# BLOOD CHARACTERISTICS OF WHITE-TAILED DEER FROM NORTHEASTERN KANSAS

Authors: Klinger, Scott R., Robel, Robert J., Brown, Bennett A., and Brent, Benny E.

Source: Journal of Wildlife Diseases, 22(3) : 385-388

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-22.3.385

*Journal of Wildlife Diseases*, 22(3), 1986, pp. 385–388


# BLOOD CHARACTERISTICS OF WHITE-TAILED DEER FROM NORTHEASTERN KANSAS

**Scott R. Klinger, Robert J. Robel, Bennett A. Brown,[1] and Benny E. Brent**
Division of Biology and Department of Animal Sciences and Industry (BEB),
Kansas State University, Manhattan, Kansas 66506, USA

ABSTRACT: Blood samples were collected from 118 white-tailed deer (*Odocoileus virginianus*) shot on the Fort Riley Military Installation in northeastern Kansas. Values for these deer for hematocrit, glucose, alkaline phosphatase, uric acid, total protein, albumin, and calcium were within the ranges reported in previous studies for undrugged white-tailed deer. Abnormally high concentrations of serum glutamic oxaloacetate transaminase (SGOT) and lactic dehydrogenase (LDH) were attributed to general trauma and tissue damage caused by shooting the deer. Fawns had higher concentrations of alkaline phosphatase than adults and had lower concentrations in winter than at other times of the year. Serum urea nitrogen (SUN) concentrations fluctuated seasonally. Elevated concentrations of SUN in adult males killed in December were attributed to an increased catabolism of muscle protein caused by low dietary intake and high energy requirements during the rut. Cholesterol concentrations varied seasonally without regard to age or sex.

## INTRODUCTION

Use of blood tests to assess nutritional status in populations of wild deer has received considerable attention. LeResche et al. (1974) and Seal (1977) concluded that the full potential of blood analyses has not been reached, and Seal et al. (1981) stressed the need to collect reference values from specific populations of deer. Blood characteristics of wild white-tailed deer have been reported for herds in Maryland (Wilber and Robinson, 1958), Texas (White and Cook, 1974; Blankenship and Varner, 1977), Michigan (Coblentz, 1975) and Minnesota (Seal and Erickson, 1969; Seal et al., 1978). The blood characteristics of wild white-tailed deer in Kansas have not been reported. The purpose of this study was to determine selected hematological and blood chemistry parameters of a wild white-tailed deer herd in Kansas.

## MATERIALS AND METHODS

Between February 1979 and December 1981, blood samples were obtained from white-tailed deer from the unfenced 40,874-ha Fort Riley Military Installation, on the western edge of the Flint Hills of northeastern Kansas. The area is mostly upland prairie or abandoned agricultural land (Klinger, 1983).

Deer were collected throughout the year by shooting in the head or neck. Within 10–30 min after death, whole blood was collected from the jugular vein of each deer into Vacutainers® and two micro-hematocrit capillary tubes. Blood samples were cooled and transported to a field laboratory. The 20-ml blood samples were allowed to clot at room temperature for 2–3 hr, then centrifuged at rcf 2,750 *g* for 15 min, after which the serum was extracted and frozen. Hematocrit was determined using a micro-hematocrit centrifuge at rcf 2,750 *g*. Samples from hunter-killed deer were collected also during the month of December in 1979, 1980, and 1981 by taking blood from the superior vena cava within 2 hr of death. Samples were treated similarly to those from deer collected throughout the year.

Within 4 wk after sample collection, sera were thawed and duplicate 2-ml subsamples were analyzed with a SMA-12 Technicon Analyzer® for glucose, lactic dehydrogenase (LDH), serum glutamate oxaloacetate transaminase (SGOT), alkaline phosphatase, uric acid, serum urea nitrogen (SUN), total protein, albumin, cholesterol, and calcium. Only sera with no visible hemolysis or lipemia were analyzed.

Deer were aged by tooth eruption, wear, and dental cementum layers; those <12 mo of age were classified as fawns and those >12 mo old as adults. Data from deer collected throughout

Received for publication 9 August 1985.
[1] Present address: Texas Heritage Program, General Land Office, Stephen F. Austin Building, Austin, Texas 78701, USA.

