



BROILER AND INDIGENOUS CHICKENS: A COMPARISON THROUGH BIOCHEMICAL PARAMETERS

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ABSTRACT

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In recent years, broiler farming has expanded much rapidly than that of indigenous chickens all over the world to meet the demand of animal protein. Serum biochemical parameters of chickens provide valuable information for the evaluation of their health status which might ultimately affect the consumers. In this study, we have compared these parameters for indigenous and broiler chickens. MANOVA, ANOVA and t-test were performed to compare the clustered and individual blood parameters according to two species of chickens. This experiment revealed that the serum lipid profile and liver functioning parameters are significantly different for the two species of chickens. The average level of these parameters was found significantly lower for indigenous chickens as compared to those of broiler chickens. This might have been brought about by the food habit of two species. Moreover, only AST was found greater for indigenous chicken. It might be suggested that indigenous (local) chicken is more suitable to the consumers due to a comparatively healthier levels of biochemical parameters.

Contribution/Originality: The paper's primary contribution is the finding that average levels of all biochemical parameters except AST are significantly lower for indigenous chicken as compared to broiler chicken. This can be considered as a guideline to the consumers in deciding which species of chickens are to be consumed. We confirm that this work is original and no part of the work has been published before.

1. INTRODUCTION

The poultry sector is a dynamic sector which has potentiality not only for meeting protein supply but also for rapid poverty reduction through employment and income generation in Bangladesh. Commercial poultry farming has become very popular by creating employment opportunities for rural farmers, retailers, traders, service providers, entrepreneurs, etc. The current poultry production system in Bangladesh classified into four main categories: i) traditional rural backyard scavenging systems ii) semi-scavenging systems iii) commercial farming

systems and iv) contract farming or integrated systems (Dolberg, 2008). A wide range of variations exists among different breeds of chicken in relation to body weight, plumage and skin color, feathering and comb type (Singh, 2001). Information on morphological, diversity, scavenging behavior, product quality, and disease resistance along with molecular markers contribute to defining breed identity of village chickens (Tixier-Boichard, Bordas, & Rognon, 2009).

Native indigenous chicken, broiler, and layer are commercially produced for consumption in Bangladesh (Miah, Chowdhury, & Bhuiyan, 2016). The national share of commercial strain of chickens to indigenous chicken (local chicken) in terms of egg production is almost equal (50:50) and that of meat production is 60:40 in Bangladesh, although the growth rate of indigenous chicken is slower than the commercial broiler when raised under the same commercial conditions (Bhuiyan, 2011). The live weight of broiler at age 28 to 35 days is 1.4-1.8 kg, while the same live weight of indigenous chicken requires approximately 6 months. The production costs of the indigenous (local) chicken are comparatively lower as farmers generally simply raise them as a free-range using any organic feed. The consumers preferred widely meat and eggs of indigenous poultry because of good taste, lean meat, better skin-color (Chowdhury, 2013) although they are costlier than commercial broilers. Indigenous scavenging chicken's meat and eggs are widely available in Bangladesh (Hossain, Nishibori, & Islam, 2012). In recent times, broiler farming is growing to meet the demand for animal protein exceeding the growth of the indigenous (local) chicken rearing industry. Consumers prefer extensively the meat and egg of indigenous (local) chickens, owing to their lean meat (less fat and cholesterol), more protein content, taste, pigmentation and suitability for special dishes although the price is higher. In some respect, the market price of per kg lives indigenous chicken is almost double than that of broiler (Islam & Nishibori, 2009). Nowadays, new researches have been developed focusing on village chickens in many African and Asian countries (Aberra, 2011; Ladokun et al., 2008; Pampori & Iqbal, 2007). Several studies have evaluated normal biochemical and hematological parameters of industrial and commercial hybrid chickens (Meluzzi, Primiceri, Giordani, & Fabris, 1992; Talebi, Asri-Rezaei, Rozeh-Chai, & Sahraei, 2005).

Serum biochemical profiles of chickens provide valuable information for the evaluation of health status which reflects many metabolic alterations of organs and tissues (FAO, 1997). The biochemical parameters of indigenous chickens and broiler chickens differ from each other in various regions of the world (Kalita. & Bhakat, 2011; Pampori & Iqbal, 2007; Simaraks, Chinrasri, & Aengwanich, 2004). Biochemical profile investigation of indigenous (local) and broiler chickens is very important for accurate interpretation of health status (Pampori & Iqbal, 2007). The enzymes Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) estimated to determine the liver functions and Creatinine for kidney functions (Younis, El-Edel, Nasr, Mahrous, & Aboghanima, 2016). Antibiotic, toxic binder, hormone, and miscellaneous growth promoters are often supplied with the diet used in commercial broiler farming which may have harmful effects on chickens and thereafter on humans (Langhout, 2000). So it is very important to know the overall meat quality between two species of chicken (broiler and indigenous). In this regard, we have compared some biochemical parameters between broiler and indigenous (local) chicken collected from the market in Bangladesh.

2. METHODS

2.1. Animal and Experiment

For this study, seventy broiler chickens of 35th day age and fifteen indigenous (local) chickens of usual consuming size were randomly selected from a local market of Sylhet, Bangladesh. Chickens were weighed and blood samples were collected from the wing vein at the fasting period. Thereafter serum was separated and Lipid profile (Cholesterol, Triglycerides, High-density lipoprotein (HDL), Low-density lipoprotein (LDL)), Liver function (Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST)) & Kidney function parameter (creatinine) were measured.

The animal experiments were carried out in accordance with the U.K. Animals (Scientific Procedures) Act, 1986 and associated guidelines, EU Directive 2010/63/EU for animal experiments. The field and laboratory experiments were conducted in May 2016.

