World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

Check for updates

# Study of the biological activity of an arginine-containing iodine compound

Tamari Vasini [1,*], Amrosi Chkuaseli [1], Avtandil Chagelishvili [1] and Ekaterine Gvaladze [2]

[1] *Institute of Animal Husbandry, Animal Husbandry, Agricultural University of Georgia, Tbilisi, Georgia.*
[2] *Veterinary Clinical Laboratory Institute, Veterinary medicine, Agricultural University of Georgia, Tbilisi, Georgia.*

World Journal of Advanced Research and Reviews, 2025, 26(01), 2336-2342

Publication history: Received on 26 February 2025; revised on 12 April 2025; accepted on 14 April 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.26.1.1191

## Abstract

The biological activity of an arginine-containing iodine compound was studied. It was determined that, in the experimental groups of broilers, blood morphological parameters (hemoglobin, erythrocytes, leukocytes) were higher compared to the control group yet remained within normal ranges. In the second experimental group, the elevated hemoglobin and erythrocyte values suggest enhanced oxygen transport in the body, supporting a more intensive metabolism and accelerating the broilers' growth rate. Although still within normal limits, the increased leukocyte count indicates an activated immune response, while normal ESR values confirm the absence of pronounced inflammatory processes. Most of the blood biochemical parameters (AST, ALT, total protein, and globulin) also remain within normal limits, reflecting a stable health status. Overall, these findings do not indicate any serious pathological processes and are consistent with the broilers' normal physiological condition and metabolic status.According to the analysis of dry matter components in experimental groups (including protein and fat concentration) and moisture content in the meat samples of the experimental groups, supplementation of broiler feed with an arginine-containing iodine compound reduced the meat's moisture content while increasing the dry matter concentration compared to the control group.

**Keywords:** Arginine; Iodine; Microelements; Broiler; Feed; Blood; Protein; Fat; Moisture

## 1. Introduction

It is well known that essential microelements are crucial for the normal growth and development of living organisms (humans, poultry, livestock, and plants) [1,2]. Among these essential microelements, iodine is of particular importance. In medicine, veterinary science, and as a supplement in premixes, iodine salts (primarily iodides and iodates) have long been used. Nowadays, in addition to these forms, biologically active supplements enriched with iodine- based on cow's (or goat's) milk proteins (casein) or yeast are also successfully utilized as sources of iodine (e.g., "iodari," "iodcasein," "albito," etc.) [3–7].Given the importance of iodine-containing supplements, we have continued our research on the biological activity of an arginine-containing iodine compound, the synthesis conditions, physicochemical properties, and biological activity of which were previously investigated by us [8]. Specifically, we studied the effect of this arginine-containing iodine feed supplement on broiler chicken (cross "ROSS-308") productivity, including daily and absolute weight gain, survival, total feed consumption per bird, feed consumption per kilogram of weight gain, and the rearing effectiveness (European Production Efficiency Index). Based on these studies, we found that adding the feed supplement positively influences all zootechnical parameters. By day 35, live weight in the experimental groups increased by 1.03–5.60% compared to the control, while daily weight gain increased by 1.06–5.73%. The survival rate in the experimental groups was 4–6% higher compared to the control, and feed consumption in the experimental groups was 3.98–9.66% lower than in the control.

* Corresponding author: T. Vasini

Copyright © 2025 Author(s) retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution License 4.0.

## 2. Methods Used

- Study of certain morphological parameters of blood.
- Study of certain biochemical parameters of blood.
- Determination of the protein, fat, and ash content in broiler meat.

## 3. Result and Analysis

The Effect of an Arginine-Containing Iodine Compound on Selected Morphological and Biochemical Parameters of Broiler Meat and Blood

In broiler chickens, the levels of several morphological and biochemical blood parameters such as: hemoglobin (HGB), erythrocyte count (RBC), leukocyte count (WBC), and the erythrocyte sedimentation rate (ESR) are significant indicators of overall health status and physiological condition. Indeed, variations in these parameters can affect not only productivity but also the general health of the broilers.

