

RESEARCH NOTE

HEMATOLOGY AND DETECTION OF HEMOPARASITES IN THE AMERICAN KESTREL (*FALCO SPARVERIUS*) DURING SUMMER NESTING PERIOD¹

SEAN A. CASTELLUCCI, SCOTT B. OPLINGER and JAMES R. KLUCSARITS¹

Department of Biology
Alvernia College
Reading, PA 19607 - 1799

ABSTRACT

A series of hematological tests including packed cell volume, total solids, white blood cell count (differential and absolute) and detection of hemoparasites were performed on the American kestrel (*Falco sparverius*) in east-central Pennsylvania. The packed cell volume ($55.5 \pm 5.35\%$), total solids (4.68 ± 0.81 g/dl) and white blood cell count (17133 ± 10737 cells/ μ l) are within ranges reported previously for other raptors. Hemoparasites were detected in eleven out of 14 American kestrels sampled during the 1996 summer nesting season. The results contribute to the growing database on the hematology of birds of prey. [J PA Acad Sci 72 (1) 29-31, 1998]

INTRODUCTION

Avian hematology has attracted considerable study and interest (Balasch et al. 1976, Hunter and Powers 1980, Sturkie 1986, Powers et al. 1994), yet sparse hematological data are available for birds of prey (Bond and Gilbert 1958, Cooper 1975, Balasch et al. 1976, Hunter and Powers 1980). Most studies of wild raptor hematology have been done under captive situations or involved raptors in the process of recovery (Snyder et al.

1980, Gee et al. 1981). Other studies (Hunter and Powers 1980, Gessaman 1986) have reported values on the hematology of free-ranging raptors, which may differ from the values of captive raptors. The purpose of this study was to establish baseline information on the American kestrel (*Falco sparverius*) with respect to hematological data.

METHODS AND MATERIALS

The study area consists of approximately 625 km² of partly wooded farmland in east-central Pennsylvania, northern Berks County. Kestrels were captured for banding and sampling purposes either directly from the nestboxes, or via a bal-chatri (Berger and Mueller 1959). Birds were trapped from 30 May to 5 July 1996 between the hours of 0500 and 0915-H. The birds were weighed to the nearest gram and both wing chord and tail length were measured in millimeters.

Birds were hooded, placed on their backs, and feathers were displaced from the ventral portion of the elbow exposing the medial (brachial) vein where it crosses over the proximal aspect of the radius and ulna (Smith and Bush, 1978). An average of 0.2 ml (200 μ l) of blood was collected. A drop of whole blood was smeared onto a slide for evaluation of differential white blood cell count and detection of hemoparasites. The method used was the "coverslip and slide technique" to decrease cellular damage to the avial blood (Dein 1984). A second sample was collected in a microhematocrit tube (Chase Industry, Lindenhurst, NY 11757, approximately 70 μ l (0.07 ml), and spun at 10,000 RPM for 5 minutes in a hematocrit centrifuge.

Blood smears were stained using Wright's stain at a dilution factor of 0.108 g in 50 ml of absolute methanol. Smears were coated with Wright's stain and left to stand for four minutes before an equal amount of buffer was

¹Received for publication 18 October 1997; accepted 3 February 1998.

added. This 1:1 solution was left in contact with the smear for an additional seven minutes (Dein 1984). A differential count was performed counting 100 leukocytes, as suggested by Dein (1984), and calculating the percentage of each individual type. Two veterinary lab technicians (Omega Medical Laboratories, 2001 Statehill Road, Wyomissing, PA 19610) performed the differential count using the same method of counting 100 leukocytes, which is their standard. They also performed an estimated white blood cell count. Absolute white cell counts for each type of leukocyte were calculated by multiplying total white blood cell count by the percentage of each cell type in the differential count. Male and female data have been reported separately for the purpose of this study.

