

Comparative study of morphology and hemato-biochemical parameters of *Gallus gallus domesticus*

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ABSTRACT

The aim of the current study was to characterize three different stages of *Gallus gallus domesticus*' morphology, hematology, and biochemistry. The findings of the study demonstrated that the ecological situation, origin and other environmental factors influence the morphology and hemato-biochemical parameters of the three different steps of *Gallus gallus domesticus*. Comparatively, the levels of hemoglobin in the three breeds were 11.5 g%, 14.8 g%, and 18.0 g%, and the levels of cholesterol were 205.0 mg%, 148.1 mg%, and 133.3 mg% (Broiler, Desi and Kadaknath). When compared to other breeds of *Gallus gallus domesticus*, Kadaknath had higher levels of protein, lipid, and glycogen that are appropriate for human consumption. All morphological, hematological and biochemical indicators in the Kadaknath breed were superior to those in other breeds.

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Introduction

Although several studies have compared the normal biochemical and hematological characteristics of commercial hybrid chickens to those of their industrial counterparts, very little is known about the comparison of blood profiles between the latter and their indigenous counterparts.

According to the Economic Survey 2009–2010, rural poultry accounts for 32.32 percent of Pakistan's total egg output and 16.4 percent of the country's total chicken meat production, it has been suggested in international media that indigenous livestock breeds are disappearing because they cannot compete economically with commercial kinds of cattle known for their much greater output rates¹¹.

To increase revenue for rural farmers and preserve genetic diversity among local breeds, chickens must be bred. Because EDTA is known to produce haemolysis of the red cells of crowned cranes⁸. Blood samples were taken from each breed using EDTA tubes and examined using Automated Hematology Analysis

to estimate hematological parameters of the blood. Analyzed The Desi, Broiler, and Kadaknath chickens, all had a PCE-210 error. Because of their resilience in the face of adversity and their capacity to fend off local illnesses, native rural breeds are a precious genetic resource for any nation. The chicken industry in many developing nations, including India, is still largely dependent on the indigenous gene pool. People in rural areas particularly continue to love it because of the belief that it has unique traits like as adaptation to harsh settings, resistance to certain diseases, and high-quality meat and eggs. As a major food supply (eggs and meat) and economic opportunity (particularly for women), poultry farming plays an important role in rural communities. Protein is the most abundant macronutrient in the human body since it is so crucial to survival¹⁵. In Madhya Pradesh, the Kadaknath chicken is known as "Kali masi," which literally translates to "the bird possessing black meat¹⁶."

Therefore, it was decided to evaluate the morphological features, hematological and biochemical

TABLE-1 : Comparison of Morphological characters of *Gallus gallus domesticus*

Sr. No	Characters	Broiler	Desi	Kadaknath
1	Colour	White-Plumage-Egg Shell. Yellow-skin.	Plumage color is red, yellow skin, color of egg is brown.	Plumage and almost all organs vary from grayish to black, color of egg is brown.
2	Comb	Single type.	Single	Single
3	Eyes	Bright.	Bright, rounded	Moderately large, little darker and round.
4	Abdomen	Soft.	Soft & pliable	Moderately softer.
5	Body size	Smaller comparatively with lower feed consumption but late maturity and High egg yield.	Comparatively smaller with good production potential.	Moderately long, Fairly deep, full, straight from front to rear".

values of the Broiler, Desi, and Kadaknath breeds to determine which would be the most productive and cost-effective under local climatic circumstances.

Materials and Methods

Hematology:

Each breed had an EDTA tube full of blood tested by an automated hematology analyzer (Errma PCE - 210) to determine the blood's hematological properties.

Biochemistry:

The current research was conducted at the Department of Zoology, P.V.P. College in Pravaranagar. Analysis of meat samples taken from Loni's sliding freezer. Three local breeds' biochemical parameters were analyzed. We took some fresh meat samples, dried them at 570 degrees Celsius, powdered them, and dissolved 1 g of the powder in 5% trichloroacetic acid. Technique¹² was used to determine the protein content in meat samples from three different chicken breeds; Standard method was used to determine the amount of glycogen present. Method³ was used to determine the amount of lipid present.

