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ERYTHROGRAM VARIATIONS BETWEEN NORMAL AND PARASITIZED MATURE AND IMMATURE PARTRIDGES, PHEASANTS AND HARES

The present communication deals with changes in the erythrogram of certain species of game, Bohemian partridge (*Perdix perdix* L.), ring-necked pheasant (*Phasianus colchicus colchicus* L.), European hare (*Lepus europaeus* Pall.) and red deer (*Cervus elaphus* L). The changes are compared with erythrograms of control animals or healthy animals of the same age.

Standard hematological methods were used. Hemoglobin was determined colorimetrically as acid hematin, packed cell volume by microhematocrit; blood cells of birds were counted optically in Show solution, mammalian blood cells in Türk and Hayem solution. May Grünwald-Giemsa stain was used for staining of blood films.

Erythrogram of immature partridges, pheasants and hares:

It is evident from Table 1 and 2 that newly-hatched partridges and pheasants exhibit low erythrocyte (RBC) counts, low hemoglobin (Hb) levels, and low packed cell volumes (PCV) as compared with adult birds. The count of polychromatophil red cells and normoblasts, as a rule, are higher in younger birds. The erythrocyte volume decreases in the partridge from the end of the first week, and in the pheasant from the fourth week of age; in both species the mean corpuscular hemoglobin (MCH) decreases with age; the mean corpuscular hemoglobin concentration (MCHC) continually increases in the partridge, and levels off at the age of 12 weeks in the pheasant. (Hanusova 1968: Thesis for Ph.D. Biol. Faculty of Charles University Prague; Pujman 1949: Lesnická práce 2, 138-142; Pujman 1960: Folia Hematol. 77, 2, 196-203; Pujman 1966: Symposium on partridge, 114-117, VULHM a CSMS; Pujman and Hanusova 1967: For Socialist - Agricultural Science XVI, 377-390).

At the beginning of November hares younger than 1 year have lower red cell counts (7.0×10^6) and Hb levels (13.5 g/100 ml) than older hares (RBC 7.7×10^6., Hb 13.7 g/100 ml) in blood freshly taken after shooting. The following indices exhibit only slight differences in younger and older hares: PCV 46 and 48%; MCH 19 and 18 $\mu\mu$g MCHC 30 and 28, 6% respectively (Pujman and Hanusova 1967: For Socialist Agricultural Science XVI, 377-390).

TABLE 1. *Age variations in the red blood cell count in partridges.*

Age	RBC $X10^6$	RBC-P[1] $X10^3$	RBC-nb[2] $X10^3$	Hb g%	MCH /μ/μg	PCV %	MCHC %	(Volume) MCV c/μ
1 week	1.8	250	14	7.4	41	27.7	26.4	155
4 weeks	2.3	220	3	8.3	35	34	24.5	144
12 weeks	2.9	200	singly	10.0	34	34	29.5	117
mature	3.3	200	singly	11.8	33	—	—	—

[1] RB-P number of polychromatophilic corpuscles

[2] RBC-nb number of normoblasts

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TABLE 2. *Age variations in the red blood cell count in pheasants.*

Age	RBC X10⁶	RBC-P[1] X10³	RBC-nb[2] X10³	Hb g%	MCH /μ/μg	PCV %	MCHC %	(Volume) MCV c/μ
1 week	2.2	323	22	8.0	36	28	28.1	127
4 weeks	2.7	200	2.1	9.8	36	37	25.1	150
12 weeks	3.3	117	singly	10.6	32	35	31.5	104
mature	3.6	—	singly	11.2	31	42	27.0	112

[1] RB-P number of polychromatophilic corpuscles
[2] RBC-nb number of normoblasts

Parasite-induced anemias:

In adult partridges, with blood cells parasitized by blood sporozoa, there is only slight anemia, manifested (Table 3) by an indistinct decrease of the Hb value and RBC. More severe anemic changes are elicited, however, by the threadworm *Syngamus trachealis,* both in partridges and in pheasants. In a developed syngamosis in the partridge, the polychromatophil cell count is slightly decreased; in the pheasant this count is indistinctly increased but normoblasts are found in the blood. In syngamatic pheasants the PCV is normal, probably because the volume of the RBC is increased. The MCHC is slightly lowered. Some of these changes resemble the erythrogram of young pheasants up to one month old. A 0.1% addition of thiabendazole to pheasant feed manifests itself in a normalisation of the erythrogram. The elevated normoblast and polychromatophil cell counts, in treated pheasants, suggests enhanced hematopoiesis (Páv and Pujman 1966: Symposium on partridge, 118-129, VULHM CSMS; Pujman and Hanusová 1967: For Socialist Agricultural Science XVI, 377-390).

TABLE 3. *Comparison of the blood of healthy, malaric and syngamotic partridges (average values).*

Index	Healthy	Malaric	Syngamotic
RBC X10⁶	2.81	2.53	2.11
Hb g%	11.3	11.1	9.5

TABLE 4. *Comparison of the red blood cell counts of healthy, twelve weeks old pheasants and of syngamotic sixteen weeks old pheasants.*

Age	RBC X10⁶	RBC-P[1] X10³	RBC-nb[2] X10³	Hb g%	PCV %	MCH /μ/μg	MCHC %	(Volume) MCV c/μ
Healthy	3.3	117	singly	10.6	33.5	32	31.5	104
Syngamot.	1.76	126	6	9.8	34.5	57	29.0	200
Treated	3.1	289	41	11.8	40.0	37	30.0	127

[1] RBC-P number of polychromatophilic corpuscles
[2] RBC-nb number of normoblasts

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Pesticide-induced anemias:

DDT administered to adult pheasants in 0.1 mg/kg oral doses once in fourteen days (Table 5), amounting to a total dose of 0.7 mg/kg, elicits a decrease of RBC to $2.2x10^6$, and of the Hb level to 10.6 g/100 ml. Control animals had $2.7x10^6$ RBC and 11.3 g/100 ml (Pujman and Hanusová 1967: For Socialist Agricultural Science XVI, 377-390.

In December hares, of both sexes and all ages shot in localities treated with Endrin, had a decrease of the mean Hb level to 14.5 g/100 ml, and of the PCV to 46.8%; the MCHC was 30.6. The decrease of the Hb level and the PCV, observed in hares from the Endrin-treated environment is statistically significant ($P < 0.05$). Control December hares had the following values: 15.1 g/100 ml Hb; 49.7% PCV; 30.5% MCHC.

Young hares shot in localities contaminated by dust fall - out, or industrial gaseous exhalations, or both, had MCHC values below 30%, while control hares had a MCHC of 32.3%. The difference is statistically significant (Nováková and Pujman 1965: VIII, e Congres de biologistes du gibier 293-296; Nováková E. 1968: Jour. Forest. Suisse 31-34).

TABLE 5. a. / *The effect of 0.7 mg/kg of DDT on the mean Hb and RBC count in the pheasant.*

	Hb g%	RBC $X10^6$
Control	11.3	2.7
DDT	10.6	2.2

b. / *The mean values of the erythrogram of hares exposed to Endrin.*[1]

	Hb g%	PCV %	MCHC %
Control	15.1	49.7	30.5
Endrin	14.5	46.8	30.6

[1] Field examinations E. Nováková 1968.

Tranquillizer-induced anemic changes:

Chlorprothixene (trans-2-chlor-9-/3 dimethylamino - propyliden / thioxanthen - hydrochloride) intramuscularly injected in a 3 mg/kg dose elicits in deer a rapid and steep decerase of the RBC, PCV and Hb levels (Table 6). This decrease becomes apparent as early as 30 minutes after the injection of chlorprothixene, attaining a minimum after 60 minutes. After 180 minutes the erythrograms of experimental deer resemble that of the control animals, sampled at the same time intervals (Hanusová and Pujman 1968: Biologisace a chemisace, 3, 271-274).