RESULTS AND DISCUSSION

The results for packed-cell volume (%), total solids (g/dl), white blood cell count (cells/ μ l), relative differential white blood cell count (% cell type) and absolute differential count (cells/ μ l) are presented in Table 1.

The PCV calculations were found to be slightly different from those previously reported by Hunter and Powers (1980) on the American kestrel. According to Sturkie (1975) hematocrit values can fluctuate consequent to the season. The overall mean hematocrit value (PCV) of $55.5 \pm 5.35\%$ falls within the range previously cited for free roaming female American kestrels. The values found for PCV also fit the ranges reported in studies involving other raptors (Gessaman et al. 1986, Smith and Bush 1978, Cooper 1975, Powers et al. 1994).

The mean total solids value of 4.68 ± 0.81 g/dl was slightly higher than those values reported for other falconiforms (Balasch et al. 1976, Gee et al. 1981) but within the range given by Elliott et al. (1974). Our data supports

Lumeij and de Bruijne's (1985) statement that measurements using the refractometric method are significantly higher than those values obtained by the Biuret method. Smith and Bush (1978) reported that low total solids values are usually indicative of poor nutrition in raptors.

The mean value reported for WBC's, 17331.33 ± 10737.3 cells/ μ l (Table 1), and the relative differential counts are within ranges found for other falconiforms (Christoph and Borowski 1961, Elliott et al. 1974, Smith and Bush 1978, Powers et al. 1994). White blood cell counts may vary due to stress which is induced through the capture and handling of the bird in the wild (Powers et al. 1994). Other studies have shown significant differences in white blood cell counts between free-roaming raptors and those that are in captivity (Snyder et al. 1980).

Prevalence (% affected) of the blood parasites *Haemoproteus* and *Plasmodium* detected from the blood smears are reported in Table 2. *Haemoproteus* was found to be the most abundant parasite, affecting nine of 12 (75%) females sampled. Apanius (1991) reported a *Haemoproteus* infection of eighty-five percent among one hundred American kestrels sampled. *Plasmodium* was observed in one out of 12 (8.33%) females sampled. This percentile is lower than that previously reported by Forrester et al. (1994) for other falconiforms. *Leucocytozoon*, another blood borne parasite, may not have been recognizable due to the fact that it is sometimes masked by the presence of the precipitate in Wright's stain (Dein 1984).

TABLE 2. Hemoparasitic detection in the adult American kestrel in east-central Pennsylvania.

Hemoparasite	adult female (N=12)	adult male (N=2)
<i>Haemoproteus</i>	9 (75%)	2 (100%)
<i>Plasmodium</i>	1 (8.33%)	0.00%

TABLE 1. Hematology of american kestrel.

	PCV (%)	TS (g/dl)	WBC (cells/ μ l)	HET ^a	Relative Differential WBC Count (%)				Absolute Differential WBC Count (cells/ μ l)				
					Eo ^b	BASO ^c	LYMPH ^d	MONO ^e	HET	EO	BASO	LYMPH	MONO
Female													
N	12	12	12	12	12	12	12	12	12	12	12	12	12
Mean	55.5	4.68	17133.33	39	8.58	3.83	45.33	2.75	7127.33	1504.17	659.83	7298.5	410.17
SD	± 5.35	0.81	10737.30	9.42	3.32	1.34	9.35	1.71	5389.64	1101.15	446.13	4059.99	251.65
Range	44-62	3.4-5.9	7000-42000	25-54	4-15	2-7	26-61	1-6	2300-18900	460-3780	140-1680	3520-16800	70-900
Male													
N	2	2	2	2	2	2	2	2	2	2	2	2	2
Mean	47	3.7	10900	40.5	12	7	35	5.5	4443	1403	820	3644	590
SD	± 4.24	0.42	2687.01	2.12	7.07	4.24	12.73	0.71	1319.46	1093.19	650.54	446.89	70.71
Range	44-50	3.4-4	9000-12800	39-42	7-17	4-10	26-44	5-6	3510-5376	630-2176	360-1280	3328-3960	540-560

^a Heterophils

^b Eosinophils

^c Basophils

^d Lymphocytes

^e Monocytes

ACKNOWLEDGMENTS

The authors wish to thank Keith Bildstein and the staff of Hawk Mountain Sanctuary; Bob and Sue Robertson; Dr. Godon and the staff of Antietam Animal Hospital; Kim Rio V.M.D.; Matt Volz; the science department of Alvernia College and our families for their support. This is Hawk Mountain contribution #66.

