MORPHOMETRICAL STUDY OF DEEP PECTORAL MUSCLE IN CHABRO CHICKEN IN RELATION WITH AGE AND SEX

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DOI: https://doi.org/10.5281/zenodo.15081579

ABSTRACT

India has the largest livestock population in the world. Meat industry in India is however, still in growing stage. According to APEDA (2019), India produced approximately 4.61 million metric tons of meat, primarily buffalo meat, on a carcass-weight-equivalent (CWE) basis. According to FAOSTAT India ranked fifth in the world meat (373.0 million tons) production, and this increase is due to higher production of poultry and bovine meat. Chabro chicken is a rural meat type bird. It is a cross breed of Barred Plymouth Rock and red Cornish bird. They are active, large in built and are adapted to all climatic zones of our country; hence, they are fit for backyard poultry farming. present study was done with the objective to study correlation of gross morphological parameters of deep pectoral muscle of Chabro chicken with age, sex, and meat quality, of 18 male and 18 female, clinically healthy Chabro chicken, procured from the Poultry Farm, Department of Poultry Science, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura., were divided into three age groups with six birds in each group. The mean volume increased with age in both sexes. The mean cross-sectional area of deep pectoral muscle was 181.67 mm^2, 290.99 mm^2 and 336.67 mm^2 in male bird of 6, 8 and 10 weeks of age respectively.

KEYWORDS: Chabro chicken, poultry, muscle, breast, deep pectoral, meat.

INTRODUCTION

India has the largest livestock population in the world. Meat industry in India is however, still in growing stage. According to APEDA (2019), India produced approximately 4.61 million metric tons of meat, primarily buffalo meat, on a carcass-weight-equivalent (CWE) basis. According to FAOSTAT India ranked fifth in the world meat (373.0 million tons) production, and this increase is due to higher production of poultry and bovine meat. The global poultry industry is expected to grow at a compound annual growth rate (CAGR) of 7% from 2021 to 2025. In India, the poultry industry is expected to grow by 8–10% in 2025. The Meat in general refers to skeletal muscles, associated with fat and other edible tissues. It is the most important source of animal protein in human diet (Lawrie, 2005; McAfee et al., 2010). Chabro chicken is a rural meat type bird. It is a cross breed of Barred Plymouth Rock and red Cornish bird. They are active, large in built and are adapted to all climatic zones of our country; hence, they are fit for backyard poultry farming. The breast muscle of chicken often is referred to

as white meat (Jacob et al., 2014). Anatomically the musculature of breast region is formed by superficial pectoral and deep pectoral muscles. A systematic study on the morphological parameters of the cross bred Chabro chicken muscles in relation to meat quality has not been documented so far; hence, the present study was done with the objective to study correlation of gross morphological parameters of deep pectoral muscle of Chabro chicken with age, sex, and meat quality. The study will be helpful to generate baseline data and will also be helpful for the scientists, breeders, farm practitioners and meat technologists, who can exploit the data to improve their breeding policies, farm management practices and quality of meat and meat products. This will go a long way to help the poor, marginal and landless farmers also to earn better income through the scientific and economic poultry rearing practices.

MATERIALS AND METHODS

The present study was conducted in the department of Veterinary Anatomy, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura, on the deep pectoral muscle of 18 male and 18 female, clinically healthy Chabro chicken, procured from the Poultry Farm, Department of Poultry Science, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura., were divided into three age groups with six birds in each group.

Table 1: Division of groups according to the age

S. No.	Group	Age of birds in weeks	Number of birds	
			Male	Female
01	I	6	6	6
02	II	8	6	6
03	II	10	6	6

The shape and attachment of the muscle was recorded. Then the deep pectoralis, muscle of the breast region was dissected out, The weight was recorded with the help of single penned electronic weighing machine (KERN PLJ 600-3NM). The volume of muscles was measured by water displacement method with the help of a graduated cylinder. The biometrical parameters (length, width, thickness) of each muscle were recorded with the help of Vernier Callipers or non-stretchable nylon thread and metric scale. The biometrical parameters recorded on each muscle were Length, Width, Thickness and Cross-sectional area of muscle.