At the end of our trial [8], before slaughtering the broilers, blood samples were collected from three birds in both the control and experimental groups to determine specific morphological and biochemical parameters. The results of these analyses are presented in Table 1.

**Table 1** Some Morphological Parameters of Broiler Blood

| **Parameter** | **Units** | **Normal Range** | **Groups** | | | |
|---|---|---|---|---|---|---|
| | | | Control | I Experimental | II Experimental | III Experimental |
| Hemoglobin (HGB) | g/L | 90-130 | 118 | 120 | 129 | 126 |
| Red Blood Cells (RBC) | $10^{12}$ /L | 3-4 | 3,3 | 3,5 | 3,8 | 3,4 |
| Hematocrit (HCT) | % | 24-31 | 38 | 41 | 27 | 36 |
| Color Index | - | 2-3 | 2,4 | 0,9 | 2,5 | 2,1 |
| Platelets (PTL) | $10^{9}$ /L | 35-100 | 65 | 60 | 90 | 55 |
| White Blood Cells (WBC) | $10^{9}$ /L | 20-30 | 20,0 | 27 | 24.0 | 23,0 |
| Monocytes (MON) | % | 1-10 | 1 | 4 | 3 | 4 |
| Lymphocytes (LYM) | % | 52-0 | 50 | 57 | 1 | 57 |
| Erythrocyte Sedimentation Rate (ESR) | mm/hr | 4-7 | 5 | 3 | 5 | 4 |

From among the morphological blood parameters (Table 1), we first determined hemoglobin levels, a vital protein in red blood cells that transports oxygen from the lungs to tissues and facilitates the return of carbon dioxide for exhalation. An optimal hemoglobin level is essential for supporting metabolic processes and maintaining the rapid growth characteristic of broilers. Deviations from the normal range can significantly affect both the health and productivity of broilers [9–11]. Elevated hemoglobin may indicate dehydration or adaptation to environments with lower oxygen levels, whereas reduced hemoglobin generally indicates anemia, which can stem from nutritional deficiencies, blood loss, or chronic diseases. Anemic birds often exhibit lethargy and slower growth rates [12–13].

As shown in Table 1, in the experimental groups, broiler blood hemoglobin ranges from 120–129 g/L, which is 1.7–9.3% higher than in the control group but still within the normal limit for 35-day-old broilers. Thus, while remaining within normal limits, this elevated hemoglobin level indicates an increased capacity for oxygen transport, conferring a beneficial effect on broiler growth.

Along with hemoglobin, we determined the erythrocyte count-(RBC), which similarly facilitates oxygen transport in the body. Neither excessively high nor low erythrocyte counts are desirable. Elevated levels may be associated with dehydration or adaptation to high-altitude conditions, where the body compensates by producing more erythrocytes to

enhance oxygen delivery. Low erythrocyte levels indicate anemia, which can result from inadequate or unbalanced nutrition, parasitic infections, or hemorrhage, thereby diminishing oxygen supply to tissues and influencing overall performance.

In blood samples collected at day 35 from broilers in the experimental groups (Table 1), the erythrocyte count was higher than in the control. Specifically, it ranged from 3.4–3.8×10^12/L in the experimental groups, compared with 3.3×10^12/L in the control group (3.03–15.15% lower than in the experimental groups). Notably, the second experimental group showed the highest levels of both hemoglobin and erythrocytes (3.8×10^12/L), still within normal limits. We can, therefore, infer that the relatively higher erythrocyte count in these broilers suggests enhanced oxygen transport, naturally intensifying metabolic processes and promoting faster growth.

Leukocytes (WBC) are an integral part of the immune system, protecting the body from infections and diseases. An elevated leukocyte count frequently indicates an active immune response to infection, inflammation, or stress. For instance, broilers exposed to heat stress often show increased leukocyte counts, reflecting their immune response to such stressors. Conversely, a reduced leukocyte count may suggest immunosuppression, raising the birds' susceptibility to infections and diseases [14].

At 35 days of age, the leukocyte count (Table 1) in all four groups remained within the normal range. In the experimental groups, it ranged from 23 to 27×10^9/L, while in the control group, it was 20×10^9/L—15–35% lower than in the experimental groups.

