8 | 6.2 | 5 |
| Aspartate aminotransferase (IU/L) | 28.4 | 18.6 | 15 | 83.0 | 40.8 | 5 |
| Lactate dehydrogenase(IU/L) | 621 | 393 | 15 | 384 | 26.3 | 5 |
| Cholesterol (mg/dL) | 63 | 14.7 | 15 | 51.4 | 18.6 | 5 |
| Calcium (mg/dL) | 10.0 | 0.55 | 15 | 11.0 | 0.56 | 5 |
| Phosphorus (mg/dL) | 5.3 | 0.9 | 15 | 3.74 | 2.2 | 5 |
| Sodium (mEq/L) | 128 | 4.1 | 15 | 134 | 3.5 | 5 |
| Potassium (mEq/L) | 4.5 | 0.4 | 15 | 4.3 | 0.4 | 5 |
| Chloride (mEq/L) | 86.3 | 5.3 | 15 | 98.2 | 3.5 | 5 |
| Copper (µg/ml) | 0.76 | 0.22 | 15 | 1.6 | 0.48 | 5 |
| Iron (µg/ml) | | | | 1.3 | 0.13 | 5 |
| Magnesium (µg/ml) | 29.3 | 3.2 | 15 | 21.8 | 5.1 | 5 |
| Zinc (µg/ml) | 1.9 | 0.3 | 15 | 1.42 | 0.16 | 5 |
| Alpha-tocopherol (µg/ml) | 0.32 | 0.16 | 14 | 0.77 | 0.28 | 5 |
| Retinol (µg/ml) | 0.055 | 0.03 | 14 | 0.064 | 0.02 | 5 |