INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 14, No. 5, p. 225-234, 2019

RESEARCH PAPER OPEN ACCESS

Hemato-biochemical profile carcass and meat quality traits of Naked Neck Rhode Island Red (RIR) and Black Astralorpe (BAL) chicken

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Key words: Blood Profile, Biochemistry, Carcass Trait, Meat Quality.

http://dx.doi.org/10.12692/ijb/14.5.225-234 Article published on May 10, 2019

Abstract

The present research aimed to evaluate the hemato-biochemical profile, carcass characteristics and meat quality traits of three genotypes Naked Neck (NN), Rhode Island Red (RIR) and Black Australorpe (BAL). A total of 45 birds having age of fourteen weeks, 15 birds of each genotype were randomly divided into three experimental groups having 05 birds in each replicate. Comparative hemato-biochemical profile, total protein, albumin and globulin of three genotypes were estimated using standard methods. Carcass traits were analyzed after careful evisceration, carcass dissected into edible, inedible parts separately weighed and calculated in percentage. The pH of carcass measured through Calibrated pH meter and water holding capacity (drip loss of meat) was measured using bag method. Hemato-biochemical analysis showed no significant (P>0.05) variation in all blood parameters.The total inedible parts were differed significantly (P<0.05) as NN had higher inedible percentage among three genotypes. In carcass yield, breast (%), drumstick (%), thigh yield (%) was higher significantly (P<0.05) for BAL to RIR and NN chicken. The gizzard, heart, liver (giblets) (%) was significantly (P<0.05) higher for Black Astralorpe and Rhode Island Red compared to naked neck Chicken.The edible carcass yield (%) was significantly higher for Black Astralorpe (70.10±2.1), Rhode Island Red (69.87±1.4) and lowest for Naked Neck (NN) genotypes. pH and drip loss (quality) of meat was found non-significant (P>0.05). In conclusion, the genotypes have same feature of hemato-biochemical profile proved good health status, carcass characteristic data for better breeding plan and good quality meat.

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Introduction

Blood play a vital role in nutrient transportation, waste products and exchange of gases in the body. The blood examination focuses on the cellular component and its chemical constituents (Hrubec *et al.*, 2002) whereas blood profile may be exploited in nutritional studies and improvement of chickens stock (Ladokun *et al.,* 2008). The variation in blood profile of different types of birds as Naked Neck (Pampori and Iqbal, 2007), Cobbs broiler (Barreiro *et al.*, 2009) and laying birds (El- Gendy *et al.*, 2011) are associated with age, sex, stocking density, nutrition and environmental condition. (Azeez *et al.*, 2009) reported that variation in blood profile of chicks under the same age and managemental condition was found based on blood sampled at different time interval of the day depends on physical activity (Islam, *et al.*, 2004), feed change (Ugwu *et al.*, 2008) and polluted water consumption (Akporhuarho, 2011).

The biochemical profile of blood as serum protein used as indirect measurement of dietary protein quality (Alikwe *et al.*, 2010) whereas decline in blood cells, indicates anemic condition and exposes the flock to infection (Akporhuarho, 2011). Recently, (Ali *et al.*, 2011) reported serum cholesterol and lipid significantly drop in post hatch chick broiler chicks.

However, blood examination can assess health status of animals and may serve as basic tool for assessing comparative poultry pathology and immune status of bird (Bonadium, 2009).

In poultry production, high carcass yield provide more profit to farmers and satisfaction to consumer. The carcass and parts yield of fast growing bird's present higher yield in comparison with slow growing birds which exists higher thighs and drumstick yield (Fanatico *et al.*, 2005). Literature has shown that indigenous birds slaughtering age affect meat flavor (Jaturasitha, 2004) while sex affect carcass yield both sexes with female higher breast yield, male higher thighs, blood and feathers yield (Musa *et al.*, 2006; Takahashi *et al.*, 2006).

The research exposed that pH of muscles of chicken is lower while higher muscle pH linked with red meat (Allen *et al.*, 1998). The low pH in biceps muscles was reported by (Chuaynukool *et al.*, 2007) of indigenous birds in comparison to broilers.

