

# THE ASSESSMENT OF PHYSIOLOGICAL STATUS OF THE RABBITS (BELGIAN GIANT BREED) AND HARES (*LEPUS EUROPAEUS PALLAS*) BY COMPARATIVE CHARACTERIZATION OF HAEMATOLOGICAL PROFILE

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## Abstract

The purpose of this research was to establish the physiological status of rabbits (Belgian Giant breed) and (*Lepus Europaeus Pallas*) by determining hematological profile (this has been achieved comparative by gender). Characterization of blood parameters was performed using an automated hematology analyzer, ABX Micros ABC VET. For this purpose were determined: the number of - leukocyte-white blood cells (WBC), erythrocyte- red blood cell counts (RBC); the total amount of hemoglobin in blood (HGB); percentage of red blood cells (hematocrit) (HCT); the average blood volume (MCV)-the size of red blood cells; average globular hemoglobin (MCH); mean hemoglobin concentration (MCHC) and platelet count (PLT). The highest average white blood cells (WBC) was observed in rabbit females ( $6.35 \times 10^3/\text{mm}^3$ ) and the lowest in hare males ( $4.65 \times 10^3/\text{mm}^3$ ). The highest values of erythrocytes (RBC) was observed for *Lepus Europaeus Pallas* (females ( $11.25 \times 10^6/\text{mm}^3$ ) and males ( $10.24 \times 10^6/\text{mm}^3$ )), and the lowest for Belgian Giant breed rabbits (females ( $6.01 \times 10^6/\text{mm}^3$ ) and males ( $6.57 \times 10^6/\text{mm}^3$ )). For platelet count (PLT), were determined the highest values for hare females  $533.41 \times 10^3/\text{mm}^3$ ,  $379 \times 10^3/\text{mm}^3$  for rabbit males. Rabbit females and hares males had relatively similar mean values ( $344.38 \times 10^3/\text{mm}^3$  and  $341.40 \times 10^3/\text{mm}^3$ ). Determine blood parameters showed significant variations in their average between the species studied, but were within the range observed in other studies.

**Key words:** rabbit, hare, hemoglobin, leukocytes, thrombocytes

## INTRODUCTION

Complete blood count is a diagnostic test that can provide numerous diseases. The results may reflect problems of blood volume (dehydration), or blood loss. It can also indicate a malfunction in producing, the life cycle and the rate of destruction of blood cells, as well as some acute or chronic infections. The need to perform this research was given by the global absence of data on this subject for the rabbits (Belgian Giant breed) and hares (*Lepus Europaeus Pallas*).

Hematological determinations were performed in order to establish the health and metabolic activity of the studied animals.

Red blood cells (RBC) carry hemoglobin (HGB) and oxygen. The amount of oxygen

received from tissue depends on the number and the functioning of red blood cells and hemoglobin. The values of MCV, MCH, and MCHC of hemoglobin reflects the size and concentration of hemoglobin of cells, and are used in the diagnosis of various types of anemia [1, 4]. The low number of white blood cells (WBC) indicates the destruction of the bone marrow (infection, fibrosis, tumors). An increased number of white blood cells may indicate: leukemia, infection, inflammation, and physical or emotional stress [2, 3].

## MATERIAL AND METHODS

Characterization of sanguine parameters was realised using a haematological automatic analyzer, ABX Micros VET ABC. Counting principle is based on the variation in impedance generated by the passage of blood cells through the aperture calibrated.

This paper is part of a broader study aimed at comparative characterization of the

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rabbits (Giant Belgian breed) and hares (*Lepus Europaeus Pallas*) meat and physiological status. To be able to realize the hematological determinations, biological material was formed by 85 individuals: 49 hares (24 males and 25 females) and 36 rabbits (5 males and 31 females) belonging to Belgian Giant breed.

