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MORPHOLOGICAL ANALYSIS OF BREAST AND THIGH MUSCLES IN DIFFERENT POSTNATAL AGES OF BROILER CHICKEN AND ITS CARCASS CHARACTERISTICS

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ABSTRACT

The aim of this experiment was to analyze the morphology of muscles and carcass quality Cobb-500 and Ross broiler chicken at different age, where the weight of live bird, carcass, major cut portions, lean and bone were measured. The average highest live weight at D_{35} was recorded as 1860.18±6.29g in Cobb-500 and 1640.47±7.57g in Ross broiler chicken. The average carcasses weights at D_1, D_7, D_{14}, D_{21}, D_{28} and D_{35} were recorded as 14.90 ±0.53g, 27.85±0.30g, 85.31±0.82g, 211.94±4.31g, 618.36 ±0.92g and 1289.05±5.39g for Cobb-500 and in case of Ross strains 12.89±0.41g, 25.83±0.38g, 82.09±0.35g, 210.58±2.66g, 565.55±2.41g and 1133.80±3.51g respectively. Highest dressing percentage was recorded at D_{35} which was 69.29±0.11g in Cobb-500 and 69.12±0.12g in Ross strains. The length, breadth, thickness and weight of pectoralis thoracis, supracoracoideus, iliotibialis lateralis and iliotibialis cranialis skeletal muscles were higher in Cobb-500 at every studied ages. Finally the experiment focused that Cobb-500 chicken is superior in terms of meat production for its unique skeletal muscle growth and carcass yield.

Key words: Morphology, Muscle, Carcass yield, Cobb-500, Ross chicken

INTRODUTION

New food sources and raw matters are reclaimed by the quick and uncontrolled increase of human population and of its higher life standards, as well. Meat is found on the top of food matters and poultry hybrids could provide high quality meat at large amount, at relatively low prices and short time and can be easily processed at a large variety of specific products (Teuşan *et al*., 2009). Broiler chicken is the cheapest and safest animal protein source which can efficiently and rapidly fulfill the shortage of protein requirements. The share of poultry in the animal protein component of the human diet is estimated to be 30 percent in 1995 (Huque, 1996). Small scale poultry farmers are the main producers of the poultry in Bangladesh. In an estimate on the production based on the year 1991, it was found that about 98 percent of chicken meat was produced by small scale farm holder (Huque and Stem, 1993). The International Food Policy Research Institute has estimated that by year 2015 broiler chicken will account for 40 percent of all animal protein (IFPRI, 2000). In spite of its potential, no research on muscular growth and carcass quality of broiler chicken grow satisfactory in Bangladesh. Most of the farmers rear Cobb-500 and Ross broiler chicks in their farms but they do not know which strain is more efficient in terms of muscular growth and carcass quality under the same management. The marketing of poultry has been greatly diversified with a significant increase in cut-up (parts) and processed products (Le Bihan *et al.*, 2001). Consumers also like low fat meat to avoid health hazard. Demand for high quality cut-up (parts) and further processed convenience foods have changed its marketing practices (Wats and Kennet, 1995). For this reason breasts and broiler filets have become critical to processors (Young *et al.*, 2001). The continuing effort made by breeders to produce broiler chickens with improved production traits necessitates continuing evaluation of the various broiler strains. Based on the age and strains characteristics, this study was performed aiming to determine the of meat yield and muscular growth in two commercial broiler strains named by Cobb-500 and Ross (a tetra linear hybrid produced by the British firm Ross Breeders (Adela Marcu *et al.*, 2009) broiler chicken reared in small scale farming system in Bangladesh. The results of this study could give indications to small scale farm holders as to which strains of broiler chicken should be used for more profit, eventually resulting in an up scaling of the meat production.

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MATERIALS AND METHODS

A total of 288 live birds of both strains were randomly collected from 16 different small scale broiler farm of Dinajpur, Rangpur and Nilphamari districts at 1st, 7th, 14th, 21st, 28th, and 35th day of age. These biological samples were carried to the Anatomy and Histology laboratory of Hajee Mohammad Danesh Science and Technology University, Dinajpur. After recording the live weight the birds were allowed to slaughter through ventral neck cutting at about ¾ diameter of the neck by using sharp knife. 5-6 minutes were allowed for proper bleeding. After removal of feather and skin subcutaneous fat was collected with the help of forceps and scalpel blade. Then eviscerated carcass was weighed. The major edible cut portions (breast, thighs and drumsticks) were separated and weighed. Total lean and total bone were collected and measured. The length, breadth, thickness and weight of *m. pectoralis thoracis* and *m. supracoracoideus* from breast, *m. iliotibials lateralis* and *m. iliotibialis cranialis* from thigh were measured. The morphometric study of the selected parameters was performed by using scale (cm and mm) and electric balance.