The quality of meat is maintained on storage at 4°C for certain period of time as for chicken meat it range from 12- 24 hours, on this flavor and tenderness are improved (Takahashi, 1996).The storage temperature increase shelf life of meat, chilled poultry meat at 2-4°C shelf life is maximum two days, however shelf life can be extended up to six months when kept under storage of -20°C (Mountney and Parkhurst, 1995). Storage of meat affect water holding capacity and influence quality processing, low water holding capacity results to inferior meat products (Huff-Lonergan and Lonergan, 2005).

In recent year trend toward preference of organic meat with no or permissible limit of chemicals in livestock chain which contain low water footmark is developed in different parts of the globe (Fanatica *et al.*, 2005; Hoekstra, 2012). The demand of organic meat has increased due to consumer liking of meat flavor and texture, low footmark and professed health benefits (Dyubele *et al.*, 2010; Hoekstra, 2012). However, no literature information for carcass characteristics of indigenous Naked Neck and exotic Rhode Island Red and Black Astralorpe is available. The indigenous birds led to slaughter and sell out without looking for carcass characteristics and composition.

Material and methods

Hemato-biochemcial parameters

A total of 45 birds, fourteen weeks-old, 15 each of NN, RIR and BAL were randomly divided into three experimental groups having 05 birds in each replicate. Blood samples from each replicate were collected for assessment of complete blood count of birds. Red blood cells (RBC) and white blood cells (WBC) were estimated by hemocytometer (Campbell, 1995). Haemoglobin level on Sahli's Apparatus, packed cell volume (PCV) on microhaematocrit

method and erythrocyte indices were estimated from RBCs, Hemoglobin and packed cell volume respectively (Ritchie *et al.*, 1994). In blood biochemistry total protein, albumin and globulin was determined using standard methods. The total protein concentration was measured calorimetrically as described by Doumas *et al.*, (1981).

Carcass yield and meat quality characteristics

Total 30 birds were selected 10 from each genotype for meat quality and carcass determination. The birds were sacrificed, weighed and de-feathered.

The birds carcasses were dissected, eviscerated and cut in parts. The carcass yield analysis estimated both edible carcass parts as pectoral muscles (%) breast muscles (%), thigh (%), drumsticks (%), giblets (%) and the inedible carcass parts include blood (%), feathers (%), leg (%) and head (%).The pH of carcass was measured after slaughtering using calibrated pH meter. Meat sample (10 g) from different parts (pectoral muscle, breast and thighs) was cut separately, blended with distilled water (1:5) in blender and pH was measured at room temperature (20-25^{o}C).The water holding capacity (drip loss of meat) was measured after storing at 4^{o}C for period of 01, 07 and 14 days using bag method (Honikel, 1997).

Statistical analysis of data

The experiment was conducted on completely randomized design (CRD) and collected data were analyzed using analysis of variance (ANOVA) and significant difference of means between genotype groups were calculated using least significant test (LSD) test at probability level (5%) (SAS, 2001).

Results

Comparative hemato-biochemical profile of Naked Neck, Rhode Island Red and Black Astralorpe chicken

Comparative haemato-biochemical profile include RBCs, WBCs, Hemoglobin, PCV, MCV, MCH, MCHC, total protein, albumin and globulin of the three genotypes were studied.

Haemato-biochemical analysis showed no significant (P>0.05) variation in all blood parameters and the values were found in normal range (table 1).

Table 1. Comparative hemato-biochemical profile of Naked Neck, Rhode Island Red and Black Astralorpe chicken.