Hares which were collected (during hunting seasons), came from Iași County hunting funds (Coarnele Caprei, Ciurea, Cotu Morii). Both species was studied at the age of reproductive maturity, adults (11-12 months). The rabbits (Belgian Giant breed) have had an average body weight of 11.5 kg and the hares have had 5.6 kg. Blood collection for hematological determinations was performed on live hare caught in the net, fed and accommodated in the dark for not being stressed. For rabbits Belgian Giant breed blood sampling was performed in the same way, with except of darkness. Blood sampling for hematological profile was performed in vacutainers with the EDTA (Ethylene Diamine Tetra Acetic acid) anticoagulant. At hares, blood was collected from the auricular and ulnar veins. At rabbits, blood collection was performed from auricular veins.

The results obtained were interpreted statistically. The first stage occurred usual statistical estimators calculation - arithmetic mean ( $\bar{X}$ ), standard deviation (s), variance

( $S^2$ ) and coefficient of variation (V%) - calculated using the software algorithm. To test the statistical significance of differences between the studied characters, we used ANOVA Single Factor algorithm included in Microsoft Excel software package.

**RESULTS AND DISCUSSIONS**

Following the determinations performed, the results obtained were statistically processed. Statistical estimators calculated for white cells, both for hares and for rabbits are shown in table 1, depending on sex.

The highest value of the mean of leukocytes was observed in female of the rabbits  $6.35 \times 10^3 / \text{mm}^3$  (table 1.) and the lowest in male of hares ( $4.65 \times 10^3 / \text{mm}^3$ ).

The coefficient of variation for WBC in male of hares has registered values much above 20% (79.44%). Hence it follows that the study population was heterogeneous in terms to the number of white blood cells.

For hare females coefficient of variation was 19.95%, which is a relatively homogeneous population in terms of the content of the leukocytes. In male rabbits coming from Giant Belgian breed, was met a very homogeneous population (8.89%) and in female rabbits (table 1) coefficient of variation (14.79%) represented a relatively homogeneous population.

Table 1 The number of white blood cells (WBC) for rabbits and hare ( $10^3 / \text{mm}^3$ )

WBC	No	$\bar{X} \pm s \bar{X}$	V%	$S^2$	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	4.65± 0.73	79.44	13.68	1.50	20.50
Females <i>Lepus Europaeus</i>	25	5.40±0.21	19.95	1.16	3.80	8.60
Males Belgian Giant	5	6.03±0.54	8.89	0.86	5.40	7.10
Females Belgian Giant	31	6.35±0.35	14.79	3.57	4.00	11.20

By performing statistical analysis with ANOVA analysis of variance test, the number of white blood cells for blood harvested from

rabbits and hares (males and females) have been determined, within the population studied, insignificant differences (table 2).

Table 2 The significance of differences for the number of white blood cells (WBC) by gender

WBC	The statistical significance of the differences
<i>Lepus Europaeus</i>	$\hat{F}=0.845$ , $F_{5\%}(1;48)=4.042$ ; $\hat{F} < F_{5\%}$ n.s.
Belgian Giant	$\hat{F}=0.075$ , $F_{5\%}(1;31)=4.159$ ; $\hat{F} < F_{5\%}$ n.s.

The highest values of erythrocytes have been observed for female hares (11.25x10<sup>6</sup>/mm<sup>3</sup>), followed by those for male hares (10.24x10<sup>6</sup>/mm<sup>3</sup>) and the lowest for female Belgian Giant (6.01x10<sup>6</sup>/mm<sup>3</sup>) and then for males (6.57x10<sup>6</sup>/mm<sup>3</sup>) (table 3).