A key parameter of broiler health and normal physiological status is the erythrocyte sedimentation rate (ESR). An elevated ESR can be a nonspecific marker of inflammation or infection, reflecting the presence of acute-phase proteins in the blood. A reduced ESR is less common and typically has limited clinical significance in poultry.

As shown in Table 1, the ESR in both the control group and the second experimental group was 5 mm/hr (within the normal range), while in the first experimental group, it was slightly below the normal limit. Monitoring these hematological parameters is essential for assessing broiler health and ensuring timely intervention to maintain optimal productivity and welfare.

Based on the above analysis, we can conclude that the laboratory determination of blood components is a critical procedure for diagnosing various diseases and disorders in poultry. As the internal environment of the organism, blood is highly sensitive to physiological changes, which is reflected in its composition.

To investigate broiler metabolic processes further, we conducted biochemical blood tests in addition to the general blood analysis, measuring aminotransferases: Aspartate Aminotransferase (AST/GOT), Alanine Aminotransferase (ALT/GPT), and Gamma-Glutamyl Transferase (GGT/γ-GT), as well as total protein, albumin, and globulin (see Figure 1).

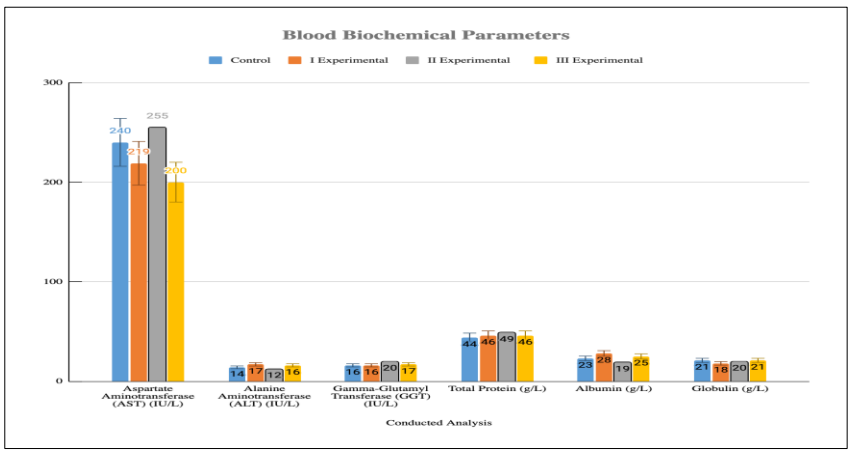


**Figure 1** Blood biochemical parameters

Aspartate Aminotransferase (AST) is a key enzyme involved in amino acid metabolism in broiler chickens. It is highly concentrated in the liver, skeletal muscle, heart muscle, and brain. AST catalyzes the transfer of amino groups between aspartate and α-ketoglutarate, producing oxaloacetate and glutamate, essential intermediates in energy production and protein synthesis. Elevated serum AST indicates tissue damage or stress, particularly in the liver and muscles, as the enzyme is released into the bloodstream following cellular injury. Monitoring AST activity is, therefore, crucial for assessing broiler health since increased levels can signal liver dysfunction, muscle damage, or systemic stress responses [15]. The normal range in broilers is 220–297 IU/L. According to Figure 1, AST levels for both the control and experimental groups remain within normal limits (200–255 IU/L), with only the third experimental group being slightly below the normal range.

Alongside AST, Alanine Aminotransferase (ALT) is another important marker of liver function. Both enzymes facilitate the transfer of amino groups, with ALT found in the highest concentration in the liver. It is commonly used to evaluate liver function in broilers [16–18], since it is released into the bloodstream when hepatocytes are damaged. Its normal range in broilers is 12–24 IU/L. From the results shown in Figure 1, ALT levels range from 12–17 IU/L across all groups, remaining within normal limits.