Parameters	Genotype			P. Value
	NN	RIR	BAL	
	Mean ± SE	Mean ± SE	Mean ± SE	
Hematological indices				
RBC (x 10^6/ul)	2.11±0.18	2.14± 0.12	2.13±0.10	NS
WBC (x 10^3/ul)	3.85±0.24	3.83±0.29	3.87±0.32	NS
HB (g/dl)	8.12±0.02	8.19±0.04	8.32±0.09	NS
PCV (%)	29.3±0.22	28.6±0.14	28.8±0.12	NS
MCV (fL)	138.86±1.62	133.64±1.84	135.21±1.56	NS
MCH (pg)	38.4±0.13	38.2±0.14	39.0±0.18	NS
MCHC (g/dl)	27.7±0.42	28.6±0.12	28.9±0.14	NS
Biochemical indices				
Total Protein (g/dL)	5.80± 0.22	5.73±0.14	5.76±0.12	NS
Albumin (g/dL)	3.41±0.34	3.37±0.29	3.39±0.32	NS
Globulin (g/dL)	2.39± 0.16	2.36±0.13	2.37±0.18	NS

NS, Non-significant difference.

Naked Neck (NN), Rhode Island Red (RIR) Black Astralorpe (BAL).

Comparative inedible carcass parts of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe

Comparative inedible carcass parts of male chickens of the three genotypes are presented in (table 2) .Inedible parts blood (%), feather (%), leg (%) and head (%) was found significant among three genotypes. The percent blood, leg and head was significantly higher in Black Astralope (BAL) and Rhode Island Red (RIR) as compared to Naked Neck chicken, while feather (%) was higher of Naked Neck. The total inedible parts were differed significantly (P<0.05) as Naked Neck (NN) had higher inedible percentage among genotypes.

Table 2. Comparative inedible carcass parts of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe.

Parameters	Genotype			P. value
	NN	RIR	BAL	
	Mean ± SE	Mean ± SE	Mean ± SE	
Blood (%)	4.12^{b}±0.16	4.65^{a}±0.12	4.68^{a}±0.13	***
Feathers (%)	7.50^{a}±0.42	5.57^{b}±0.18	5.17^{c}±0.12	***
Leg (%)	4.32^{b}±0.09	4.63^{a}±0.08	4.69^{a}±0.16	***
Head (%)	4.45^{b}±0.12	4.74^{a}±0.10	4.76^{a}±0.11	***
Inedible %	20.39^{a}±0.28	19.59^{b}±0.32	19.30^{c}±0.24	***

Small letters ($^{a-c}$) on means in rows indicate significant difference at P>0.05; (***),
Naked Neck (NN), Rhode Island Red (RIR) Black Astralorpe (BAL).

Small letters ($^{a-c}$) on means in rows indicate significant difference at P>0.05; (***), Naked Neck (NN), Rhode Island Red (RIR) Black Astralorpe (BAL)

Comparative edible carcass parts of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe

The edible carcass (%) of three genotypes shown in (table 3). The different carcass parts showed significant (P>0.05) difference on carcass yield of three genotype. The pectoral muscle (%), was significantly different among the three genotypes.

The breast (%), drumstick (%) thigh yield (%) was higher significantly (P<0.05) for Black Astralorpe (BAL) to Rhode Island Red (RIR) and Naked Neck (NN) chicken.

Table 3. Comparative edible carcass parts of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe**.**

Parameters	Genotype			P. value
	NN	RIR	BAL	
	Mean ± SE	Mean ± SE	Mean ± SE	
Pectoral muscle (%)	10.59^{c}±0.056	11.55^{b}±0.056	12.19^{a}±0.056	***
Breast muscle (%)	10.45^{b}±0.17	11.46^{a}±0.12	11.72^{a}±0.06	***
Thigh (%)	5.17^{b}±0.18	5.86^{a}±0.33	5.84^{a}±0.12	***
Drumstick (%)	5.07^{b}± 0.16	5.75^{a}±0.14	5.78^{a}±0.32	***

Small letters ($^{a-b}$) on means in rows indicate significant difference at P>0.05; (***),
Naked Neck (NN), Rhode Island Red (RIR) Black Astralorpe (BAL).

Comparative edible carcass parts of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe

The dressing (%) of the three genotypes presented in (table 4). The edible carcass dressing percentage revealed significant difference among three genotypes.The gizzard, heart, liver (giblets) (%) was significantly (P<0.05) higher for Black Astralorpe and Rhode Island Red compared to Naked Neck chicken. The edible carcass yield (%) was significantly higher value for Black Astralorpe (70.10±2.1), Rhode Island Red (69.87±1.4) and lowest for Naked Neck (NN) genotypes.