RESULTS AND DISCUSSION

The deep pectoral muscle, as shown in fig I and II, was lay directly under the superficial pectoral muscle. It was almost triangular in shape, thick and wide, originated from the inferior part of the either surface of the keel and body of the sternum and inserted on to the humerus just dorsal to the insertion of the superficial pectoral muscle, as described by Bradley and Grahme (1960) in birds, Nickel et al. (1977) and Getty (1975) in fowl, Danmaigoro et al. (2016) in domestic fowl, guinea fowl and pigeon and Umar et al. (2020) in Nigerian local chicken, broiler and pigeon. It was white to pale in colour as described by George and Berger (1966) in birds and Umar et al. (2020) in local broiler and chicken. In contrast to this in pigeons, the colour of muscle was dark red (Danmaigoro et al., 2016 and Umar et al., 2020). Data presented in Table-I and II and Diagram-I and II revealed that the mean length of the deep pectoral muscle in male Chabro chicken was 12.92 cm, 14.60 cm and 14.67 cm at 6, 8 and 10 weeks of age respectively. The same parameter in female Chabro chicken was 12.83 cm, 13.55 cm and 13.42 cm at respective ages. Thus, the length of muscle was longer in the male chicken than in the female of the same age, although sexual difference was statistically significant only at 8 weeks of age ($P \leq 0.05$).

Table I: Gross morphometrical parameters (Mean±SE) of Deep pectoral muscle in female Chabro chicken

Groups / Parameters	Group I (6 weeks) (Mean ±SE)	Group II (8 weeks) (Mean ±SE)	Group III (10 weeks) (Mean ±SE)
Length (cm)	12.83±0.34 (11.50- 13.80)	13.55±0.17 (12.700- 14.60)	13.41±0.50 (12.20- 15.10)
Cranial width (cm)	1.36±0.17^{b} (0.90- 1.90)	1.76±0.19^{ab} (1.00- 2.10)	2.20±0.18^{a} (1.80- 2.90)
Middle width (cm)	3.03±0.23 (2.10- 3.60)	2.81±0.10 (2.40- 3.10)	3.10±0.08 (2.90- 3.50)
Caudal width (cm)	1.01±0.07 (0.80- 1.30)	1.03±0.30 (0.40- 2.40)	0.83±0.05 (0.60-1.00)
Thickness (cm)	0.49±0.03 (0.39- 0.53)	0.55±0.07 (0.39- 0.83)	0.49±0.03 (0.38-0.60)
Weight (g)	11.86±0.85^{b} (8.63- 13.86)	13.13±1.07^{ab} (9.69- 15.67)	15.79±1.27^{a} (10.55- 19.41)
Volume (cm^3)	10.00±1.23^{b} (6.00- 15.00)	13.00±1.42^{ab} (9.00- 15.00)	16.33±2.33 ^{a} (8.00- 25.00)
Cross-sectional area (mm^2)	228.00±16.54^{c} (198.00- 307.00)	287.50±6.90^{b} (263.00- 302.00)	341.16±18.07^{a} (274.00- 398.00)

n= 6, Figures in parenthesis indicate range
a, b, c superscripts showing significant difference between groups,
Means that do not have a superscript or share similar letter are not-significantly different

Table II: Gross morphometrical parameters (Mean±SE) of Deep pectoral muscle in male Chabro chicken

Groups / Parameters	Group I (6 weeks) (Mean ±SE)	Group II (8 weeks) (Mean ±SE)	Group III (10 weeks) (Mean ±SE)
Length (cm)	12.91±0.17^{b} (12.40- 13.40)	14.60±0.32^{a} (13.20- 15.30)	I14.66±0.66^{a} (14.10- 15.50)
Cranial Width (cm)	1.35±0.194^{b} (0.80- 1.90)	2.18±0.19^{a} (1.40- 2.80)	2.40±0.21^{a} (2.10- 2.90)
Middle Width (cm)	2.48±0.21^{b} (1.90-3.40)	3.36±0.17^{a} (2.90- 3.90)	3.31±0.08^{a} (3.00- 3.50)
Caudal Width (cm)	0.79±0.05 (0.60- 1.10)	1.00±0.06 (0.70- 1.10)	0.96±0.07 (0.70- 1.10)
Thickness (cm)	0.49±0.02 ^{ab} (0.43- 0.59)	0.44±0.02^{b} (0.39- 0.53)	0.56±0.04^{a} (0.43- 0.69)
Weight (g)	12.25±0.61^{c} (10.32- 13.58)	14.91±0.83^{ab} (12.37- 18.50)	18.88±1.96^{a} (12.12- 26.60)
Volume (cm^3)	14.83±1.55^{bc} (10.00- 19.00)	14.33±0.66^{b} (12.00- 16.00)	23.33±3.07^{a} (15.00- 30.00)
Cross-sectional area (mm^2)	181.66±12.89^{b} (158.00- 244.00)	290.98±58.27^{ab} (317.00- 395.00)	336.66±19.28^{a} (289.00- 403.000

