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Hematological Values in Poultry *

J. Balasch and J. Planas

Laboratorio de Fisiología Animal
Facultad de Ciencias
Universidad de Barcelona
Barcelona (España)

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The various hematological values (hematocrit, blood and plasma volume, erythrocyte volume) have been determined in three species of poultry [hen (49 specimens), turkey (13 specimens), duck (8 specimens)] with distinction of sexes and laying period. In the turkeys and duck the determinations have been repeated about to 4-5 months from the first assay; in this moment the females were in laying state.

It is appreciated that the duck shows values considerably superior to the other species.

With age there is a diminution, in general, in blood and plasma volumen, effected by the increase in size.

Due to the superimposition of the factors it is not possible to prove here a direct influence of the laying phenomenon on the values analyzed.

Many different studies on the determination of blood volume, hematocrit values and the erythrocyte volume have been conducted on various types of poultry.

In this way, the hen has been studied (1, 5, 8, 10); the turkey (7); the duck (1); the pigeon (1, 6, 10). At the same time, some wild specimen have been analyzed; amongst these analyzises we can mention the one made by DABROWSKI (4) on the Corvidae.

Generally, in such works the results obtained in the different species are compared and very interesting differences can be noted between the aquatic and non-aquatic birds (1) as well as in respect of data found in the remaining vertebrates (3, 6).

The correlation in size, age and blood volume has been studied (8) and the variation also known of the hematocrit in respect to sexual maturity, noting an increase of its values in relation to the androgens (5, 6, 10).

The estrogens do not seem to have any effect on such values, although according to GILBERT (5) it is suggested that the diminution in the hematocrit values during the laying period must be sought in the higher secretion of estrogens preceding and accompanying such phenomenon.

In the bibliography we have not found any data that relate these constant hematological values with the laying period,

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except for the reference made by GILBERT (5).

In this work, we are joining together various hematological values found in there different species of poultry, where we comparatively analyze and try to relate them to the growing process and laying period.

Materials and Methods

Three different species of poultry have been studied: hen (49 specimens), turkey (13 specimens) and duck (8 specimens) with separation of sexes and state of laying as shown on Table I. The blood and plasma volumes have been determined by injection of Fe^{59} in the radial vein, during the study on the turnover of the plasma iron, according to the technique of BOTHWELL and FINCH (2) already mentioned in a previous publication (9).

The value of hematocrit has been obtained through a micro type technique, in a Gri-Gel centrifuge.

The statistic significance of the mean values have been obtained in accordance with SCHWARTZ (11).

Results

On Table I it is possible to appreciate the different results obtained.

Hematocrit. The values of hematocrit vary between 30 and 35 % both in the hen and turkey, whilst are superior in the duck (43-47 %). In the three species, higher increase is evident in the males; in turkeys of more than one year of age it reaches up to 46 %.

Blood and plasma volume. There is evident a higher proportion of blood in the duck which varies between 11.2-15 %, in front of the values of both hen and turkey (4.9 to 5.9 %) in which a diminution can generally be noted this percentage in accordance to size. The decrease of such volume in the laying female (hen and duck) is very relevant and is in contrast with the steadiness of values in the turkey where, on the other side, the size increase has been higher.

Erythrocyte volume. The erythrocyte volume referred to unity of body weight shows very elevated values in the duck, which highly differ from the ones found in both turkey and hen.

Discussion

Birds present, generally, a medium blood volume of 8.2 %, inferior to reptiles and amphibious, and superior to the medium of mammals (7.3 %). It is, however, in the relative erythrocyte volume that with the mean value of 35 ml/kg it is possible to reach the maximum value in the vertebrates (3).

The data we have found in the duck are amongst the higher (51 and 73 ml/kg) and are accompanied with the highest values of blood and plasma volume, and hematocrit.

The aquatic birds studied by BOND and GILBERT (1) (wild duck, red-throated loon, coot) show a significative increase in blood volume, plasma, erythrocyte volume and hemoglobin concentration respect to non-aquatic species (hen pheasant, quail, and various rapacious species). This increase can be considered as a physiological adaptation for immersion, tending to obtain an increase in the reserve of O_2 and from this, as increase in the permanence under water.

In the various non-aquatic species studied, the pigeon (1, 6) is the one that does not fit to this general line and tends to follow the first group. According to the authors (1), in this case there may be involved a factor of adaptation to the special metabolic necessities of the flying species.