Table 4. Comparative edible carcass parts of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe.

Parameters	Genotype			P. value
	NN	RIR	BAL	
	Mean ± SE	Mean ± SE	Mean ± SE	
Dressing%	63.4^{b}±1.4	64.86^{a}±1.3	64.91^{a}±2.1	***
Gizzard%	1.81^{b}±0.06	2.14^{a}±0.07	2.18^{a}±0.03	***
Liver%	1.87^{b}±0.03	2.28^{a}±0.07	2.30^{a}±0.06	***
Heart%	0.47^{b}±0.03	0.58^{a}±0.02	0.60^{a}±0.02	***
Giblets%	4.16^{b}±0.13	5.01^{a}±0.13	5.09^{a}±0.12	***
Edible meat %	67.56^{b}±1.2	69.87^{a}±1.4	70.10^{a}±2.1	***

Small letters ($^{a-b}$) on means in rows indicate significant difference at P>0.05; (***),
Naked Neck (NN), Rhode Island Red (RIR) Black Astralorpe (BAL).

Comparative meat quality (pH and drip loss with storage) of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe

The comparative pH of drumstick and breast muscles revealed no significant (P< 0.05) in pH value of three genotype of chicken. Meat pH of three genotype have numerical difference in pH value as Naked Neck chicken have high value of pH than other chicken. The storage of meat increases the drip loss with no significant difference with different time interval (table 5).

Table 5. Comparative meat quality (pH and drip loss with storage) of male chicken of Naked Neck, Rhode Island Red and Black Astralorpe.

Parameters	Genotype			P.value
	NN	RIR	BAL	
	Mean ± SE	Mean ± SE	Mean ± SE	
pH				
Breast muscles	6.07^{a}±0.03	5.82^{a}±0.04	5.97^{a}± 0.01	NS
Drum stick	6.28^{a}±0.05	6.21^{a}±0.05	6.17^{a}±0.04	NS
Drip loss (%)				
Storage (24 hrs)	2.26^{a}±0.02	2.33^{a}±0.05	2.41^{a}±0.06	NS
Storage (7) days	4.23±0.14^{ab}	4.46±0.16^{a}	4.53±0.10^{a}	NS
Storage (14 days)	6.46±0.12^{a}	6.58±0.17^{a}	6.62±0.13^{a}	NS

Small letters ($^{a-b}$) on means in rows indicate significant difference at P>0.05; (***),
Naked Neck (NN), Rhode Island Red (RIR) Black Astralorpe (BAL).

Discussion

Comparative haemato-biochemical profile include RBCs, WBCs, Hemoglobin, PCV, MCV, MCH, MCHC, total protein, albumin and globulin of the three genotypes were studied. Haemato-biochemical analysis showed no significant (P>0.05) variation in all blood parameters and the values were found in normal range (table 1). The analysis of haemato-biochemical profile of chicken is a key factor for diagnosing different diseases which can help to assess health of individual and flock (Fudge, 2000). Our results are in line to (Pollock *et al.*, 2001) as they stated that hemoglobin (Hb) ranges (07-18.6 g/dL) while packed cell volume (PCV) was in (23-55 %) and

value below normal ranges would be indication of anemia in birds. Similarly, (El- Safty *et al.*, 2006) suggested that higher value of hematocrit for Naked Neck genotype pointed out better oxygen carrying capacity to tissues at different temperature. Fluctuation in blood profile might be affected by various elements like diets, sex, age, management and environmental condition. Our statements are favored by (Piccione *et al.*, 2005) as suggested that blood profile changes due metabolic and physical activities during the day. Moreover, blood profile might be used as disease diagnostic tool for various clinical research trails. Similar to our results (Orawan and Aengwanich, 2007) revealed no significant difference on MCH of various chicken breeds.