TABLE 1. Mean ± SD of some blood characteristics of white-tailed deer from Kansas.

| Characteristic | Seasonally collected[a] | Hunter-killed[b] | General reference range[c] |
|---|---|---|---|
| Hematocrit (%) | 45.9 ± 5.2 | 42.5 ± 7.5 | 39–58 |
| Glucose (mg/dl) | 200 ± 119 | 213 ± 200 | 60–320 |
| SGOT (IU/liter) | 254 ± 331 | 237 ± 211 | 40–150 |
| LDH (IU/liter) | 742 ± 548 | 674 ± 221 | 100–300 |
| Uric acid (mg/dl) | 0.6 ± 0.4 | 0.7 ± 0.4 | —[c] |
| Albumin (g/dl) | 3.0 ± 0.4 | 2.7 ± 0.4 | 2.5–4.2 |
| Total protein (g/dl) | 6.2 ± 0.7 | 5.4 ± 1.0 | 5.0–7.8 |
| Calcium (mg/dl) | 10.0 ± 1.3 | 9.5 ± 1.6 | 8.8–10.8 |

[a] Means of 43 deer killed from February through October 1979.
[b] Means of 75 deer killed in December 1979, 1980, and 1981.
[c] From Table 3.3 of Seal et al. (1981); no value given for uric acid.

the year were analyzed separately from data for hunter-killed deer. Data from deer collected throughout the year were stratified and analyzed by seasons, namely winter (2 Feb–23 Mar), spring (1 Apr–17 May), summer (24 Jun–15 Aug), and fall (17 Sept–22 Oct). Analysis of variance for unequal sample sizes was used to test for significant differences ($P < 0.05$) because of age and sex of hunter-killed animals, and age, sex, and season of collection of animals collected throughout the year. Product moment correlation coefficients were used to test the interrelationships between selected parameters.

## RESULTS AND DISCUSSION

Between February and October 1979, 54 deer were killed and useable blood samples were collected from 30 adult does and 13 fawns. Additionally, useable blood samples were obtained from 26 adult males, 28 adult females, and 21 fawns killed by hunters in December 1979–1981. Data from blood samples of the 75 hunter-killed deer that did not differ significantly with sex and age were pooled for analysis. Values for hematocrit, glucose, LDH, SGOT, albumin, total serum protein, uric acid, and calcium did not differ with age or season; therefore, those data were pooled. Blood characteristics of deer collected seasonally did not differ from those of hunter-killed deer (Table 1). The majority of deer killed by hunters was shot between 0800 and 1200 hours. The time-of-day at which the deer were killed and the time-lapse between death and sample collection were not correlated with any of the blood values measured. Except for LDH and SGOT, blood characteristics of deer from Kansas were within the ranges reported by Seal et al. (1981) for undrugged white-tailed deer. The high concentrations of LDH and SGOT in our deer were attributed to the general tissue trauma of shooting which could have elevated both values (Coles, 1967).

Serum cholesterol from our deer was highly variable and did not vary significantly with age, but varied significantly with season (Fig. 1). Mean concentrations were lowest in winter (68 mg/dl) and highest in fall (96 mg/dl). Coblentz (1975) found decreasing serum cholesterol concentrations in white-tailed deer from Michigan from October through January and believed that the change reflected quantity and quality of forage consumed. Warren et al. (1981) also observed a seasonal change in cholesterol concentrations similar to that reported by Coblentz (1975), but found no differences in serum cholesterol concentrations between deer fed ad libitum and deer on restricted intake. Vogelsang (1977) reported a relationship between reproductive condition and seasonal changes in cholesterol concentrations. Conceivably, seasonal cholesterol changes could be due to dietary or metabolic variation, or a combination of both.

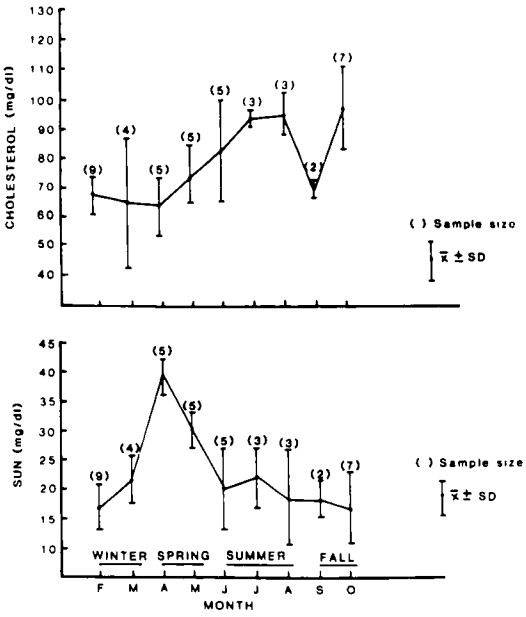


FIGURE 1. Seasonal variation in cholesterol and serum urea nitrogen (SUN) of white-tailed deer from Kansas.

SUN was unaffected by age, but varied seasonally (Fig. 1). Mean values ranged from 13 mg/dl in winter to 38 mg/dl in spring. Crude protein concentrations in rumen contents of the same deer in Kansas increased from late winter through spring, then declined (Klinger, 1983). Therefore, SUN may have reflected the crude protein concentrations of the rumen contents.