Results and Discussion

Morphological characters:

The morphological characters of three different breeds are shown (Table-1). The morphological characters of Broiler, Desi and Kadaknath are totally different due to their deposition of melanin pigment. The broiler chicken has white plumage, yellow skin and white

egg shell. The comb of broiler is single type and eyes color is bright. The Desi breed has red plumage, yellow skin and brown color egg. The comb single type and eyes color bright and round shape.

Kadaknath chickens are unlike the Desi or the Broiler variety because they deposit more melanin pigment. The feathers are black or dark gray, and the egg is a chocolate brown. The comb is a single part, and the eyes are a deep, rich brown.

Biochemical values of meat:

Table-2 displays the meat's biochemical values for three distinct breeds. It was shown that the protein, lipid and glycogen levels of the three breeds were significantly different from one another. The levels of protein, lipids, and glucose were shown to rise sequentially during the course of this research. The protein content of broiler meat is lower than that of Desi and Kadaknath chicken. Meat protein content ranges from 0.09 mg/g of tissue in Broilers to 0.225 mg/g of tissue in Desis and 2.7 mg/g of tissue in Kadaknaths.

The lipid and Glycogen concentrations were also compared in three breeds. In broiler meat, the lipid and carbohydrates concentration level was comparatively different in Desi and Kadaknath meat. In Broiler meat, lipid concentration was comparatively less (0.15 mg/g of tissue) with Desi and Kadaknath meat. In Desi meat, lipid concentration were compared with Broiler meat was slightly higher (0.2 mg/g of tissue). In Kadaknath meat the lipid concentration was high compared to other breed

TABLE-2: Comparison of egg albumin Protein in *Gallus gallus domesticus*

Sr. No	Properties	Albumin Protein (mg/g)
1	Broiler	0.135
2	Desi	0.175
3	Kdaknath	0.2

(0.24 mg/g of tissue).

The Glycogen concentration in Broiler meat is 0.22 mg/g of tissue is compare to less in Desi (0.24 mg/g of tissue) and Kadaknath (0.3 mg/g of tissue).

Biochemical values of egg albumin:

Table-3 displays the biochemical parameters of egg albumin from three distinct breeds. We also measured the protein content of egg albumen from three different breeds and confirmed our earlier findings.

Concentration in Kadaknath egg albumin is higher than Desi and Broiler egg albumin. The protein concentration in Broiler 0.135 mg/g, Desi is 0.175mg/g and Kadaknath is 0.2 mg/g.

Hematological values:

Table 4 displays hematological results for three distinct indigenous breeds. Several variables, including age, sex, season, and diet, have proved to affect hematological parameters in birds. Changes in the body's physiology and metabolism during the day have a significant impact on hematological markers. Hb, WBC, Differential count, Cholesterol, and Sugar were all elevated. In comparison to Desi (14.8 g%) and Kadaknath (18.0 g%), broiler (11.5 g%) Hb (g/dl) levels were lower in this research. The results of WBC were lower in Broiler (17100 cumm-3), comparatively Desi (22200 cumm-3) and Kadaknath (24500 cumm-3). The

cholesterol level in Broiler was higher than other breeds.

Discussion

Three breeds were differentiated by their hematological parameters. The mean values of blood glucose (312.5 mg/dL) and cholesterol (148.1 mg/dL) in the current investigation were similar to those reported by earlier workers⁴ who found serum glucose (226.74 mg/dL) and cholesterol (138.7 mg/dL) in Desi birds. When compared to the broiler breed, which had lower concentration of glucose, the high-laying Desi strain benefited more from the higher concentration.

It was discovered that there was variation in serum cholesterol level in various strains (Kadaknath, Desi and Broiler). The serum cholesterol levels of Kadaknath, Desi, and Broiler chickens were all within the normal range in the present study¹⁹.