RESULT AND DISCUSSION

Morphometry of muscles

In the present study skeletal muscles of various regions of the body of Cobb-500 and Ross broiler strains were found to differ in length, breadth, thickness and weight. *Pectoralis superficialis* muscle from the breast of Cobb-500 was higher in length (153.60±0.67 mm), breadth (53.00±0.70 mm), thickness (15.00±0.70 mm) and weight (73.58±0.66 gm) in comparison to those Ross strain (length 148.00±0.70 mm, breadth 49.00±0.70 mm, thickness 13.60±0.74 mm, weight 68.60±0.72 gm) at 35 days of age. In the thigh *Iliotibialis lateralis* was also higher in Cobb-500 in comparison to those of Ross strain. So, the same muscle of the same region was highest in length, breadth, thickness and weight in Cobb-500 in comparison to that of Ross broiler strains (Table 1).

Table 1. Length, breadth, thickness and weight (mean ± SE) of the muscles of breast and thigh region of Cobb-500 and Ross broiler chickens at 1st, 7th, 14th, 21st, 28th and 35th days of age (n=5)

Name of muscles	Cobb-500				Ross			
	Length (mm)	Breadth (mm)	Thickness (mm)	Weight (g)	Length (mm)	Breadth (mm)	Thickness (mm)	Weight (g)
Age: 1 day								
Pectoralis thoracis	38.0±0.3	14.0±0.6	1.0±0.07	0.17±0.01	35.6±0.31	12.5±0.2	0.7±0.04	0.1±0.04
Supracoracoideus	31±0.17	9.0±0.18	0.5±0.04	0.7±0.04	28.0±0.24	7.9±0.16	0.3±0.04	0.5±0.05
Iliotibialis lateralis	31.3±0.18	12.0±0.1	0.9±0.04	0.17±0.03	27.9±0.15	11.7±0.19	0.9±0.04	0.17±0.03
Iliotibialis cranialis	26.0±0.1	4.1±0.14	1.3±0.04	0.1±0.04	24.7±0.17	4.5±0.19	1.3±0.02	0.1±0.02
Age: 7 days								
Pectoralis thoracis	51.4±0.6	21.6±0.4	3.0±0.09	1.7±0.03	52.2±0.25	20.0±0.5	3.4±0.09	1.6±0.02
Supracoracoideus	42.6±0.4	11.0±0.2	1.9±0.06	0.4±0.04	42.5±0.29	11.0±0.1	2.0±0.05	0.4±0.01
Iliotibialis lateralis	41.7±0.5	19.0±0.1	2.0±0.07	0.6±0.02	40.8±0.37	18.3±0.3	2.0±0.07	0.5±0.01
Iliotibialis cranialis	35.0±0.3	8.0±0.16	2.0±0.07	0.3±0.02	34.0±0.35	7.0±0.16	2.0±0.07	0.2±0.13
Age: 14 days								
Pectoralis thoracis	76.0±0.1	32.0±0.3	5.0±0.16	6.6±0.07	76.0±0.06	33.0±0.2	5.0±0.16	6.7±0.02
Supracoracoideus	61.2±0.2	22.0 ±0.1	2.0±0.07	3.8±0.01	62.0±0.16	23.0±0.1	2.0±0.07	3.9±0.06
Iliotibialis lateralis	51.2±0.3	23.0±0.3	2.5±0.03	1.2 ±0.01	51.8±0.25	23.9±0.3	2.5±0.05	1.3±0.01

