

COMPARATIVE STUDY OF THE LEUCOCYTARE FORMULA AND OF SOME BLOOD BIOCHEMICAL PARAMETERS TO ROSS 308 AND COBB 500 MEAT HYBRIDS

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Abstract

In poultry farming, thanks to the development of technology, the broiler is a remarkable achievement in terms of genetics, nutrition and economic performance. The monitoring of the disease state is done from a clinical and paraclinical point of view only when the situation requires it. The determination of hematological parameters provides valuable information for the assessment of the health status of animals, but in current avian pathology these determinations are not widely used due to the lack of reference values for avian blood profiles, the very young economic age of broilers in conditions where feeding, watering, animal hygiene are regulated and monitored daily. In addition, the fact that erythrocytes in birds are nucleated and the hematology machines do not distinguish erythrocytes from leukocytes, counting them as nucleated cells giving errors in the counting, we, in practical field conditions, resorted to performing the leukocyte formula (easier to performed even in farms) and to the laboratory determination of some biochemical parameters to achieve a small difference between the 2 broiler hybrids during the growth period. From the experiment data we found that.

Key words: albumins, biochemistry, blood serum, protein fractions, proteins.

INTRODUCTION

The broiler chicken regardless of the hybrid it comes from (Ross 308 and/or Cobb 500) gives the image of a healthy chicken; their growth presenting multiple advantages, such as: the accessibility of meat consumption (it has no religious prohibitions), food convenience (always fresh meat can be delivered), a large number can be grown on small areas, the meat has nutritional and dietary value, etc. (Ionita, 2024). Poultry health refers to: well-being, providing biological comfort, ensuring balanced nutrition (quantitative and qualitative), etc., all of which will allow to achieve the genetic performance of these hybrid breeds Ross 308 and Cobb 500 (Talebi et al., 2005).

Modern commercial broiler hybrids are not all the same: they are very similar but have distinct growth characteristics.

Some produce larger breasts, others larger thighs and legs, while some produce balanced breast and leg/thigh meat.

Several operators focus on rapid growth and meat gain from hatch, while others focus on slower growth with an emphasis on structural development - limb bones and heart muscle (Broiler Management Guide) These growth traits are important to traders looking to produce meat for their specific market targets.

With all the listed advantages, raising broilers requires the identification and application of appropriate biosecurity measures to prevent possible diseases with serious economic implications (Figures 1 and 2).

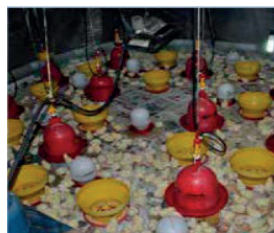


Figure 1. Advanced broiler breeding technology
(www.aviagen.com)

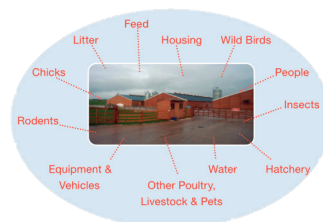


Figure 2. The main risk factors of bird diseases
(FAO, 2011)

Thanks to the immunoprophylactic measures applied for a very long time, no disease situations were recorded during the short economic period of 28-35 days when these chickens are raised. That's why hematological analyzes are not used either, and blood biochemical determinations are made only for scientific and economic purposes to improve the quality of the meat and influence it through the addition of nutrients to improve or correct certain targeted properties.

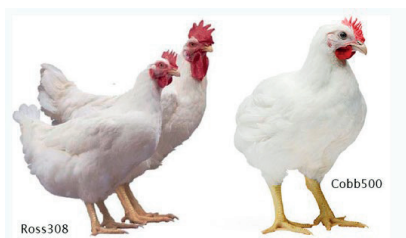


Figure 3. Broiler breeds Ross 308 and Cobb 500 (www.aviagen.com)

MATERIALS AND METHODS

To perform the metabolic Mini profile, we collected blood samples from broilers of different breeds, similar ages, 2 different rearing units, but from clinically healthy birds.

The collection was carried out in special vacutainers for biochemistry and hematology, by puncturing the humeral vein; for serum expression, the blood samples were kept at room temperature, then in the refrigerator at 4⁰C.