In present study, the protein in broiler meat (0.09 mg/g) was less than other breeds Desi meat (0.225 mg/g) and Kadaknath meat (2.7 mg/g). Earlier reports⁹ showed the value of protein in broiler meat (23.09 %) and desi breed meat (24.18%) which were comparatively

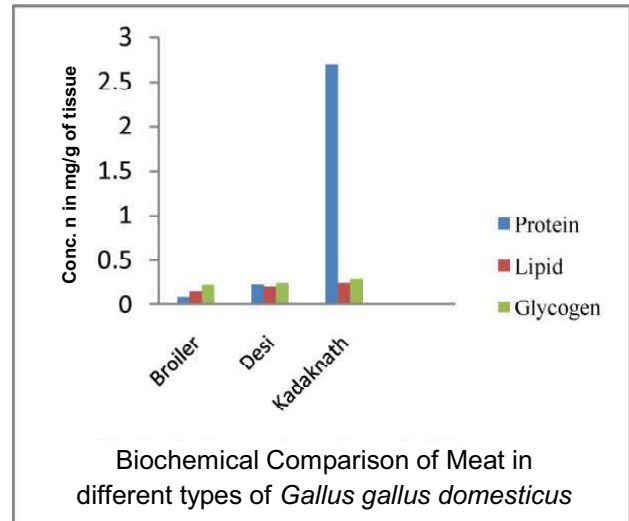


Fig. 1 : Biochemical Comparison of Meat in different Species of *Gallus gallus domesticus*

TABLE-3 : Comparison of biochemical values of meat in different species of *Gallus gallus domesticus*

Sr.No.	Contents	Protein (Mg/g of Tissue)	Lipid (Mg/g of Tissue)	Glycogen (Mg/g of Tissue)
a	Broiler	0.09	0.15	0.22
b	Desi	0.225	0.2	0.24
c	Kadaknath	2.7	0.24	0.3

TABLE-4 : Comparison of hematological parameters in different stages of *Gallus gallus domesticus*

Sr. No.	Parameters	Breed of fowls		
		Broiler	Desi	Kadaknath
1	Hb (g/dl)	11.5 g %	14.8 g %	18.0 g %
2	WBC (cumm-3)	17100	22200	24500
	a. Neutrophils (%)	52	20	34
	b. Lymphocytes (%)	44	76	63
	c. Eosinophils (%)	02	3	2
	d. Monocytes (%)	02	1	1
	e. Basophiles (%)	00	00	00
3	Cholesterol (mg %)	205.0	148.1	133.3
4	Sugar (mg %)	200	312.5	262.5

high.

The lipid value in broiler meat (0.15 mg/g) is also lower than other, Desi meat (0.2 g/mg) and Kadaknath meat (0.24) is little higher than desi meat. The lipid level in Broiler meat is (0.34 %) and Desi (0.12) in earlier report⁹.

In present research work, protein level of Kadaknath meat (2.7 mg/g) is higher than other breed, Desi (0.225 mg/g).

Conclusion

One might get the conclusion that the Kadaknath breed did better than the Broiler breed and the Desi breed as a whole. Kadaknath chickens have greater protein, lipid, and glycogen levels, as well as better hematological profiles, than either the Desi or Broiler breeds. According to the results of the hematological analysis, the Kadaknath has greater resistance strength against

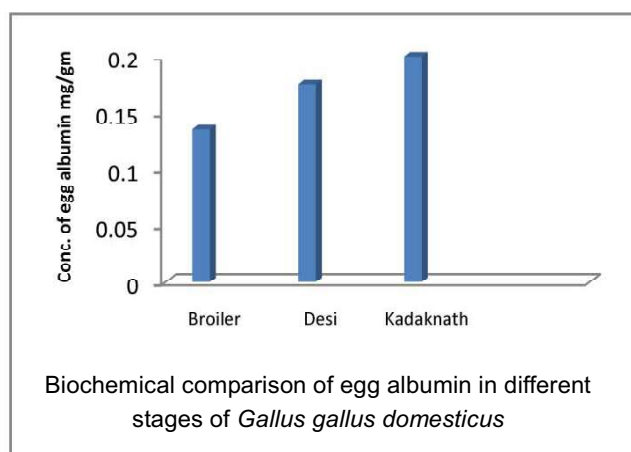


Fig. 2 : Biochemical Comparison of egg in different types of *Gallus gallus domesticus*

sickness, and its meat and eggs are beneficial to human health.

References

1. Albert L Lehniger. Principles of biochemistry, Ed.-5th. 1954; pp. 110-135.
2. Adeyemo I A, Sani A. Hematological Parameters' and serum biochemical indices of broiler chickens fed aspergillusniger hydrolyzed cassava peel meal based diet. *International Journal of Research and Reviews in Applied Sciences/IJRRAS*. 2013; **15** (3) : 410-415
3. Barnes H, Bradstock ZJ. Estimations of lipid in marine animal and tissue. *J. Expt. Mar. Biol. Ecol.* 1973; **12** (1):103-118.