2.2. Statistical Analysis

MANOVA, ANOVA and t-test were performed to compare the group variables (clustered parameters) and individual blood parameters according to two species of chickens.

3. RESULTS AND DISCUSSION

We have desired to test the hypothesis that the group means level of biochemical parameters for both the species are equal against the alternative that the group means are different. As the assumption of homogeneity of variance-covariance violated, we could use the Pillai's Trace test (a test statistic that is very robust and not highly linked to assumptions about the normality of the distribution of the data).

Table 1 shows that the MANOVA test is significant as Pillai's Trace=0.66, $F(4, 80)=38.62$, $p<0.001$, and noncentrality parameter=154.50. This indicates that there exist significant differences between the group mean of lipid profile for two chicken species; the $\eta^2=0.66$ indicates that approximately 66% of the multivariate variance of the dependent variables is associated with the group factor.

Table-1. Effects of chicken's species on serum lipid profile of chicken at finisher period (Multivariate Tests using Pillai's Trace).

Effect	Response	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncentrality Parameter	Observed Power
Species	Lipid profile (TC,TG,HDL & LDL)	0.66	38.62	4	80	0.00	0.66	154.50	1.00

Since the MANOVA test was found significant, we examined the univariate ANOVA in Table 2. The response variables cholesterol, triglycerides, HDL and LDL were found significantly different for chicken species and revealed that the mean value of all lipid profile parameters was significantly greater for broiler chicken as compared to indigenous chicken.

These results partially support (Abdi-Hachesoo, Talebi, & Asri-Rezaei, 2011; Kalita, Sultana, Roy, & Bharali, 2018) findings that significant differences observed only for cholesterol values for hens of indigenous and broiler; and Sirri, Castellini, Roncarati, Franchini, and Meluzzi (2010) findings that a lower lipid content exist in meat from slow-growing Brown Classic Lohman (SG) birds than that from fast-growing Cobb 700 (FG) birds.

Table-2. Species influence on serum lipid profile of chicken's at finisher period.

Dependent Variable	Species	Mean	SE	95% CI for mean difference		F	Sig.
				Lower Bound	Upper Bound		
Cholesterol	Broiler	209.50	5.67	198.22	220.79	57.44	0.00
	Indigenous	107.13	12.26	82.76	131.51		
Triglycerides	Broiler	168.51	5.96	156.65	180.38	82.13	0.00
	Indigenous	39.87	12.88	14.25	65.49		
HDL	Broiler	131.31	5.84	119.71	142.92	4.06	0.04
	Indigenous	103.33	12.61	78.26	128.41		
LDL	Broiler	81.94	4.19	73.61	90.28	31.66	0.00
	Indigenous	25.80	9.06	7.79	43.81		

Pillai's Trace test for MANOVA in Table 3 revealed that there exists significant difference in liver functioning variables for two species of chickens. Here, partial eta square (η^2)= 0.51 indicates that approximately 51% of multivariate variance of the dependent variables is associated with the group factor.

Table-3. Effects of chicken's species on serum liver functions at the finisher period (Multivariate tests using Pillai's Trace).

Effect	Response	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncentrality Parameter	Observed Power
Species	Liver functions (ALT,AST)	0.51	42.14	2	82	0.00	0.51	84.28	1.00

Through ANOVA, we can find out the specific components of liver functions that varied significantly. Table 4 revealed that the liver function parameter AST was significantly different for two species of chicken and the mean level of AST is greater for indigenous chicken as compared to broiler while another parameter ALT was found insignificant.

Table-4. Species influence on liver functions of chicken's at the finisher period.

Dependent Variable	Species	Mean	SE	95% CI for mean difference		F	Sig.
				Lower Bound	Upper Bound		
ALT	Broiler	7.56	0.54	6.49	8.63	0.73	0.39
	Indigenous	6.47	1.16	4.16	8.78		
AST	Broiler	170.30	11.24	147.95	192.65	64.68	0.00
	Indigenous	385.47	24.28	337.18	433.76		

The independent samples t-test in Table 5 showed that the mean weight was significantly different for two species of chicken. The mean weight of broiler was 2235.10 gm; whereas, for the indigenous chicken it was 830.27 gm. Moreover, creatinine was found significantly different for two species and the mean values for broiler and indigenous chickens were 0.41 and 0.35 respectively.

Table-5. Effects of chicken's species on body weight and creatinine of chickens at finisher period (Independent samples t-test).

Parameters	Species	Mean±SD	t-value	p-value	Mean difference	95% CI for mean difference	
						Lower Bound	Upper Bound
Body weight	Broiler	2235.10±249.59	21.14	0.00	1404.83	1272.66	1537.01
	Indigenous	830.27±127.98					
Creatinine	Broiler	0.41±0.07	2.36	0.02	0.06	0.01	0.12
	Indigenous	0.35±0.17					

Investigation of the serum biochemical profile of indigenous and broiler is very important for information about the chicken's health status (Pampori & Iqbal, 2007). In this study, we have compared these parameters for the most common two species of chickens in Bangladesh. A significant difference was found between broiler and indigenous (local) chicken for clustered (multivariate) biochemical parameters i.e., serum lipid profile and liver function parameters and also individual parameter. All of the four serum lipid profile parameters, body weight and creatinine levels were found significantly greater for broiler as compared to indigenous chicken. The fact behind it might be the food habit and the rearing style of the two species. It is true that indigenous chickens mostly live on natural feed, whereas broiler chicken is fed different hormonal and fatty feed to increase the weight within a short period. Nevertheless, the AST level was found significantly lower for broiler chicken. Overall, it can be recommended that indigenous (local) chicken is more suitable to the consumers due to the comparatively low level of biochemical parameters at the usual finisher period, although the former is more expensive with lower body weight.

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