Table 3 The number of red blood cells (RBC) in rabbits and hare (10<sup>6</sup>/mm<sup>3</sup>)

RBC	Nr.	$\bar{X} \pm s \bar{x}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	10.24±0.34	17.06	3.05	3.17	12.00
Females <i>Lepus Europaeus</i>	25	11.25±0.15	6.54	0.54	8.99	12.00
Males Belgian Giant	5	6.57±0.09	1.31	0.02	6.40	6.68
Females Belgian Giant	31	6.01±0.22	20.72	1.55	3.67	9.36

For the number of red blood cells collected from rabbits, by performing statistical analysis (ANOVA) between populations were determined insignificant differences (table 4.). For hares, by the same test, significant differences have been observed in the number of red blood cells.

Table 4 The significance of differences for the number of red blood cells (RBC) by gender

RBC	The statistical significance of the differences
<i>Lepus Europaeus</i>	$\hat{F}=6.705$ ; $F_{5\%}(1;48)=4.042$ ; $F_{1\%}(1;48)=7.194$ ; $F_{5\%}<\hat{F}<F_{1\%}$ *
Belgian Giant	$\hat{F}=0.588$ ; $F_{5\%}(1;32)=4.149$ ; $\hat{F}<F_{5\%}$ n.s.

The highest average value of the total quantity of hemoglobin (HGB) was met for female hares 21.74 (g/dL), and the lowest for female rabbits 12.65 (g/dL) (table 5).

Table 5 The total quantity of blood hemoglobin (HGB) (g/dL)

HGB	Nr.	$\bar{X} \pm s \bar{x}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	19.27±0.72	18.52	12.74	4.6	23.8
Females <i>Lepus Europaeus</i>	25	21.74±0.31	7.12	2.39	19.4	25
Males Belgian Giant	5	14.3±0.404	2.82	0.49	13.8	15.1
Females Belgian Giant	31	12.645±0.443	19.51	6.09	8.6	19.7

The coefficient of variation in the total amount of hemoglobin, had values above 10% for female rabbits (19.51%) and also for male hares (18.52%), indicating a relative homogeneity of these populations. For male rabbits and female hares has been met a very representative and homogeneous population,

the coefficient of variation not exceeding 10% (table 5).

By applying the ANOVA test on the total amount of hemoglobin in blood harvested from the rabbits (males and females) were determined in the population under study, no significant difference. For hares, were noted significant differences for HGB (table 6).

Table 6 The significance of differences in total blood hemoglobin (HGB) by gender

HGB	The statistical significance of the differences
<i>Lepus Europaeus</i>	$\hat{F}=8.509$ ; $F_{5\%}(1;48)=4.042$ ; $F_{1\%}(1;48)=7.194$ ; $F_{0.1\%}(1;48)=12.285$ ; $F_{5\%}<\hat{F}<F_{1\%}<F_{0.1\%}$ **
Belgian Giant	$\hat{F}=1.305$ ; $F_{5\%}(1;32)=4.149$ ; $\hat{F}<F_{5\%}$ n.s.

The percentage of red blood cells (HCT) recorded the highest mean values for female hares 67.3%, followed by the male hares, with a value of 62.36%. The lowest average

percentages of the hematocrit were observed for female rabbits 39.85% followed by those of male rabbits 45.87% (table 7). Similar values (53.8%) for HCT were determined by Ewola and Egbunike, 2008, and by Gdbore and Akela, 2010 (39.6%). The coefficient of

variation ranged, for male hares and female rabbits it place in the category of medium homogeneity, that is between 10% and 20%, and for female hares and male rabbits had values below 10%, which expresses a very homogeneous population (table 7).

Table 7 The percentage of red blood cells - hematocrite (HCT)%

HCT	Nr.	$\bar{X} \pm s \bar{x}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	62.36±2.11	16.9	111.12	18.7	70
Females <i>Lepus Europaeus</i>	25	67.3±0.79	5.8	15.24	52.9	70
Males Belgian Giant	5	45.87±0.536	1.169	0.863	44.8	46.5
Females Belgian Giant	31	39.85±1.349	18.846	56.416	27.1	59.8

Regarding the percentage of red blood cells, from statistical point of view, for the hares were found significant differences, and

for the rabbits were found not significant differences between females and males (table 8).