The analyzes were performed in the Laboratory of the discipline of Internal Medicine, within FMV Bucharest, with the equipment provided. The leukocyte formula was obtained through laboratory analysis using the hematology analyzer Abacus Junior Vet 5. It should be noted that this device could not be used for the quantitative determination of the red blood cell and its derivatives as well as the leukocyte blood cell because erythrocytes are nucleated (Figure 4).



Figure 4. Abacus Junior Vet 5 Hematology Analyzer (own source)

For biochemical blood analyses, serum samples were separated by centrifugation and measured by standard methods using the ARKAY apparatus (Figure 5).



Figure 5. ARKRAY Dry Biochemistry Analyzer, Model SPOTCHEM EZ-SP-4430 (own source)

To obtain the blood serum, the blood samples collected on the anticoagulant were centrifuged (Figure 6).



Figure 6. Centrifuge (own source)

To determine the leukocyte formula, we resorted to the hematology analyzer, which evaluated the percentage of the components of the white series, and I also made an image of them, from which nucleated erythrocytes and some white elements (heterophile, eosinophil, monocyte, lymphocyte) can be observed in Figure 7.

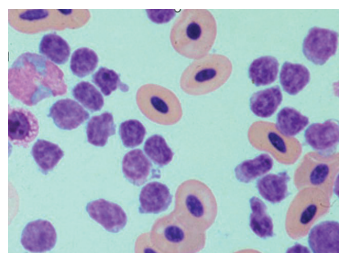


Figure 7. Microscopic field with red and white blood elements (own source)

RESULTS AND DISCUSSIONS

Currently in Romania but also in the European Union, the share in the growth of meat hybrids belongs to the Ross 308 hybrid (it has a fast development, efficiently utilizes the feed, etc.). Ross 308 is a high-performance broiler that can reach impressive body weights (females around 3 kg and males 3.5 kg at 47 days of age); it has a very good yield at slaughter (Sam et al., 2023). The Cobb 500 hybrid has a low feed conversion rate, fast growth, a less expensive nutritional regimen; has adaptation problems with an increased sensitivity to growth on permanent litter; it was oriented especially to produce "breast" (Talebi et al., 2005).

A. Ross 308 meat hybrids

Genetic heritage: Ross 308 is bred by Aviagen, a global poultry company. It is a cross between two different chicken breeds, each selected for specific traits such as growth rate, feed efficiency and meat quality.

It is globally recognized as a broiler that delivers consistent performance.

Integrated and independent producers appreciate its growth rate, feed efficiency and robust performance. Ross 308 boasts unmatched genetics optimized for fast growth, exceptional meat quality and efficient feed conversion.

Its adaptability to various environments and robust health profile makes it a reliable option for both small-scale and commercial operations. This breed dominates the market, trusted by poultry producers for its proven track record and superior attributes.

The Ross 308 hybrid (Figure 8) requires a differentiated feed to achieve high performance but shows better resistance to microclimate conditions.



Figure 8. Ross 308 hybrid at 21 days of age (own source)

In Romania, it is grown on a large scale because the parents of Ross meat hybrids have a higher percentage of eggs compared to the parents of Cobb and because the hatching percentage is higher.

Especially in birds, the clinical diagnosis is completed with the laboratory examination, based on the results of hematological and biochemical investigations (Al-Aufi et al., 2024).

Table 1. Average biochemical values in 28-day-old Ross 308 chickens (n = 20)

Parameters	UM	Physiological values	Age 28 days (mediate)
Total proteins	g/dl	3-7	3.5
Albumins	g/dl	2.6-4.6	1.42
Globulins	g/dl	1.4-2.4	2.1
Uric acid	mg/dl	1.6-4.2	17.3
Triglycerides	mg/dl	25-500	145.0
Cholesterol	mg/dl	50-400	225.0
GOT	UI/l	125-500	505.2
GPT	UI/l	26-34	38.9
Bilirubin	mg/dl	0.2-4.0	1.2
Creatinine	mg/dl	0.3-0.9	0.4

Table 1 shows that uric acid is slightly increased, albumin is decreased and GOT and GPT are increased.