Gamma-Glutamyl Transferase (GGT) is an important enzyme in the γ-glutamyl cycle and plays a crucial role in maintaining intracellular glutathione levels, thereby supporting antioxidant defense and detoxification processes. In broiler chickens, GGT serves as a reliable biomarker of liver function, where an elevated blood level indicates potential liver stress, damage, or biliary obstruction. Consequently, it is valuable for monitoring liver health and metabolic status, particularly under nutritional, environmental, or disease-related challenges. Moreover, GGT activity may be influenced by the bird's age and developmental stage [19–20]. The normal range is 18–35 IU/L for broilers. Figure 1 shows GGT values of 16–20 IU/L. Notably, in the control and first and third experimental groups, GGT is slightly below the normal range, although not alarmingly so. GGT levels are generally low under normal physiological conditions, and minor fluctuations are typically not clinically significant. Marked increases, however, can indicate liver or biliary tract dysfunction.

Serum total protein is a major indicator of broiler chicken health and metabolic status, reflecting both nutritional adequacy and physiological wellbeing. According to one study [21], factors such as nutritional management, health status, and immune function affect total protein levels in serum. Proteins like albumin help maintain osmotic pressure and transport essential nutrients, while globulins contribute to immune function. Elevated serum protein may indicate improved nutrient absorption and immune stimulation, whereas reduced levels can suggest protein deficiency, impaired liver function, or chronic illness. Consequently, monitoring total serum protein can help optimize feeding strategies and detect early metabolic or immune disturbances in broiler production.

**Table 2** Chemical Composition of Broiler Meat

| Test Parameter and Units | Control | N1 Experimental Group | N2 Experimental Group | N3 Experimental Group |
|---|---|---|---|---|
| Protein (%) | 20.59 | 21.81 | 21.94 | 21.6 |
| Fat (%) | 1.30 | 2.85 | 3.07 | 2.57 |
| Ash (%) | 1.31 | 1.33 | 1.31 | 1.31 |
| Energy Value (kcal per 100 g of product) | 114 | 114 | 116 | 124 |
| Moisture (%) | 73.64 | 74.54 | 70.89 | 71.92 |

From the data shown in Figure 1, total protein varies between 44 and 49 g/L, which is within the normal range of 43–60 g/L for broilers. Albumin, whose normal range is 31–35 g/L, is measured at 19–28 g/L partly below the lower boundary. However, total protein remains within normal limits. A decrease in albumin may be counterbalanced by a compensatory rise in globulin, which remains within its normal range of 12–25 g/L (measured between 18 and 21 g/L). This situation, normal total protein, lower albumin, and higher globulin can arise during mild immune activation or inflammation, where the organism produces more globulins (such as immunoglobulins or acute-phase proteins) without exceeding normal levels. It is also possible that albumin is being utilized or redistributed to meet specific physiological demands (e.g., tissue repair or stress responses). Under these circumstances, the lower albumin level is tolerable and does not constitute a critical deviation.

At 35 days of age, we also examined the effect of the arginine-containing iodine compound on the chemical composition of broiler meat. From each group, six birds (three females and three males) were slaughtered, and meat samples were taken for chemical analysis to determine the mass fractions of protein, fat, and ash. The results are shown in Table 2.

Broiler meat is widely recognized as a major and relatively inexpensive source of protein, playing a significant role in human nutrition. Because broiler meat protein is an excellent source of amino acids, its protein content was a particularly relevant parameter in the biochemical analysis. In all experimental groups, the protein content exceeded that of the control, with the highest level observed in the second experimental group-a 6.56% increase compared to the control. Another noteworthy finding is that the energy value was higher in all the experimental groups than in the control. Regarding moisture, the lowest value was recorded in the second experimental group (the same group with the highest protein content). As for ash content, it was nearly identical across all groups (1.31–1.33%).

Furthermore, the calorie content per 100 g of product was essentially the same among the control, first, and second experimental groups (114–116 kcal), whereas it was slightly higher in the third experimental group (124 kcal).

