Differential Leucocyte Cell Counts from the Pygoscelid Penguins of Antarctica

Authors: Zinsmeister, V. A. P., and VanDerHeyden, M. J. N.

Source: Journal of Wildlife Diseases, 23(3) : 521-523

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-23.3.521

Journal of Wildlife Diseases, 23(3), 1987, pp. 521–523

Differential Leucocyte Cell Counts from the Pygoscelid Penguins of Antarctica

V. A. P. Zinsmeister and M. J. N. VanDerHeyden, Department of Anatomy, School of Veterinary Medicine, Purdue University, West Lafayette, Indiana 47907, USA

ABSTRACT: Differential leucocyte counts were obtained for three cogeneric species of wild antarctic penguins, *Pygoscelis adelie* (adelie), *Pygoscelis papua* (gentoo), and *Pygoscelis antarctica* (chinstrap). Significant differences between the differential leucocyte counts of the three species were not observed.

Key words: Antarctica, Pygoscselid penguins, differential leucocyte counts, *Pygoscelis adelie, Pygoscelis papua, Pygoscelis antarctica.*

Hematologic data on wild cogeneric species of penguins are limited to erythrocytic parameters in the adelie, gentoo, and chinstrap penguins of Antarctica (Block and Murrish, 1974; Guard and Murrish, 1975; Myrcha and Kostelecka-Myrcha, 1979, 1980; Kostelecka-Myrcha and Myrcha, 1980; Murrish, 1982). In addition, data from limited numbers of captive penguins are reported (Schmitt and Righton, 1962; Stoskopf et al., 1980; Hawkey et al., 1985).

In 1983, one of us (VAPZ) was invited to accompany scientists from the Instituto Antartico Chileano as part of a research expedition to Ardley Island South Shetlands, Antarctica (62°13′S, 58°55′W). From 9 October to 15 November 1983, blood and tissue samples were obtained from wild adult pygoscelid penguins for morphologic and histochemical analysis (Zinsmeister et al., 1984; Zinsmeister and Valencia, 1985). Anticoagulated blood (sodium EDTA) was collected from four female and one male adelie, five female and one male gentoo and one female and one male chinstrap penguins via cardiac puncture during halothane anesthesia. Sex, maturity and health status were determined post mortem. Blood films were prepared immediately, air dried, and stored unfixed prior to transport to the United States and subsequently stained with Wright's blood stain. A 200 cell differential count was performed by the cross-section method on each of two blood smears from each penguin. The two values were averaged to determine the final count. The percentage of polychromatophils was determined by evaluating 1,000 red blood cells under oil immersion. Approximately 200 fields (estimated 50,000 red blood cells) were observed for hemoparasites.

Data from one female adelie penguin were discarded due to elevated percentages of monocytes and band heterophils suggesting the bird was ill. Data from the four adelies and six gentoos were compared for significant differences with the Student's *t*-test.

Comparisons of the differential counts, and percentages of polychromatophils of the three species of *Pygoscelis* are given in Table 1. No significant differences, due to sex or species were noted for the values, except those for monocytes. Hemoparasites were not observed in any of the blood films.

The leucocytic values for the genus *Pygoscelis* were similar to those obtained from other captive species of penguins cited previously. In general, the heterophils in penguins are the most numerous white cells in the normal peripheral circulation and this finding contrasts sharply with many other birds, where the lymphocytes are most frequently observed (Maxwell, 1978a, 1978b; Stoskopf et al., 1983). Elevated numbers of avian heterophils are reported

TABLE 1. Mean values and ranges for six hematological parameters determined for 12 wild pygoscselid penguins from Antarctica.

	Adelie	Gentoo	Chinstrap
Number of birds examined	4	6	2
Differential WBC			
Heterophil %	65.3 38.5–86.0	55.3 40.8–69.8	61.6 56.0–67.3
Lymphocyte %	23.9 7.8–51.8	37.1 26.0–45.0	35.8 27.8–43.8
Eosinophil %	4.5 1.8–7.5	4.0 2.5–7.0	0
Monocyte %	3.9* 2.5–5.5	2.3* 1.0–3.3	2.4 0–4.8
Basophil %	2.5 0.8–6.0	0.9 0.3–1.0	0.3 0–0.5
Polychromatophil %	1.3 1.0–2.0	0.9 1.0–2.0	1.5 1.0–2.0

* Significantly different at $P < 0.05$.

as a result of stress, bacterial infections and inflammatory reactions (Burton and Guion, 1968; Assoku et al., 1970; Hawkey et al., 1985).

Eosinophils are the second most prevalent granulocyte in penguins (Stoskopf et al., 1983). Lower numbers of eosinophils were observed in blood films from the chinstrap penguins versus the adelies and gentoos. Avian eosinophilia is associated often with hypersensitivity reactions and hemoparasitism (Olson, 1959; Moriya and Ichikawa, 1982; Maxwell, 1984).

The percentage of basophils was higher than those reported for captive gentoo penguins (Hawkey et al., 1985). In general, avian basophils are the least common granulocyte in the peripheral circulation and usually account for 1% of the total white blood cell count. Our findings may reflect a physiologic or pathologic difference between captive versus wild penguins or they may result from failure of other investigators to recognize basophils as they tend to degranulate readily in aqueous solutions.