n= 6
Figures in parenthesis indicate range
a, b, c superscripts showing significant difference between groups,
Means that do not have a superscript or share similar letter are not significantly different

Whereas, Scheuerman (2003) also reported higher value in male birds. Rahman (2014) reported the length of deep pectoral muscle in Cobb-500 and Ross strains of chicken 14.10 cm and 13.60 cm respectively at 35 days (5 weeks). Danmaigoro et al. (2016) measured length of deep pectoral muscle pigeon (8.25 cm), Guinea fowl (14.05 cm) and domestic fowl (13.25 cm). Umar et al. (2020) measured it in pigeon (7.40 cm), chicken

(13.95 cm) and in broiler (13.25 cm). The length of muscle increased with age in birds of both sexes. However, the increase was statistically significant between 6 to 8 weeks only in male birds. In male Chabro chicken the width of deep pectoral muscle of cranial, middle and caudal segments was recorded 1.35 cm, 2.48 cm and 0.80 cm in 6 weeks, 2.18 cm, 3.36 cm and 1.00 cm in 8 weeks, while 2.40 cm, 3.32 cm and 0.97 cm in 10 weeks. Same values in female Chabro chicken at 6 weeks 1.37 cm, 3.03 cm and 1.02 cm, in 8 weeks 1.77 cm, 2.82 cm and 1.03 cm and in 10 weeks old male it averaged 2.20 cm, 3.10 cm and 0.83 cm respectively. Rahman (2014) reported the width of deep pectoral muscle in Cobb-500 and Ross strain of chicken as, 4.20 cm and 3.80 cm respectively at 35 days (5 weeks). Danmaigoro et al. (2016) measured width of deep pectoral muscle pigeon (2.57 cm), Guinea fowl (4.52 cm) and domestic fowl (4.12 cm). Umar et al. (2020) measured width of deep pectoral muscle in pigeon (1.40 cm), in local chicken (2.90 cm) and in broiler (4.25 cm). In male birds, the width of all the three segments of muscle increased significantly during 6 to 8 weeks of age. The width was slightly higher in male than in female at 6 weeks of age, but at 8 and 10 weeks it was slightly higher in female Chabro birds, as stated by Scheuermann (2003). The sexual difference in width of muscle was statistically non-significant. The mean thickness of the deep pectoral muscle of male Chabro birds at 6, 8 and 10 weeks of age 0.50 cm, 0.45 cm and 0.57 cm respectively. The same in female was 0.50 cm, 0.55 cm and 0.50 cm of respective ages. Rahman (2014) reported the thickness of deep pectoral muscle in Cobb-500 and Ross strain of chicken as, 1.20 cm and 1.00 cm respectively at 35 days (5 weeks). The thickness of muscle was more in female birds at 8 weeks, but at 10 weeks, it was more in male birds, as stated by Scheuermann (2003). In male birds the muscle grew significantly in thickness between 8 to 10 weeks of age. The mean weight of the deep pectoral muscle was 12.25 g, 14.92 g and 18.89 g in male Chabro chicken at 6, 8 and 10 weeks of age. The same was 11.86 g, 13.14 g and 15.79 g in female of same age, indicated that the weight of the muscle was always more in male than in male chicken, as reported by Scheuermann (2003) in commercial broiler chicken. Although, the sexual difference was statistically non-significant. Rahman (2014) reported the weight of deep pectoral muscle in Cobb-500 (49.2 g) and Ross (46.29 g) strains of chicken. Danmaigoro et al. (2016) stated the weight of muscle in pigeon (4.45 g), guinea fowl (25.02 g) and domestic fowl (16.82 g). Umar et al. (2020) measured same in pigeon (19.00 g), chicken (50.00 g) and broiler (37.50 g). The weight of muscle increased with age in male as well as in female Chabro chicken at all ages. The relative weight of deep pectoral muscle in female and male Chabro birds at was 1.44% and 1.22% of live weight at 6 weeks, 1.27% and 1.27% at 8 weeks and 1.38% and 1.32% at 10 weeks respectively. Umar et al (2020) also reported the relative weight of the deep pectoral muscle in local chicken (3%), broiler (2.66%) and pigeon (4%) respectively. The mean volume of the deep pectoral muscle in male Chabro chicken was 14.83 cm^3, 14.33 cm^3 and 23.33 cm^3 at 6, 8 and 10 weeks respectively. The same parameters were 10.00 cm^3, 13.00 cm^3 and 16.33 cm^3in female chicken of similar age, indicated more voluminous muscle in the male than in female of same age. The mean volume increased with age in both sexes. The mean cross-sectional area of deep pectoral muscle was 181.67 mm^2, 290.99 mm^2 and 336.67 mm^2 in male bird of 6, 8 and 10 weeks of age respectively. The same parameter measured 228.00 mm^2, 287.50 mm^2 and 341.17 mm^2 in female birds of same age. This indicated that the cross-sectional area of muscle was more in female birds than in male in all age groups and there was a continuous increase in the cross-sectional area of muscle in male as well as in female birds with increase in age.