The chemical analysis of broiler meat shows that the chelated iodine-containing supplement significantly improves the meat's nutritional profile, quality, and market appeal. By increasing the protein content, it provides enhanced nutritional value for consumers seeking protein-rich foods, essential for muscle development and overall health. Additionally, the higher energy content reflects a nutrient-rich product that delivers more dietary energy per serving, an advantage when meeting increased energy demands. Moderate increases in fat content, alongside reduced moisture levels, improve the meat's taste, texture, and flavor, making it juicier and more appealing to consumers. Meanwhile, lower moisture content extends shelf life and boosts food safety by limiting bacterial growth. Overall, these traits make broiler meat enriched with a chelated iodine compound a premium market choice, offering a high-quality product that meets consumers' nutritional needs while also improving production efficiency and profitability for producers.

## 4. Conclusion

Based on the experimental study of the biological activity of the arginine-containing iodine compound under production conditions, the following conclusions can be drawn:

- In the experimental groups of broilers, the morphological blood indicators (hemoglobin, erythrocytes, leukocytes) were higher than in the control group yet remained within normal limits. The second experimental group was especially notable: its high levels of hemoglobin and erythrocytes suggest enhanced oxygen transport, promoting more intensive metabolism and accelerating growth. Although the leukocyte count was elevated, it remained within the normal range, indicating an activated immune response, while normal ESR values showed no signs of pronounced inflammatory processes.
- Most of the blood biochemical parameters (AST, ALT, total protein, globulin) in the studied broilers remained within normal limits, reflecting stable health. Although GGT and albumin levels were slightly below normal, this deviation was not critical because lower albumin was compensated by higher globulin levels within the normal range, likely due to mild immune activity or physiological stress. Overall, the test results did not indicate any serious pathological processes and reflected the normal physiological and metabolic status of the birds.

According to the analysis of dry matter components (including protein and fat concentration) and moisture content, supplementation of broiler feed with an arginine-containing iodine compound reduced moisture content in the meat of the second and third experimental groups and increased the concentration of dry matter components in all experimental groups compared to the control group.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

## References

[1] Chen J., Yan F., A. V. Kuttappan, Cook K. , Buresh B. , Roux M. , Hancock D., Mercedes Vázquez-Añón; "Effect of methionine and trace minerals (zinc, copper and manganese) supplementation on growth performance of

broilers subjected to Eimeria challenge"; Frontiers in Physiology, 2022, November Vol.13, 21; https://doi.org/10.3389/fphys.2022.991320;

[2] Devrim Saripinar Aksu; The effects of lower levels of organically complexed zinc, copper and manganese in broiler diets on performance, mineral concentration of tibia and mineral excretion Kafkas Üniversitesi Veteriner Fakültesi Dergisi, 2011, 17, 1, pp.141-146; https://www.researchgate.net/publication/272355373_

[3] Bykova E.V. , Voronin S.P. , Korobov A.P. , Vasiliev A.A. , Gumeniuk A.P. , Kudinov A.V. , Zimens Y.N. . Effect of Chelating Compounds of Microelements for Iodine Enrichment of Cow Milk; OnLine Journal of Biological Sciences 2018, 18 (3): 285.289 DOI: 10.3844/ojbsci.2018.285.289

[4] Tsyganova O.S. The influence of iodine casein in the early postembryonic period on the productive performance of broiler chickens [PhD dissertation]. All-Russian Scientific Research and Technological Institute of Poultry Farming ,2009. . https://www.dissercat.com/content/vliyanie-iodkazeina-v-rannii-postembrionalnyi-period-na-produktivnye-pokazateli-tsyplyat-bro

[5] Hunchak V. , Ratych I. B. ,. Gutyj B. V , Paskevych H. A. Metabolic effects of iodine in poultry for its deficiency or excess in the diet; Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series "Agricultural sciences" 2016; (18) No 2 ; DOI: https://doi.org/10.15421/nvlvet6716

[6] Alpeisov Sh.A.., .Moldakhmetova G.A. The Effect of the feed additive "Albit Bio" in combination with the probiotic "Torulact" on the productivity of broiler chikens; Stock-raising and veterinary; 2022, №1 (93) ISSN 2304-3334; https://doi.org/10.37884/1-2022/02

[7] Swaitkewicz S. , Arczewska-wlosek A. , Jozefiak D. The efficacy of organic minerals in poultry nutrition: review and implications of recent studies; World's Poultry Science Journal, 2014, Vol.70, (3), pp.475–486; DOI: https://doi.org/10.1017/S0043933914000531