Single injections of 10 mg/kg or 100 mg/kg of chlorprothixene, elicit a marked anemia in pheasants (Table 7). The higher the dose administered, the sooner the onset of cell loss and more pronounced the decrease of the RBC and the Hb level. Similar results follow intramuscular injections of Octoclothepine (/+/— 8— chlor-10-/4-methylpiperazine/ -10, 11-dihydrodibenzo/b, f/ thiepine/maleate) in doses of 5 mg/kg or 50 mg/kg.

TABLE 6. *Influence of repeated bleeding and of injection of Chlorprothixene 3 mg/kg intramuscularly upon the erythrogram of roe deer.*

Time (min.)	Chlorprothixene treated RBC $X10^6$	Hb g%	PCV %	repeated bleeding RBC $X10^6$	Hb g%	PCV %
0	10.3	16.0	47	10.7	17.3	55
30	7.0	13.4	34	10.2	17.3	51
60	6.6	13.6	36			
90				9.8	17.3	53
180	8.8	15.6	42	9.0	17.3	48

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TABLE 7. *Influence of Chlorprothixene upon the erythrogram of the pheasant.*

	RBC X10⁶	RBC-P[1] X10³	Hb g%	MCH /μ/μg
a. /	3.3	21.0	11.7	35
Repeated bleeding.	2.9	51.0	11.1	38
	2.8	55.0	10.8	39
b. /	3.0	15.0	12.4	41
Saline solution	2.8	74.0	12.2	43
intramuscularly.	2.6	105.0	11.6	45
c. /	3.1	15.0	13.1	42.2
Chlorprothixene	2.7	72.0	12.9	47.7
10 mg/kg	2.5	67.5	12.4	49.6
intramuscularly.	2.4	62.0	11.4	47.4
d. /	3.2	16.0	11.8	37
Chlorprothixene	2.3	65.0	10.1	43
100 mg/kg	1.9	46.5	8.8	46
intramuscularly.	1.8	45.0	9.1	50

[1] RBC-P number of polychromatophilic corpuscles

About 3 hours following administration of the lower dose of each tranquilizer, the RBC are about $2.3x10^6$, and the Hb level is by about 13% - 15% lower than the initial value. The higher doses elicit erythropenia with counts equalling 1.8-$2.0x10^6$ RBC and a decrease of the Hb level to 9.1-9.4% (Pujman 1967: Biologisace a chemisace, 375-379).

The survey shows that in game animals (particularly birds), anemia may result from several causes. Anemia can be observed from the erythrograms but very often the different types are so similar that it permits no inference of the causative agent. The erythrogram "normalizes" during growth due to enhanced erythropoiesis in the bone marrow: Partridge, 1 week-old, M: E = 1: 5, 2; 4-week old, M: E = 1: 2.7 (Hanusová 1968: Thesis for Ph.D. Biol. Faculty of Charles University Prague).

In parasite induced anemias, apart from the destructive effect of the parasites themselves and of the cell loss due to blood sucking, a possible additional noxious effect of toxic substances, excreted within the host organism, can be neither confirmed nor eliminated. The causative mechanism of anemias due to pesticides, fall-out, and exhalations still remain unrevealed. Transitory anemia elicited by tranquilizers may be due to hemodilution. Its occurence precludes the administration of tranquilizers during hematological examinations.

Summary

Normal hematological changes occuring between birth and maturity were studied in several species of wild mammals and birds. In general, young animals had lower PCV, Hb and RBC values than did adults of the same species. Polychromatophil and normoblast counts however, were higher in young animals.

Parasite induced anemia resulted from direct destruction of RBC's and possibly to toxic substances acting on non-parasitized cells.

Although anemia resulting from environmental pollutants (pesticides) was confirmed, the mechanisms of action on the cells remains unknown.

Tranquilizers produced only transitory anemia which was suspected to result from hemodilution.

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