CONCLUSION

The length of muscle was longer in the male chicken than in the female of the same age. In male birds, the width of all the three

segments of muscle increased significantly during 6 to 8 weeks of age. The width was slightly higher in male than in female at 6 weeks of age. The weight of muscle increased with age in male as well as in female Chabro chicken at all ages. The muscle was more voluminous muscle in the male than in female of same age. The mean volume increased with age in both sexes.

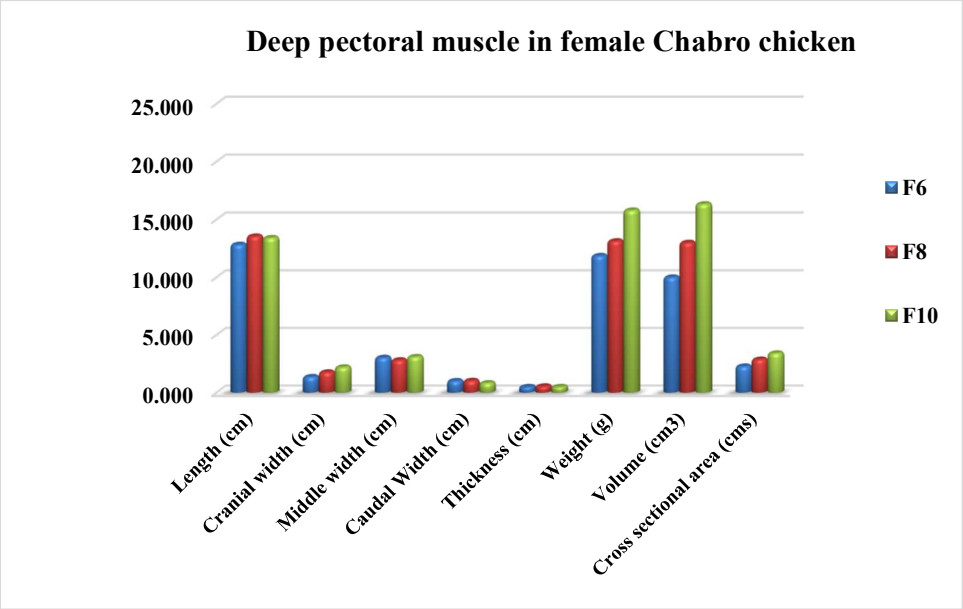

Diagram I: Bar diagram showing the changes in different gross parameters of deep pectoral muscle with age in female Chabro chicken.