[8] Vasini T. Chkuaseli A. , Chagelishvili A. , Beshkenadze I. , Klarjeishvili N. , Tchikaidze M. Synthesis and study of arginine-containing iodine chelates, World Journal of Advanced Research and Reviews, 2025 January,25(1):2424-24. https://www.researchgate.net/publication/388690516_Synthesis_and_study_of_arginine-containing_iodine_chelates

[9] Ulupi N. , Aryani S., Evni F. and Nugraha R. "Effects of Transportation Duration on Broiler Chicken Physiology and Performance Factors," International Journal of Poultry Science, 2018,Vol. 17: 197-204.,. DOI:10.3923/ijps.2018.197.204

[10] Rathaur, D. Rai C. , Km M. , Parvin R. and Mushtaq H. , "Growth performance and hematological traits of broiler chickens reared under assorted monochromatic light sources," Poultry Science, 2013,Vol. 92, Issue 6, pp.1461-1466. DOI:10.3382/ps.2012-02945

[11] Adegoke A.V., Abimbola M.A. and Sanwo K.A., "Performance and blood biochemistry profile of broiler chickens fed dietary turmeric (Curcuma longa) powder and cayenne pepper (Capsicum frutescens) powders as antioxidants," Veterinary and Animal Science, 2018,vol. 6, pp. 95-102.https://doi.org/10.1016/j.vas.2018.07.005

[12] Khajali F. "Managing broiler production challenges at high altitude," Veterinary Medicine and Science, 2022, March. https://doi.org/10.1002/vms3.784

[13] Kareem D. U. and Amos A. T. "Blood profile as a health indicator in broiler chickens fed diets of different particle sizes supplemented with multienzyme," Acta Technologica Agriculturae, 2024,p. 45–59,. DOI:10.2478/ats-2024-0005

[14] Ribeiro L. R. R. , Sans E. C. D. and Santos R. M. "Will the white blood cells tell? A potential novel tool to assess broiler chicken welfare," Veterinary Science, 2024,vol.11,. https://doi.org/10.3389/fvets.2024.1384802

[15] Boin Lee and Yonung Min Choi . "Association of Serum Glucose, Serotonin, Aspartate Aminotransferase, and Calcium Levels with Meat Quality and Palatability Characteristics of Broiler Pectoralis Major Muscle," Animals (Basel), 2022 , Yun,17,(12) 12: 1567. doi: 10.3390/ani12121567

[16] Bagno O. E. A. , "Physiological status of broiler chickens with diets supplemented with milk thistle extract," Veterinary world, 2021,May,14(5): 1319-1323.DOI:10.14202/vetworld.2021.1319-1323

[17] Senanayake S.S.H.. e. al., "Changes in the serum enzyme levels and liver lesions of broiler birds reared under different management conditions," Tropical Agricultural Research, 2015, vol. 26 (4): 584 – 595,. DOI:10.4038/tar.v26i4.8121

[18] Kim J. H. and Kil D. Y. , "Comparison of toxic effects of dietary organic or inorganic selenium and prediction of selenium intake and tissue selenium concentrations in broiler chickens using feather selenium concentrations," Poultry science, 2020,vol. 99(12): 6462–6473, https://doi.org/10.1016/j.psj.2020.08.061

[19] Mindan . Xing. Min Gao,Ping Han e. al "Characteristics of peripheral blood Gamma-glutamyl transferase in different liver diseases," Medicine (Baltimore), 2022,vol. 101(1):e28443. doi:10.1097/MD.0000000000028443

[20] Joao Paulo Rodrigue Bueno e.al. "Effect of age and cyclical heat stress on the serum biochemical profile of broiler chickens," Ciências Agrárias, 2017. vol. 38(3):1383-1392, DOI:10.5433/1679-0359.2017v38n3p1383

[21] S. E. B. B. &. N. O. Tóthová, "Changes of total protein and protein fractions in broiler chickens during the fattening period," Veterinary World, 2019,vol. 12(4): 598–604. doi: 10.14202/vetworld.2019.598-604