Name of muscles	Cobb-500				Ross			
	Length (mm)	Breadth (mm)	Thickness (mm)	Weight (g)	Length (mm)	Breadth (mm)	Thickness (mm)	Weight (g)
Iliotibialis cranialis	47.9±0.1	11.0±0.2	2.5±0.19	0.5±0.01	48.0±0.16	12.0±0.1	2.5±0.08	0.6±0.01
Age: 21 days								
Pectoralis thoracis	102.±0.8	34.2±0.2	5.6±0.24	13.2±0.05	99.6±0.57	32.1±0.19	5.5±0.13	11.6±0.2
Supracoracoideus	83±0.70	22.8±0.3	5.5±0.16	5.1±0.03	81.4±0.19	21.7±0.1	5.0±0.04	4.8±0.05
Iliotibialis lateralis	58.8±0.4	29±0.50	3.±0.06	2.90±0.04	54.0±0.32	24.9±0.5	2.8±0.07	2.1±0.03
Iliotibialis cranialis	54.3±0.37	14.6±0.4	3.2±0.06	1.6 ±0.01	49.1±0.43	11.2±0.2	3.1±0.09	1.2±0.07
Age: 28 days								
Pectoralis thoracis	117.±0.5	44.0 ±0.4	10.4±0.4	35.5±0.3	114.1±0.3	41.1±0.5	9.5±0.09	32.4±0.1
Supracoracoideus	105.±0.6	28.8±2.4	9±0.17	19.8±0.05	102.1±0.6	27.2±0.6	8.5±0.17	17.0±0.3
Iliotibialis lateralis	67.2 ±0.6	33.8±0.3	3.2±0.08	6.2±0.07	62.9±0.24	32.0±0.28	3.1±0.13	6.1±0.12
Iliotibialis cranialis	64±0.57	16.1±0.6	3.0±0.21	3.4±0.23	58.0±0.57	13±0.35	2.70±0.1	3.22±0.1
Age: 35 days								
Pectoralis thoracis	153.6±0.6	53±0.70	15±0.70	73.5±0.6	148±0.70	49±0.70	13±0.74	68±0.72
Supracoracoideus	141±0.85	42±0.85	12±0.85	49.2±1.4	136±0.70	38±0.70	10±0.67	46.2±0.8
Iliotibialis lateralis	84±0.70	40±0.70	3.5 ±0.1	13.4±0.6	81±0.70	37±0.70	3.2±0.10	11.5±0.9
Iliotibialis cranialis	78±0.70	25±0.70	3.1±0.11	6.7 ±0.6	73±0.70	21±0.70	3±0.11	5.8±0.68

Carcass characteristics

In the present study the higher value of carcass was found in Cobb-500 at different studied postnatal ages in comparison to that of Ross strain (Table 2) and on the basis of this result Cobb-500 may be recommended for farming. The highest dressing percentage (DP) based on live weight was 69.29±0.11 in case of Cobb-500 and 69.12±0.12 in case of Ross strain at 35 day of age. The differences in dressing percentages in between Cobb-500 and Ross broiler chicken were found statistically non significant ($P<0.01$) at 21st, 28th and 35th day of age whereas at day old, 7th and 14th day the differences were significant (Table 2). The average weight of major edible cut portions like breast, thighs, and drumsticks were higher in Cobb-500 in comparison to those of Ross broiler strain and these differences become more significant with the advancement of age (Fig. 1-3). The breast yield at 35th day of age of Cobb-500 (432.03±3.27g) was in agreement with Nicolova *et al*. (2009) who recorded 430.71g breast at 35th day of age in Cobb-500. Teuśan *et al*., (2009) reported 22-25% breast musculature in Cobb-500 and it was calculated as 29.51% at 35th day of age in the present study. In the present study the result of thigh (13.07%) and drumstick (13.85%) yield of Cobb-500 at the age of 35th day were higher than that of Nicolova *et al*. (2009) who concluded 9.59% thighs and 10.32% drumsticks in Cobb-500 at 35th day of age. The drumsticks yield in Ross strain at 35th day of age was 13.51% which was lower than that of Ojedapo *et al.* (2008) (17.94%). The present study was also in accordance with result from Santos *et al.* (2004) and Marcato *et al.* (2006) researches who concluded significantly larger breasts and drumsticks in chicken of Cobb-500 genotype than in other genotypes. Nicolova *et al.* (2009) noted that age of slaughtering has effect on most of carcass parts of commercial chickens that has been proved in the present study. The lean: bone ratio has an important impact

on meat quality. In the present study the total lean and bone were determined separately at every studied age. Total lean and bone production was higher in Cobb-500 but lean: bone ratio was higher in Ross strain (Table 2) at every studied age except 21st day of age.

Table 2. Live weight and carcass characteristics of Cobb-500 and Ross broiler chickens at 1st, 7th, 14th, 21st, 28th and 35th days of age (n=5)

Parameters and Strains	Age					
	Day-1	Day-7	Day-14	Day-21	Day-28	Day-35
Live Weight (g)						
Cobb-500	47.31±1.93	93.18±0.56	199.94±1.56	470.60±2.42	1066.46±1.04	1860.18±6.29
Ross	42.49±0.64	91.61±0.36	197.50±0.64	467.14±2.80	987.40±2.09	1640.47±7.57
Hot carcass Weight[a] (g)						
Cobb-500	14.90±0.53	27.85±0.30	85.31±0.82	211.94±4.31	618.36±0.92	1289.05±5.39
Ross	12.89±0.41	25.83±0.38	82.09±0.35	210.58±2.66	565.55±2.41	1133.80±3.51
Dressing Percentage[b]						
Cobb-500	31.57±0.94	29.63±0.19	42.65±0.11	45.01±0.69	57.97±0.05	69.29±0.11
Ross	30.31±0.53	28.18±0.33	41.56±0.09	45.07±0.29	57.27±0.13	69.12±0.12
Total Lean Weight (g)						
Cobb-500	7.65 ±0.02	13.17±0.02	50.66±0.26	96.69±0.38	381.29±1.56	797.77±3.20
Ross	6.82±0.05	12.52±0.06	48.56±0.28	92.44±0.78	345.48±1.60	694.89±4.80
Total Bone Weight (g)						
Cobb-500	6.58±0.03	11.82±0.42	27.29±0.29	82.58±0.43	147.71±1.53	298.84±3.96
Ross	5.83±0.05	10.44±0.03	25.69±0.40	82.44±2.26	130.33±1.29	257.53±4.90
Tissue ratio in carcass (ratio of lean and bone)						
Cobb-500	1.17±0.01	1.12±0.04	1.86±0.01	1.17±0.002	2.38±0.21	2.67±0.02
Ross	1.17±0.01	1. 20±0.01	1.89±0.02	1.12±0.003	2.65±0.01	2.70±0.03

