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Hematologic and Serum Chemistry Reference Values for Adult Brown Mink

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ABSTRACT: Hematologic and serum chemistry reference values were determined for 160 12-month-old brown untamed captive mink (*Mustela vison*). Blood was obtained by jugular venipuncture after administration of ketamine and xylazine. There were no statistically significant differences between male and female mink. The packed cell volume, hemoglobin, and red blood cell count were 10 to 20% lower than previously reported for non-anesthesized mink. Serum glucose, alanine aminotransferase and aspartate aminotransferase values also were lower than previously reported values.

Key words: Mink, *Mustela vison*, hematology, serum chemistry.

Hematologic and serum chemistry values for mink (*Mustela vison*) have not been extensively studied. Most reports of reference values for hematologic data were based on low numbers of animals (Kennedy, 1935; Kubin and Mason, 1967). Previous reference ranges for serum chemistry have reported few parameters (Kubin and Mason, 1967). Reference ranges would be useful for evaluation of physiologic and pathologic alterations in wild mink as well as captive mink.

Our objective was to determine hematologic and serum chemistry reference ranges for 12-month-old untamed captive brown mink (80 females and 80 males) in order to establish reference values for detection of illness in captive and wild mink. The mink were obtained from North Branch Fur Farm, North Branch, Minnesota (USA), and housed individually in wire cages at 23 ± 5 C and a humidity of 31 to 70% at the College of Veterinary Medicine animal facilities, University of Minnesota, St. Paul, Minnesota. A commercial ration (Hager Co., St. Paul, Minnesota, USA), formulated to meet or exceed the minimum nutrient requirements for mink, was fed ad libitum. The mink had been vaccinated at 8 wk of age against *Pseudomonas* spp. pneumonia, canine distemper, mink virus enteritis, and Type C botulism (Fort Dodge Labs Inc., Fort Dodge, Iowa, USA), and were treated with one oral dose of 200 μg ivermectin (Ivomec, MSD AG Vet, Rahway, New Jersey, USA).

After 3 wk, all mink were active and eating; no signs of illness were observed. All mink fasted for 12 hr before blood samples were drawn. The animals were anesthetized with a combination of 40 mg/kg ketamine (Ketaset, Fort Dodge Labs Inc., Fort Dodge, Iowa) and 1 mg/kg xylazine (Rompum, Mobay Corp., Shawee, Kansas, USA) administered intramuscularly approximately 10 min before venipuncture on 3 or 4 February 1992. The mink were positioned on their back and 6 ml of blood was obtained from a jugular vein using a 22 gauge needle and 12 ml syringe. Approximately 4 ml of blood was placed in a sterile evacuated tube containing no anticoagulant and 2 ml was placed in a sterile evacuated tube containing tripotassium ethylenediamine tetracetic acid (EDTA) as an anticoagulant. The blood collected for serum chemistry determinations was allowed to clot at 22 C and then centrifuged; the serum was transferred to clean tubes. The serum and whole blood was stored at 4 C and analyzed the same day. The analyses for serum urea nitrogen, sodium, potassium, chloride, total carbon dioxide, glucose, calcium, creatinine, and phosphorus and calculations of aniongap and osmolality were done with a selective-ion electrode analyzer (Astra-8, Beckman Instruments, Brea, California, USA)using the reagents and methodologies recommended by the manufacturer. The analyses for se-

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TABLE 1. Hematologic data for 160 healthy 12-mo-old captive brown mink (80 females and 80 males).

Parameter	Males (mean ± SD)	Females (mean ± SD)
Hematocrit (%)	45.9 ± 3.1	47.3 ± 3.0
Hemoglobin (g/dl)	15.6 ± 1.1	15.5 ± 0.9
Red blood cells ($10^6/\mu l$)	8.07 ± 0.67	7.74 ± 0.51
Mean cell volume (fl)	56.9 ± 1.9	61.2 ± 2.2
Mean cell hemoglobin concentration (%)	34.0 ± 0.52	32.7 ± 1.0
Total leukocytes ($10^3/\mu l$)	6.49 ± 2.02	5.28 ± 1.68
Segmented neutrophils ($10^3/\mu l$)	2.64 ± 1.27	2.32 ± 1.00
Band neutrophils ($10^3/\mu l$)	0.008 ± 0.020	0.003 ± 0.012
Lymphocytes ($10^3/\mu l$)	3.12 ± 1.05	2.37 ± 0.82
Monocytes ($10^3/\mu l$)	0.19 ± 0.13	0.18 ± 0.11
Eosinophils ($10^3/\mu l$)	0.47 ± 0.44	0.38 ± 0.47
Basophils ($10^3/\mu l$)	0.05 ± 0.54	0.03 ± 0.031
Platelets ($10^3/\mu l$)	729.58 ± 125.40	840.70 ± 259.36
Reticulocytes (%)	2.1 ± 0.9	1.67 ± 0.74
Heinz bodies (%)	0.0 ± 0	0.01 ± 0.02

rum cholinesterase, albumin, alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were determined using an automated chemistry analyzer (CX4, Beckman Instruments, Brea, California).