Table 8 The statistical significance of differences in the percentage of red blood cells by gender

HCT	The statistical significance of the differences
<i>Lepus Europaeus</i>	$\hat{F}=4.836$ ; $F_{5\%}(1;48)=4.042$ ; $F_{1\%}(1;48)=7.194$ ; $F_{5\%} < \hat{F} < F_{1\%}$ *
Belgian Giant	$\hat{F}=1.867$ ; $F_{5\%}(1;32)=4.149$ ; $\hat{F} < F_{5\%}$ n.s.

Regarding the average of red blood cell volume (MVC), is observed a large quantity for rabbits (male rabbits 71.33  $\mu\text{m}^3$  followed

by the females 66.71  $\mu\text{m}^3$ ) and then for those of hares (61.48  $\mu\text{m}^3$  for males and 60.29  $\mu\text{m}^3$  for females) (table 9).

Table 9 The average blood cells volume, red blood cell size (MCV)  $\mu\text{m}^3$

MCV	Nr.	$\bar{X} \pm s \bar{x}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	61.48±0.7	5.75	12.51	56	71
Females <i>Lepus Europaeus</i>	25	60.29±0.36	2.95	3.17	58	64
Males Belgian Giant	5	71.33±0.881	1.24	2.33	70	73
Females Belgian Giant	31	66.71±0.601	5.02	11.21	61	74

After statistical evaluation of MCV parameter (depending on the sex of the animals), was observed significant differences for rabbits and small differences for the hares (table 10). The average globular of hemoglobin (MCH) (table 11) for *Lepus Europaeus Pallas* recorded the lowest values

for male hares (18.4 pg), followed by the female hares (18.9 pg).

For rabbits the average globular of hemoglobin (MCH), mean values observed were relatively close, for male rabbits (21.7 pg), followed by the female rabbits (21.1 pg) (table 11).

Table 10 The statistical significance of differences in size of red blood cells (MCV) by gender

MCV	The statistical significance of the differences
<i>Lepus Europaeus</i>	$\hat{F}=2,598$ $F_{5\%}(1;48)=4,042$ ; $\hat{F} < F_{1\%}$ n.s.
Belgian Giant	$\hat{F}=5,486$ , $F_{5\%}(1;32)=4,149$ ; $F_{1\%}(1;32)=7,499$ ; $F_{5\%} < \hat{F} < F_{1\%}$ *

Table 11 The average globular of hemoglobin (MCH) (pg)

MCH	Nr.	$\bar{X} \pm s \bar{X}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	18.4±0.48	13.04	5.76	8.8	20.8
Females <i>Lepus Europaeus</i>	25	18.9±0.21	5.62	1.14	17.9	23.1
Males Belgian Giant	5	21.7±0.392	1.808	0.463	21.2	22.5
Females Belgian Giant	31	21.1±0.203	5.366	1.285	18.7	23.8

By applying the analysis of variance test were observed insignificant differences on the average globular of hemoglobin (MCH) between sexes for rabbits and hares (table 12).

Table 12 The statistical significance of differences for average of globular hemoglobin (MCH) (pg)

MCH	The statistical significance of the differences by gender
<i>Lepus Europaeus</i>	$\hat{F}=1.260$ ; $F_{5\%}(1;48)=4.042$ ; $\hat{F} < F_{5\%}=n.s.$
Belgian Giant	$\hat{F}=0.826$ ; $F_{5\%}(1;32)=4.149$ ; $\hat{F} < F_{5\%}=n.s.$

For the mean hemoglobin concentration (MCHC) we observed similar values for the two species studied. The highest values was for female rabbits (31.7 g/dL), followed by those for female hares (31.5 g/dL). Lowest average values were recorded for male hares (29.96 g/dL) followed by those for male rabbits (31.1 g/dL) (table 13).