LITERATURE CITED

- Apanius, V. 1989. Reproductive success of American kestrels (*Falco sparverius*) utilizing nest boxes in Eastern Pennsylvania. Unpublished Ph.D. dissertation, the University of Pennsylvania, Philadelphia, Pennsylvania.
- Balasch, J., S. Musquera, L. Palacios, M. Jimenez and J. Palomeque. 1976. Comparative hematology of some falconiforms. *Condor* 78:258-259.
- Berger, D.D. and H.C. Mueller. 1959. The Bal-Chatri: a trap for the birds of prey. *Bird Banding* 30:18-26.
- Bond, C.F. and P.W. Gilbert. 1958. Comparative study of blood volume in representative aquatic and non-aquatic birds. *Am. J. Physiol.* 194: 519-521.
- Christoph, H.J. and G. Borowski. 1961. Beitrage zur Hamatologie der Zootiere. IV. Das Blutbild von Greifvogeln (Accipitres) unter besonderer Berucksichtigung einger in Deutschland noch heimischer kleinerer Arten. *Kleintier-Praxis* 6:71-76.
- Cooper, J.E. 1975. Haematological investigations in East African birds of prey. *J. Wildl. Dis.* 11:389-394.
- Dein, F.J. 1984. Laboratory manual of avian hematology. Association of Avian Veterinarians, Boca Raton, FL U.S.A.
- Elliott, R.H., E.E. Smith and M. Bush. 1974. Preliminary report on hematology of birds of prey. *J.Zoo.Anim. Med.* 5:11-16.
- Forrester, D.J., S.R. Telford Jr. and G.W. Foster. 1994. Blood parasites of raptors in Florida. *Raptor Res.* 28(4):226-231.
- Gee, G.F., J.W. Carpenter and G.L. Hensler. 1981. Species differences in hematological values of captive cranes, geese, raptors, and quail. *J. Wildl. Manage.* 45:463-483.
- Gessaman, J.A., J.A. Johnson and S.W. Hoffman. 1986. Hematocrits and erythrocyte numbers for Cooper's and sharp-shinned hawks. *Condor* 88:95-96.
- Hunter, S.R. and L.R. Powers. 1980. Raptor hematocrit values. *Condor* 82:226-227.
- Lumeij, J.T. and J.J. de Bruijne. 1985. Evaluation of the refractometric method for the determination of total protein in avian plasma or serum. *Avian Path.* 14:441-444.
- Powers, L.V., M. Pokas, K. Rio, C. Viverett and L. Goodrich. 1994. Hematology and occurrence of hemoparasites in migrating sharp-shinned hawks (*Accipiter striatus*) during fall migration. *J. Raptor Res.* 28(3): 178-185.
- Smith, E.E. and M. Bush. 1978. Haematologic parameters on various species of Strigiformes and Falconiforms. *J. Wildl. Dis.* 14:447-450.
- Snyder, J.E., D.M. Bird and P.C. Lague. 1980. Variations in selected parameters in the blood of captive American kestrels. Pages 113-115 in J.E. Cooper and A.G. Greenwood [Eds.], Recent advances in the study of raptor diseases. Chiron Publications Ltd., West Yorkshire, U.K.
- Sturkie, P.D. 1975. Avian physiology. 3rd ed. Cornell Univ. Press, Ithaca, NY.
- Sturkie, P.D. 1986. Avian physiology. 5th ed. Springer-Verlag, NY, NY, U.S.A.