[a]Reduction of skin, head, organ of thoracic, abdominal, and pelvic cavities from total carcass; [b]Ratio of hot carcass weight and live body weight

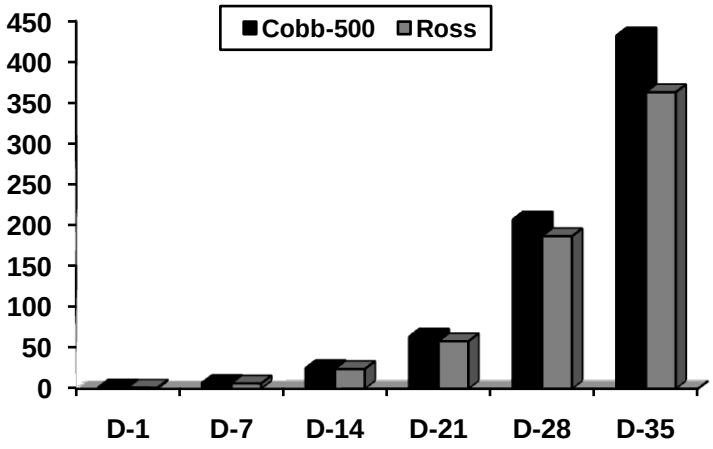

Fig. 1. Growth curve and growth rates of breast yield in Ross and Cobb-500 broiler strains (Values of the X axis indicates the weights (g) and Y axis indicates the age of the birds)

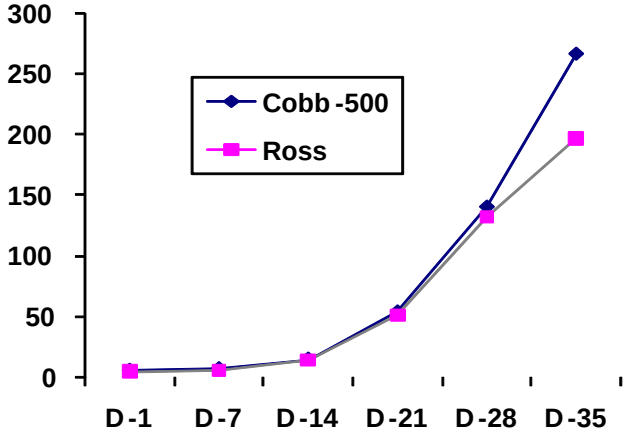

Fig. 2. Growth curve and growth rates of legs meat yield of Ross and Cobb-500 broiler strains (Values of the X axis indicates the weights (g) and Y axis indicates the age of the birds)

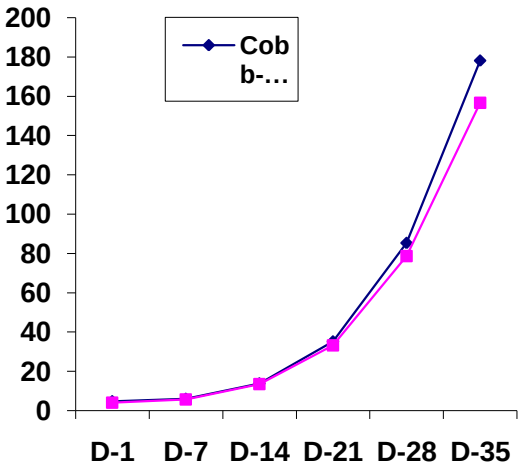

Fig. 3. Growth curve and growth rates of drumstick yield of Ross and Cobb-500 broiler strains (Values of the X axis indicates the weights (g) and Y axis indicates the age of the birds)

This study concludes that strain selection and age of the bird are two significant criteria in commercial broiler farming system. Muscular growth and meat yield are very important to evaluate the total production and profitability of the farm. Cobb-500 strain has a higher skeletal muscle growth and meat yield than those of Ross strain. Therefore Cobb-500 may be the first choice for better meat production and profit through broiler farming in Bangladesh.

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