Hematologic tests included hematocrit, hemoglobin, red blood cell (RBC) count, RBC indices, total leukocyte count, leukocyte differential cell count, platelet count, reticulocyte count, and Heinz body count. Red blood cell counts, total leukocyte and platelet counts, and RBC indices were determined using a semi-automated blood cell counter (Model S+IV, Coulter Electronics, Hialeah, Florida, USA) adjusted for evaluation of animal blood samples. Wedge-type blood smears were prepared and stained with Wright stain for determination of 200 cell differential leukocyte counts and leukocyte and RBC morphology. For reticulocyte counts, two drops of EDTA-anticoagulated blood was incubated with an equal volume of new methylene blue stain for 15 min and wedge-type blood smears were prepared. Heinz body slides were prepared by staining with brillant green stain (Schwab and Lewis, 1969). Reticulocytes and Heinz bodies were enumerated as the percent of 1,000 RBC counted.

The combination of ketamine and xylazine provided consistent short-term anesthesia. After intramuscular injection, mink became tractable within 5 to 10 min and could be placed in dorsal recumbency and bled without restraint. The mink began to recover 15 to 20 min after administration. No adverse effects of anesthesia were observed except for occasional vomiting during recovery. Six ml of blood could be drawn rapidly from male mink; however, some female mink had very small jugular veins and aspiration of 6 ml of blood required 2 to 3 min.

Data were analyzed by one way analysis of variance (Statview 512, Brainpower Inc., Calabasa, California). If the F-test was significant, the means of interest were compared using the Scheffe's F-test.

Results of hematologic tests generally were similar to previously published values except for hematocrit, hemoglobin concentration, RBC count and platelet count (Table 1). Hematocrit, hemoglobin concentration and RBC count in our study were 10 to 20% lower compared to other studies (Fletch and Karstad, 1972). This difference was likely due to the method of restraint used. Venipuncture without sedation may result in higher RBC param-

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TABLE 2. Serum chemistry data for 160 healthy 12-mo-old captive brown mink (80 males and 80 females).

Parameter	Males (mean ± SD)	Females (mean ± SD)
Plasma cholinesterase (μ/l)	1,268 ± 447	1,218 ± 461
Serum urea nitrogen (mg/dl)	15.2 ± 5.6	16.2 ± 6.7
Creatinine (mg/dl)	0.71 ± 0.08	0.63 ± 0.07
Glucose (mg/dl)	125.8 ± 18.7	123.9 ± 19.4
Total protein (g/dl)	5.94 ± 0.31	6.09 ± 0.31
Albumin (g/dl)	2.98 ± 0.14	3.00 ± 0.17
Alanine aminotransferase (μ/l)	71.6 ± 56.9	80.0 ± 68.7
Aspartate aminotransferase (μ/l)	67.0 ± 13.7	76.3 ± 37.4
Sodium (meq/l)	153.7 ± 1.3	153.4 ± 1.3
Chloride (meq/l)	114.5 ± 1.7	114.6 ± 1.6
Potassium (meq/l)	4.34 ± 0.23	4.51 ± 0.52
Total carbon dioxide (meq/l)	25.8 ± 1.7	24.5 ± 1.9
Total calcium (mg/dl)	9.54 ± 0.39	9.47 ± 0.39
Inorganic phosphorus (mg/dl)	5.29 ± 0.79	5.19 ± 1.07
Calculated anion gap (meq/l)	14.4 ± 1.1	15.7 ± 1.3
Calculated osmolality (m osm/l)	306.5 ± 3.3	305.7 ± 2.5

eters in many animal species due to splenic contraction (Schalm et al., 1975). For mink, the effect of splenic contraction on RBC parameters has not been determined. Alternatively, administration of sedatives, anesthetics, or tranquilizers to animals may reduce RBC numbers due to decreased blood pressure and splenic sequestration of RBC (Collette and Merriwether, 1965). Based on the magnitude of these differences, we believe that separate reference ranges should be used for hematocrit, hemoglobin, and RBC count for anesthetized and non-anesthesized mink. Platelet counts were quite variable in our study, especially in female mink. Our values were approximately three times greater than previously reported values (Kubin and Mason, 1967), but only four mink were included in their study. Reticulocytes contained large mats of reticulum (aggregate type). Heinz bodies were present in less than 1% of the RBC in all mink. When present they were large and singular.

Reports of serum chemistry data for mink are limited (Kubin and Mason, 1967). The values that we report for mink generally are similar to reference ranges reported for dogs and cats (Schalm et al., 1975). Our values for serum glucose were similar to those of others in which blood samples were collected under anesthesia (Kubin and Mason, 1967).

Statistically significant differences between male and female mink were not observed either for hematologic or chemistry data (Tables 1 and 2). This generally is consistent with other reports in which few sex differences were observed (Fletch and Karstad, 1972). We believe that a single reference range can be used for hematologic and serum chemistry data for both male and female mink.

These data provide reference values for healthy adult captive brown mink. These values were derived from an adequately large population to provide valid reference values. The standard deviations for all test results were smaller than in previous studies and individual values falling outside 2 SD of the mean were observed only for platelet count (n = 16), ALT (n = 4) and AST (n = 9). As such, they can be used for detection of changes associated with diseases or nutritional and management problems in ranch mink. These values may not be applicable to immature mink. Despite differences in nutrition, environment and

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activity level in wild mink, these data provide general guidelines for evaluation of wild mink.

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