Table 2. Average biochemical values in 38-day-old Ross 308 chickens (n = 20)

Parameters	UM	Physiological values	Age 38 days (mediate)
Total proteins	g/dl	3-7	3.4
Albumins	g/dl	2.6-4.6	2.3
Globulins	g/dl	1.4-2.4	1.1
Uric acid	mg/dl	1.6-4.2	26.7
Triglycerides	mg/dl	25-500	125.5
Cholesterol	mg/dl	50-400	268.0
GOT	UI/l	125-500	432.0
GPT	UI/l	26-34	42.0
Bilirubin	mg/dl	0.2-4.0	1.6
Creatinine	mg/dl	0.3-0.9	0.7

Table 2 shows small variations in the biochemical parameters compared to broilers from the age of 28 days.

Albumin is the most important plasma protein substance that is formed in the liver; permanent exchanges between serum albumins and tissues explain the frequency of quantitative albumin variations in various pathological states. The decrease in albumin can be due to the decrease in liver production, infectious processes, acute inflammation, protein losses at the renal, gastrointestinal level etc.

A proteinemia of more than 3 mg/dl may be associated with albumin loss through abnormal fluid distributions in the body, such as abdominal ascites or effusions around organs; these two aspects can be encountered at slaughter without being diagnosed by laboratory examination. In birds, uric acid is the main molecule of nitrogen catabolism and plays a vital role; there is a direct relationship between the amount of protein ingested and the level of uric acid in the blood.

The high concentration of protein in the forage ration during the growing period causes an increase in the level of uric acid in the blood.

The appearance of the leukocyte formula in the Ross 308 hybrid falls within the physiological limits at both 28 and 38 days of age.

Table 3. Leukocyte formula in Ross 308 hybrids, at the age of 28 and 38 days (n = 20)

Parameter	U/M	Physiological values	Mediate chicken 28 days	Mediate chicken 38 days
Lymphocytes	%	57-93	60.1	63.7
Heterophiles	%	8-48	34.5	22.9
Eosinophils	%	1-8	2.6	11.6
Basophils	%	0-3	0.8	0.6
Monocytes	%^	0-7	2	1.2

Table 3 shows eosinophilia in 38-day-old chicks (at finishing).

In the routine practice of clinical laboratories, it is possible to determine both the proportion of eosinophils per 100 leukocytes counted in the pan optically stained blood smear and the number of eosinophils per mm of peripheral blood allows their identification even when the leukocyte formula leads to false positive results due to the uneven distribution of blood cells on the smear. In recent years, the techniques for identifying and counting blood elements have been automated, significantly simplifying the analysis and increasing the accuracy of the results.

Next, we present the hematological and blood biochemical situation of the Cobb 500 hybrids

B. Cobb 500 meat hybrids

Selected for breeder and broiler genetic excellence, Cobb 500 offers unmatched durability and uniformity, exceptional feed efficiency and outstanding growth rate. Today's modern broiler chickens are more efficient, productive and robust than previous generations.

This progress is due to Cobb's commitment to improving genetics and advances in breeding methods that increase performance potential and enhance longevity and welfare outcomes. A cross-characteristic COBB 500 broilers - white feathers and genetically yellow skin, so that even when fed normal diets the unpigmented skin of the finished carcass is always yellow. Compared to other broiler crosses, COBB 500 has higher productivity and less growth in the fattening period. In 35 days, the average weight is 1.9 kg, it should be in 42 days - 2.4 kg (Figure 9).



Figure 9. The Cobb 500 hybrid at the finish (own source)

Table 4. Average biochemical values in 28-day-old Cobb 500 chickens (n = 20)

Parameters	UM	Physiological values	Age 28 days (mediate)
Total proteins	g/dl	3-7	3.16
Albumins	g/dl	2.6-4.6	1.18
Globulins	g/dl	1.4-2.4	1.98
Uric acid	mg/dl	1.6-4.2	8.15
Triglycerides	mg/dl	25-500	97.5
Cholesterol	mg/dl	50-400	143.3
GOT	U/l	125-500	218.3
GPT	U/l	26-34	18.0
Bilirubin	mg/dl	0.2-4.0	0.30
Creatinine	mg/dl	0.3-0.9	1.91

Table 4 shows the increase in uric acid and creatinine and the slight decrease in albumin.