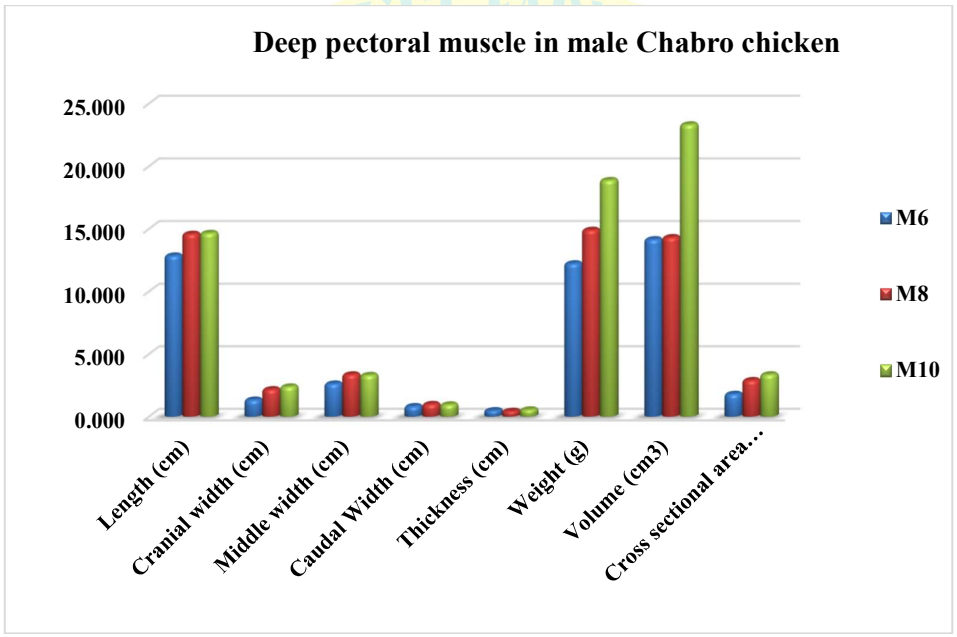

Diagram II: Bar diagram showing the changes in different gross parameters of deep pectoral muscle with age in male Chabro chicken.

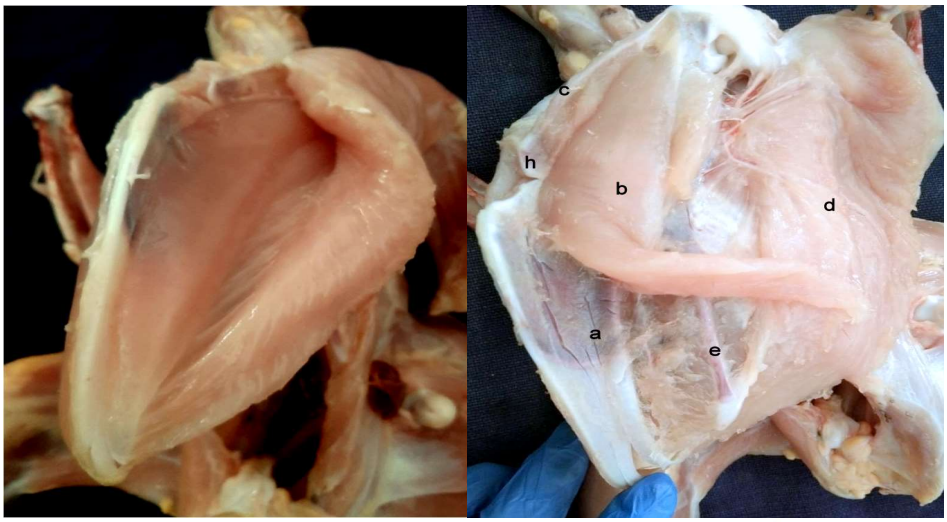

Fig II: photograph of breast region muscles of Chabro chicken showing a- keel of the sternum, b- superficial pectoral muscle, c- deep pectoral muscle

ACKNOWLEDGEMENT

Authors acknowledge thanks to Dr. D. N. Sharma, Retired Professor and Head, Department of Anatomy, Palampur, for his expertise in histological interpretation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the findings and publication of this work.

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Cite this article: Yogita Pandey, Archana Pathak, M.M. Farooqui, Akhilesh Pandey, P.K. Shukla, and B.P. Shukla. (2025). Morphometrical Study of Deep Pectoral Muscle in Chabro Chicken in Relation with Age and Sex. Vet Farm Frontier, 02(03), 1–6. https://doi.org/10.5281/zenodo.15081579