Lymphocyte numbers may decrease seasonally or with chronic stress and cortisol/ACTH administration (Siegel, 1980; Stoskopf et al., 1983; Wingfield et al., 1984). Lymphocyte values were similar to those published previously (Hawkey et al., 1985).

Monocytes were more numerous in the adelies than the gentoos. Monocytosis has been associated with chronic and tissue destructive diseases (Woerpel and Rosskopf, 1984).

The number of polychromatophils in the circulation is related to the rate of erythropoiesis. In general, 1–2% of avian erythrocytes are polychromatophilic and their increased numbers are often associated with inflammation and hemorrhage (Campbell and Dein, 1984). Although thrombocytes were observed in all blood smears, their numbers were not evaluated.

LITERATURE CITED

ASSOKU, R. K. G., W. J. PENHALE, AND A. BOXTON. 1970. Haematological changes in acute experimental *Salmonella gallinarum* infection in chickens. Journal of Comparative Pathology 80: 473–485.

BLOCK, G. A., AND D. E. MURRISH. 1974. Viscous properties of bird blood at low temperature. Antarctic Journal of the United States 9: 98–99.

BURTON, R., AND C. W. GUION. 1968. The differential leukocyte blood count: Its precision and individuality in the chicken. Poultry Science 47: 1945–1949.

CAMPBELL, T. W., AND J. DEIN. 1984. Avian hematology. Veterinary Clinics of North America 14: 223–249.

GUARD, C. L., AND D. E. MURRISH. 1975. Effects of temperature on the viscous behavior of blood from Antarctic birds and mammals. Comparative Biochemistry and Physiology 52A: 287–290.

HAWKEY, C. M., H. J. HENDERSON, AND M. G. HART. 1985. Haematological findings in captive gentoo penguins (*Pygoscelis papua*) with bumblefoot. Avian Pathology 14: 251–256.

KOSTELECKA-MYRCHA, A., AND A. MYRCHA. 1980. Hematological studies of Antarctic birds II. Changes of the hematological indices during the development of the Pygoscelid penguins. Polish Polar Research 1: 175–181.

MAXWELL, M. H. 1978a. The fine structure of granules in eosinophil leucocytes from aquatic and terrestrial birds. Tissue and Cell 10: 303–317.

———. 1978b. Electron cytochemistry of developing and mature eosinophils in the bone marrow

of the fowl and the duck. Histochemical Journal 10: 63–77.

———. 1984. Histochemical identification of tissue eosinophils in the inflammatory response of the fowl (*Gallus domesticus*). Research in Veterinary Science 37: 7–11.

MORIYA, O., AND K. ICHIKAWA. 1982. Isolation of chicken eosinophils and their migration response in chicken embryos. Developmental and Comparative Immunology 6: 717–726.

MURRISH, D. E. 1982. Acid-base balance in three species of Antarctic penguins exposed to thermal stress. Physiological Zoology 55: 137–143.

MYRCHA, A., AND A. KOSTELECKA-MYRCHA. 1979. Blood picture in some species of Antarctic birds. Bulletin de l'Academic Polonaise des Sciences Serie des Sciences Biologiques 27: 911–915.

———, AND ———. 1980. Hematological studies on Antarctic birds I. Hematological indices in some species of birds studied during the austral summer. Polish Polar Research 1: 169–173.

OLSON, C., JR. 1959. Avian hematology. *In* Diseases of poultry, 4th Ed., H. E. Biester and L. H. Schwarte (ed.). Iowa State University Press, Ames, Iowa, pp. 53–69.

SCHMITT, VON J., AND M. RIGHTON. 1962. Hamatologische befunde bei pinguinen. Nordisk Veterinaermedicin 14: 305–313.

SIEGEL, H. S. 1980. Physiologic stress in birds. Bioscience 30: 529–534.

STOSKOFF, M. E., E. NEELY, AND B. MANGOLD. 1983. Avian hematology in clinical practice. Modern Veterinary Practice 64: 713–717.

———, B. A. YARBROUGH, AND F. B. BEALL. 1980. Baseline hematology of the African blackfooted penguin. *In* Proceedings, 1st International Symposium Comparative Pathology, Smithsonian Press, Washington, D.C., pp. 647–652.

WINGFIELD, G. C., G. P. SMITH, AND D. S. FARMER. 1984. Endocrine responses of white-crowned sparrows to environmental stress. Condor 84: 399–409.

WOERPEL, R. W. AND W. J. ROSSKOPF. 1984. Clinical experiences with avian laboratory diagnostics. Veterinary Clinics in North America 14: 249–286.

ZINSMEISTER, V. A. P., AND J. VALENCIA. 1985. Ultrastructural histochemical demonstration of concanavalin A binding sites on adelie penguin blood cells. Antarctic Journal of the United States 19: 169–170.

———, ———, AND J. GOLOWASCH. 1984. Procedures and methodologies for obtaining tissue samples from the pygoscelid penguins of Antarctica. Antarctic Journal of the United States 19: 155–158.

Received for publication 7 April 1986.