Table 13 Mean hemoglobin concentration (MCHC) (g/dL)

MCHC	Nr.	$\bar{X} \pm s \bar{X}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	29.96±0.72	12.01	12.96	14.3	32.7
Females <i>Lepus Europaeus</i>	25	31.5±0.34	5.35	2.85	30.2	39.2
Males Belgian Giant	5	31.1±0.611	1.964	1.12	30.3	32.3
Females Belgian Giant	31	31.7±0.195	3.436	1.188	29.9	33.6

By applying the analysis of variance test rabbits and hares, we observed insignificant for the mean hemoglobin concentration in differences in terms of their gender (table 14).

Table 14 The statistical significance of differences in mean of hemoglobin concentration-MCHC (g/dL)

MCHC	The statistical significance of the differences by gender
<i>Lepus Europaeus</i>	$\hat{F}=3.688$ ; $F_{5\%}(1;48)=4.042$ ; $\hat{F} < F_{1\%}=n.s.$
Belgian Giant	$\hat{F}=0.895$ ; $F_{5\%}(1;32)=4.149$ ; $\hat{F} < F_{5\%}=n.s.$

For platelet count (PLT), we determined the highest values for female hares 533.41x 10<sup>3</sup>/mm<sup>3</sup>, 379x10<sup>3</sup>/mm<sup>3</sup> for male rabbits. Female rabbits and male hares had relatively similar mean values (344.39x10<sup>3</sup>/mm<sup>3</sup> and 341.40x10<sup>3</sup>/mm<sup>3</sup>) (table 15).

Table 15 The platelets count (PLT) 10<sup>3</sup>/mm<sup>3</sup>

PLT	Nr.	$\bar{X} \pm s \bar{X}$	V%	S <sup>2</sup>	$\bar{X}$ Min	$\bar{X}$ Max
Males <i>Lepus Europaeus</i>	24	341.40±55.63	81.48	77.39	30	943
Females <i>Lepus Europaeus</i>	25	533.41±24.01	22.05	13.83	375	794
Males Belgian Giant	5	379.00±41.02	10.82	57.00	297	422
Females Belgian Giant	31	344.39±23.05	37.27	16.65	26	615

In terms of the number of blood platelets (PLT), applying statistical tests to observe the significance of differences between populations for hares were revealed significant differences. For rabbits, gender differences was insignificant (table 16).

Table 16 The statistical significance of differences for blood platelets (PLT)10<sup>3</sup>/mm<sup>3</sup>

PLT	The statistical significance of the differences by gender
<i>Lepus Europaeus</i>	$\hat{F}=10.435$ ; $F_{5\%}(1;48)=4.042$ ; $F_{1\%}(1;48)=7.194$ ; $F_{0.1\%}(1;48)=12.285$ ; $F_{5\%}<\hat{F}<F_{1\%}<F_{0.1\%}$ **
Belgian Giant	$\hat{F}=0.207$ ; $F_{5\%}(1;32)=4.149$ ; $\hat{F}<F_{5\%}$ n.s.

A large number of research results have shown that the effect of the action of different microorganisms depends not only on their pathogenicity or virulence but also by the resistance organism, and this in its turn is heavily influenced by nutritional status [4, 5, 6].

### CONCLUSIONS

The result of this study provide an alternative set of reference values that can be used in the clinical evaluation of the rabbits (Belgian Giant breed) and hare (*Lepus Europaeus Pallas*), by gender. Given the larger collectivities livestock, conducting blood tests for preventive purposes is of high perspective, on condition provided that at intervals to determine the precise established those constant blood that are capable of most accurately reflect the health of the animals.

Thanks hematological techniques that we currently offering health surveillance of animal populations consists to explore various blood parameters by several individuals, in the same physiological category, subject to the same conditions of life. These exams expresses metabolic state of the animals at the time of sampling, being helpful to highlight nutritional imbalances or

infections earlier and anticipation of metabolic disorders to prevent them by adopting optimal conducts.

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