The data contributed by the same authors on two species of rapacious birds,

Table I. *Hematological values (mean ± σ) in chicken, turkey and duck.* NL = no laying; L = laying.

Species	N.° animals	Body weight g	Hematocrit %	Blood volume		Plasma volume		Erythrocyte volume	
				ml	ml/100 g b.w.[b]	ml	ml/100 g b.w.[b]	ml	ml/kg b.w.[b]
Chicken									
♂	10	2,070±513	33±7	104±29	4.9±1.4	71±20	3.4±1.1	30.4±8	15.1±3
♀ NL	12	1,530±380	30±2	91±20	6.2±1.5	62±15	4.3±1.2	27.2±6	18.4±5
♀ L	27	3,020±710	32±3	114±42	3.9±1.4	77±21	2.6±0.8	38.0±13	13.3±5
Turkey									
♂	7	3,100±450	35±2	185±16	5.9±0.5	121±11	3.8±0.3	64.8±6	20.9±2
♂ [a]	6	10,600±1,676	46±3	364±92	3.4±0.9	196±52	1.9±0.5	167±42	15.9±4
♀ NL	5	4,360±685	35±2	185±24	4.2±0.5	120±19	2.7±0.3	65±7	15±2
♀ L [a]	4	7,375±117	34±2	313±50	4.2±0.7	207±36	2.7±0.5	108±13	14.6±2
Duck									
♂	4	2,650±530	44±3	306±106	11.2±4.0	168±50	6.3±1.7	137±48	51.4±17
♂ [a]	4	3,060±510	47.5±1	207±25	6.7±1.0	108±11	3.5±0.5	98±12	32.2±6
♀ NL	4	1,000±83	46±2	157±20	15±1.0	84±9	8.4±0.7	73.7±13	73.2±9
♀ L [a]	4	1,500±0	43±1	121±12	8±0.8	70±4	4.6±0.5	52.3±4	35.1±3

a) Repetition of the determinations performed 4-5 months later.
b) b.w. = body weight.

do not favour such conclusion, but this has been reached in only 4 specimens and one of the species was a nocturnal that is not a great flying bird.

The hematical values pointed out by McCartney (7) on 30 specimens of female turkey, comparable to the lot of non-laying (Table I), showing in accordance with the hematocrit, but differ in the blood volume (7.2 %).

It is very difficult to relate a laying effect on the hematological values analyzed, becouse the variation in respect to age, must overlap to the modification made — if exist — by hormonal effects.

It has not been possible to analyze female speciments of equal age but not laying. Generally the hematocrit tends to reduce, together with the blood and plasma volume and the erythrocytes volumes referred to body weight unity; the turkeys do not show such diminution in respect to the laying period.

In the hen (6) it can be noticed that the hematocrit tends to descend during the laying period and it is suggested that it happens for effect of the estrogens. The increase in the values of hematocrit by action of the androgens has been practically demostrated in all vertebrates (6, 10).

References

1. Bond, C. F. and Gilbert, P. W.: *Am. J. Physiol.*, **194**, 519, 1958.
2. Bothwell, T. H. and Finch, C. A.: «Iron Metabolism». Little, Brown and Co., Boston, Mass., 1962.
3. Conte, F. P., Wagner, H. H. and Harris, T. O.: *Am. J. Physiol.*, **205**, 533, 1963.
4. Dabrowski, Z.: *Acta Biol. Crac. Zool.*, **11**, 267, 1968.
5. Gilbert, A. B.: *Br. Poult. Sci.*, **10**, 109, 1969.
6. Kaplan, H. M.: *Sciences*, **120**, 1044, 1954.

7. McCartney, M. G.: *Poultry Sci.*, **31**, 184, 1952.
8. Newell, G. W. and Shaffner, C. S.: *Poultry Sci.*, **29**, 78, 1950.
9. Planas, J. and Balasch, J.: *R. esp. Fisiol.*, **26**, 307, 1970.
10. Rodnan, G. P., Ebaugh, F. G. and Spivey Fow, M. R.: *Blood*, **12**, 355, 1957.
11. Schwartz, D.: Méthodes Statistiques à l'usage des médecins et des biologistes. Editions Médicales Flammarion, Paris, 1963.