The biochemical analysis showed no significant (P>0.05) variation in serum parameters and values were in normal range. Esonu *et al.*, (2001) suggested that serum protein is an evidence for reserved protein in the animal body. Our results of biochemical indices are line to (Ladokun *et al.*, 2008) as they revealed that naked neck birds have higher value of serum protein, albumin and globulin than normal feathered birds. Serum protein has a vital role in maintenance of osmotic pressure and exchange of nutrients into tissues and circulatory fluid. Similar to our finding (Galal *et al.*, 2007) also reported high value of total plasma protein from Naked Neck to normal feathered birds. Total protein and globulin has important role in immunity, the higher level of globulin encourages better cell mediated immune response (Ladokun *et al.*, 2008).The high level of serum protein might be due the acute immune response of Naked Neck birds to activate liver cells for secretion of acute phase protein (APP) to give protection against infection. Furthermore, serum albumin level act as protein reservoir for acid base balance, osmotic pressure and carriage for small molecules as hormone, fatty acid, vitamins and mineral (Galal *et al.*, 2007).

Comparative inedible carcass parts of male chickensof the three genotypes in (table 2) were differed significantly (P<0.05) as (NN) had higher inedible percent among genotypes. The edible carcass (%)of three genotypes in (table 3)showed significant (P>0.05) difference on carcass yield and higher value for Black Astralorpe (70.10±2.1), Rhode Island Red (69.87±1.4) and lowest (67.56±1.2) for (NN) genotypes in (table 4). Our findings are confirmed by (De Marchi *et al.*, 2005) as they reported that carcass yield of indigenous poultry was lower than other poultry breeds. Carcass yield might be influence by various factors as genetic of birds, live weight, nutrition, age and sex. Similarly, (Moujahed and Haddad, 2013) supported our findings that low live body weight affect carcass yield. In the present study, Naked Neck and exotic Rhode Island Red and Black Astralorpe were reared under same condition, but low carcass yield of Naked Neck revealed low live weight of birds. In contrast to present finding (Islam and Nishibori, 2009) detected that naked neck have higher carcass yield in comparison to normal feathered birds. However, they might have compared the Naked Neck with other local normal feathered birds with results of better carcass yield and in present study Naked Neck was compared with exotic breeds which resulted low carcass yield.

The comparative pH of drumstick and breast muscles reveal no significant (P< 0.05) in pH value of three genotype of chicken. Meat pH of three genotype numerical difference in pH value was found as Naked Neck chicken have high value of pH than other chicken. The storage of meat increases the drip loss with no significant difference with different time interval in (table 5). In comparison with red meat (Allen *et al.*, 1998) exposed that pH of chicken muscles is lower while higher pH of muscle linked with red meat The low pH in biceps muscles was reported by (Chuaynukool , 2007) of indigenous birds in comparison to broilers. The pH of breast meat range (5-6) it attributed good quality meat with high profitable products than drumstick. Our results are in agreement to (Jaturasitha *et al.*, 2008) as they found no significant difference in drip loss of breast meat. The storage time might have effect on drip loss and could decrease meat value with the passage of time. Furthermore it is stated that pH have water binding ability of protein and affect the meat quality

physically. The pH value of turkey meat (Fernandaz, 2001), broiler meat (Zhang *et al.*, 2010) and ducks (Kim, 2012) are in similar range to local chicken meat. This statement endorsed by (Mikulski *et al.*, 2011) probed that chicken of fast- slow growing genetic trait have no significant variation of breast meat pH value. Our results are line to (Cornforth, 1994) that high value of meat pH have more water retaining capacity which result in more cooking loss. Meat quality based on water holding capacity and texture, it might affect meat products and consumer preferences. Husak *et al.*, (2008) testified that meat pH has a dynamic role in attaining color, moisture absorption and (Dyubele *et al.*, 2010) affirmed that pH affect all sensory physiognomies such as tenderness and juices.

Conclusions

In conclusion, the three genotypes were found to have similar feature of hemato biochemical profile. The carcass traits and organs weight was higher in Black Australorpe, Rhode Island Red as compared to NN. The pH of drumstick, breast muscles and storage revealed no significant difference (P< 0.05) among the three genotype of chicken.

Acknowledgment

Financial support for this project was provided by the Agriculture Linkages Program (ALP) of Pakistan Agricultural Research Council (PARC) Islamabad which is highly acknowledged.

Conflict

No conflict of interest.

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