4. Bhatti BM, Talat T, Sardar R. Glucose, total proteins, uric acid and triglycerides concentrations in blood of native laying hens. *Pakistan Veterinary Journal*. 2001; **21**(4):222-223.
5. Christine Hawkey RA, Kock GM Henderson, Cindery RN. Haematological changes in domestic fowl (*Gallus gallus*) and cranes (*Gruiformes*) with Mycobacterium avium infection, *Avian Pathology*. 2007; **19**: 223-234.
6. Duwa H, Saleh B, lamido M, Saidu A. Growth, Hematological and Serum Biochemical indices of broiler chickens fed banana peel meal as replacement for maize in the semi-arid zone of Nigeria, *Online Journal of Animal and Feed Research*. 2014; **4** (5) : 121-126.
7. Economic Survey. Government of Pakistan, finance division. Islamabad (Pakistan): *Economic Advisory Wing*. 2009-2010.
8. Hawkey CM, Samour HJ, Ashton DG, Hart MC, Cindery RN, Ffinch JM, Jones DM. Normal and clinical hematology of captive cranes (*Gruiformes*). *Avian Pathology*. 1983; **12**: 73-84.
9. Jaturasitha S, Leangwunta V, Leotaragul A, Phongphaew A, Apichartsrungkoon T, Simasathitkul N, Vearasilp T, Worachai L, terMeulen U. A Comparative Study of Thai Native Chicken and Broiler on Productive Performance, Carcass and Meat Quality. Deutscher Tropentag Witzenhausen, Conference on International Agricultural Research for Development. 2002.
10. Jayaraman J. Laboratory manual in Biochemistry, Ed.-1st. 1984; 65- 66.
11. Kiani-Manesh HR. Estimation of (co) variance components of economically important traits in Iranian native fowls [Master's thesis]. Bablosar (Iran): Mazandaran University. 2000.
12. Lowry OH, Rosenbrough NJ, Farr AL Estimation of total protein. *J. Biol. Chem.* 1951; **193** : 265-275.
13. Natt. MP, Herrick CA. New blood diluents for counting the erythrocytes and leucocytes of the chicken *Poultry Sci.* 1952; (3) 735-738.
14. Nicholas V, Robert C, Longley W, Joseph H R Determination of glycogen in liver and muscle by using Anthrone reagent. *J. Biochem.* 1956; **22** : 583-587.
15. Okuzumi M, Fujii T. Nutritional and functional properties of squid and cuttle fish, 35th Anniversary of commemorative publication. 2000; p 223.
16. Parmar SNS. "Systematic Survey and Genetic characterization of Kadaknath Breed of Poultry using Specific Microsatellite DNA markers". Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur (M.P) Technical Bulletin DRS. Department of Animal Breeding & Genetics College of Veterinary Science & Animal Husbandry. 2003.
17. Ripon Kumar Dutta, M. Saiful Islam, Md. Ashraful Kabir.: Hematological and Biochemical Profiles of *Gallus* Indigenous, Exotic and Hybrid Chicken Breeds (*Gallus domesticus* L.) from Rajshahi, Bangladesh, *Bangladesh J. Zool.* 2013; **41**(2): 135-144.
18. Sonune MB. Biochemical Studies of Gastrointestinal Cestode Parasites in *Ovis Bharal* (L.) from Vidharbha Region. 2012; **3**(3): 321-322.
19. Tabinda Khawaja, Sohail Hassan Khan, Nasir Mukhtar, Mian Asghar Ali, Tanveer Ahmed, Abdul Ghafar. Comparative study of growth performance, egg production, egg characteristics and haemato-biochemical parameters of Desi, Fayoumi and Rhode Island Red chicken. *Journal of Applied Animal Research*. 2012; **40** (4): 273-283
20. Tufan Kececi, Ramazan Col. Hematological and biochemical values of the blood of Pheasants (*Phasianus colchicus*) of different ages, TUB0TAK Turk. *J. Vet. Anim. Sci.* 2011; **35**(3): 149-156.