The mean (±SD) SUN concentration in adult male deer collected in December (26 ± 8 mg/dl, $n = 26$) was significantly higher than those of adult females (19 ± 6 mg/dl, $n = 28$) and fawns (17 ± 6 mg/dl, $n = 21$). Adult males commonly are in negative energy balance in December because of reduced food intake and the high energy demands of the rut (Long et al., 1965; Mautz, 1978). The resulting catabolism of muscle protein may have elevated SUN through endogenous sources of urea.

Mean alkaline phosphatase activity in December-collected fawns (415 ± 208 IU/liter, $n = 21$) was significantly higher than those of adult males (231 ± 171 IU/liter, $n = 26$) and adult females (221 ± 168 IU/liter, $n = 28$). These findings are consistent with generally higher concentrations of alkaline phosphatase in young animals (e.g., Seal et al., 1978). The mean alkaline phosphatase activity in adult females (222 ± 62 IU/liter, $n = 7$) was significantly higher during spring than the 129 ± 44 IU/liter of 23 adult females collected during summer–winter. The mean alkaline phosphatase activity in 11 fawns collected during spring–fall was 656 ± 62 IU/liter, significantly higher than the 206 ± 33 IU/liter of two fawns collected during winter.

## ACKNOWLEDGMENTS

We thank personnel of the Veterinary Activity, Fort Riley, especially S. Cirone and R. Hunt for providing supplies and coordinating analysis of blood samples. R. Adams, Department of Pathology, Irwin Army Hospital, assisted in interpreting results and L. A. Lorence assisted in collecting deer. K. Sexson, Kansas Fish and Game Commission, coordinated aging of all deer. This study was supported by the Division of Biology, Kansas Agricultural Experiment Station (Contribution No. 86-38-J), Kansas State University, the Kansas Fish and Game Commission, and the Department of the Army.

## LITERATURE CITED

BLANKENSHIP, L. H., AND L. W. VARNER. 1977. Factors affecting hematological values of white-tailed deer in south Texas. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 31: 107–115.

COBLENTZ, B. E. 1975. Serum cholesterol level changes in George Reserve deer. J. Wildl. Manage. 39: 342–345.

COLES, E. H. 1967. Veterinary Clinical Pathology. W. B. Saunders Company, London, England, 455 pp.

KLINGER, S. R. 1983. Morphological, physiological and nutritional status of the Fort Riley, Kansas, deer herd. M.S. Thesis. Kansas State Univ., Manhattan, Kansas, 127 pp.

LERESCHE, R. E., U. S. SEAL, P. D. KARNS, AND A. W. FRANZMANN. 1974. A review of blood chemistry of moose and other cervidae with emphasis on nutritional assessment. Nat. Can. (Que.) 101: 263–290.

LONG, T. A., R. L. COWAN, G. D. STRAWN, R. S. WETZEL, AND R. C. MILLER. 1965. Seasonal fluctuations in feed consumption of the white-tailed deer. Pa. Agric. Exp. Sta. Prog. Rep. 262, 5 pp.

MAUTZ, W. W. 1978. Sledding on a bushy hillside: The fat cycle in deer. Wildl. Soc. Bull. 6: 88–90.

SEAL, U. S. 1977. Assessment of habitat condition by measurement of biochemical and endocrine indicators of the nutritional, reproductive and disease status of free-ranging animal populations. *In* Proc. Nat. Symp. Classification Inventory Analysis Fish Wildl. Habitat. U.S. Fish and Wildl. Serv. Office Biol. Serv. Pub. 78/76, pp. 305–329.

———, AND A. W. ERICKSON. 1969. Hematology, blood chemistry and protein polymorphism in the white-tailed deer (*Odocoileus virginianus*). Comp. Biochem. Physiol. 30: 695–713.

———, M. E. NELSON, L. D. MECH, AND R. L. HOSKINSON. 1978. Metabolic indicators of habitat differences in four Minnesota deer populations. J. Wildl. Manage. 42: 746–754.

———, L. J. VERME, AND J. J. OZOGA. 1981. Physiological values. *In* Diseases and Parasites of White-tailed Deer, W. R. Davidson et al. (eds.). Tall Timbers Res. Sta. Misc. Pub. No. 7, Tallahassee, Florida, pp. 17–34.

VOGELSANG, R. W. 1977. The effect of energy intake and reproductive state on blood urea nitrogen, cholesterol, and progestin levels in captive and free-ranging, white-tailed deer. M.S. Thesis. Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia, 100 pp.

WARREN, R. J., R. L. KIRKPATRICK, A. OELSHLAEGER, P. F. SCANLON, AND F. C. GWAZDAUSKAS. 1981. Dietary and seasonal influences on nutritional indices of adult male white-tailed deer. J. Wildl. Manage. 45: 926–936.

WHITE, M., AND R. S. COOK. 1974. Blood characteristics of free-ranging, white-tailed deer in southern Texas. J. Wildl. Dis. 10: 18–24.

WILBER, C. G., AND P. F. ROBINSON. 1958. Aspects of blood chemistry in white-tailed deer. J. Mammal. 39: 309–311.