Table 5. Average biochemical values in 38-day-old Cobb 500 chickens (n = 20)

Parameters	UM	Physiological values	Age 38 days (mediate)
Total proteins	g/dl	3-7	2.88
Albumins	g/dl	2.6-4.6	1.09
Globulins	g/dl	1.4-2.4	1.79
Uric acid	mg/dl	1.6-4.2	5.48
Triglycerides	mg/dl	25-500	46.1
Cholesterol	mg/dl	50-400	138.9
GOT	U/l	125-500	276.9
GPT	U/l	26-34	28.7
Bilirubin	mg/dl	0.2-4.0	0.64
Creatinine	mg/dl	0.3-0.9	1.36

Table 5 shows that in broilers at the age of 38 days, at the finishing stage, uric acid and creatinine were found to be slightly increased and the albumin is low

The appearance of the leukocyte formula in the Cobb 500 hybrid falls within the physiological limits at both 28 and 38 days of age.

Table 6. Leukocyte formula in Cobb 500 hybrids, at the age of 28 and 38 days (n = 20)

Parameter	U/M	Physiological values	Mediate chicken 28 days	Mediate chicken 38 days
Lymphocytes	%	57-93	63	67
Heterophiles	%	8-48	32	26
Eosinophils	%	1-8	3	4
Basophils	%	0-3	1	1
Monocytes	%^	0-7	1	2

Regarding the leukocyte formula, in Cobb 500 hybrids it is found that all types of white cells (granulocytes and agranulocytes) are within physiological limits (Table 6).



Figure 10. Cobb 500 broiler house (www.aviagen.com)

Next, we present some comparative metabolic results between the 2 hybrid broilers.

Table 7. Comparative protein profile

Parameters	Ross 308 (mediate)		Cobb 500 (mediate)	
	28 days	38 days	28 days	38 days
Total proteins	3.5	3.4	3.16	2.88
Albumins	1.42	2.3	1.18	1.09
Gilobulins	2.1	1.1	1.98	1.79

The analysis of the data shows (Table 7) that in the hybrid Cobb 500 albumin is found below the physiological value at both investigated ages (28 and 38 days).

Table 8. Comparative energy profile

Parameters	Ross 308 (mediate)		Cobb 500 (mediate)	
	28 days	38 days	28 days	38 days
Triglycerides	145.0	125.5	97.5	46.1
Cholesterol	225.0	268.0	143.3	138.9

From the analysis of the results (Table 8), it is observed that the parameters of the energy profile, in both hybrids, are within physiological limits.

Table 9. Comparative enzyme activity between broilers

Parameters	Ross 308 (mediate)		Cobb 500 (mediate)	
	28 days	38 days	28 days	38 days
GOT	505.2	432.0	218.3	276.9
GPT	38.9	42.0	18.0	28.7

Regarding liver activity (intensely forced by growth), a significant increase in GOT and GPT activity is recorded in hybrid Ross 308, at both tested ages (Table 9). A very good activity of these transaminases is found in Cobb 500 hybrids.

Table 10. Comparative activity of uric acid

Parameters	Ross 308 (mediate)		Cobb 500 (mediate)	
	28 days	38 days	28 days	38 days
Uric acid	17.3	26.7	8.15	5.48

Birds are known to be hyperuricemic normally. Of the 2 hybrids, it appears that Cobb 500 have uric acid values close to physiological values, including during the low finishing period. Ross 308 hybrids have high uric acid values (Table 10). This increase in uricemia is related to the period of intensive growth of the chicks, a stage of intense metabolic demand.

CONCLUSIONS

1. Modern commercial broiler hybrids are not all the same - they are very similar but have distinct growth and metabolism characteristics.
2. Growth traits are important to commercial agents who wish to produce meat for their specific market objectives.
3. Hematological, the laboratory analyzes revealed that the leukocyte formula is within normal limits, only in Ross 308 hybrids at the age of 38 days a marked eosinophilia was found
4. From a biochemical point of view, comparatively, the results show a significant increase in GOT and GPT activity in the Ross 308 hybrid, at both investigated ages

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