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Research Article

COMPARATIVE QUALITY ASSESSMENT OF COBB-400 AND CHABRO MEAT

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ABSTRACT

The broilers of lines Cobb-400 and Chabro were slaughtered at the age of 21 and 42 days at the departmental slaughter house. After slaughter, the carcass, breast and leg weights were determined. Further, colour in terms of L* (lightness), a* (redness) and b* (yellowness), pH at 24 hrs post mortem, drip loss, grill loss and shear force values and muscle fiber cross sectional study of breast and thigh muscles was conducted. In general, 42 days old broilers in both strains showed comparatively higher carcass, breast and leg weights. Fiber cross-sectional areas of breast and thigh muscles were showing higher values in older birds. In younger strains, slaughter characteristics were comparable among the lines. The L*, grill loss and shear force values increased but drip loss and a* values decreased with the advancement of age of broilers. During storage, L* and b* values in both breast and thighs increased and a* values decreased in both the strains. However, no significant differences were observed among the broiler strains on meat quality parameters.

Keywords: Breast and thigh, Broilers, Chabro, Cobb-400, Muscle fiber

Numbers of broiler strains are now used to fulfill the demand of poultry meat. All of these strains have unique quality characteristics and are capable to grow faster with good feed conversion ratios. Among all, Cobb-400 is a broiler with best growth rate, ability to thrive on low density, less costly nutrition etc. Similarly, Chabro is a rural meat type breed with multicolour plumage and is early adaptable to climate. It can be used basically for backyard poultry farming but can be reared under intensive rearing system. The most important positive quality characteristic of this breed is hardiness and to tolerate the harsh environmental conditions and poor husbandry practices without much loss in production. The low productivity was also improved through husbandry practices, health care, supplementary feed, selection and cross breeding (Padhi, 2016). The data on carcass quality, processing ability, nutritional values, mineral components, colour profile of meat and muscle fibre as well as muscle bundle diameter of these strains are very scanty. So keeping all these facts in mind, a study was undertaken to compare the quality characteristics of Cobb-400 and Chabro meat.

MATERIALS AND METHODS

Ten Broilers of 21 and 42 days of age were procured from university poultry farm and market as and when required. Carcass and cuts weight was measured after 12 hrs storage at 4±2 °C. The pH was estimated using electronic pH meter following the standard procedure. Colour profile was assessed by Hunter Colour lab and Shear force value by Warner-Bratzler shear force using grilled samples. Drip loss was calculated after weighing the weight of breast muscle at 72 h after slaughter and the drip loss was calculated as the loss of weight and was expressed as a percentage. Grill loss was measured after grilling with the core temperature of 73 °C. The values of different minerals were analyzed on Atomic Absorption Spectrophotometer. Muscle samples for the histological analysis were subjected to hematoxylin eosin for general histological examination and muscle fibre as well as muscle bundle diameter outlined by Jeremiah and Martin (1982). Specific standard staining i.e. Van Gieson's staining method for collagen fibers; Weigert's staining method for elastic fibers and Gomori's method for reticular fibres was done as per Kiernan (2008). Sections were observed under light microscope.

Data obtained in the study were repeated three times and all the parameters were analyzed in triplicate (n=9). Data were expressed as means with standard error. One way Analysis of variance (ANOVA) was done by comparing the means by using Duncan's multiple range test (DMRT), at 95% confidence level using a SPSS package (SPSS 16.0 for Windows, SPSS Inc., Chicago, IL, USA) following the procedure of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The present investigation was carried out to find out the differences in genetic line and age on the meat quality characteristics of Cobb-400 and Chabro. The study comprised of different aspects i.e. carcass characteristics, meat quality characteristics, colour profile, mineral profile and histological study of muscle fibers.

Carcass characteristics: The carcass characteristics of Cobb-400 was found superior and significantly ($P<0.05$) higher in terms of carcass weight, breast and leg weight than Chabro strains. Contrary to this, both breast and leg yields in comparison to carcass weight were significantly ($P<0.05$) higher in Chabro than Cobb-400 in both the traits (Table 1). These changes might be due to faster growth rate of Cobb-400 than Chabro at the age of 21 and 42 days. The higher breast and leg weight indicates the higher meat

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yield in Cobb-400 than Chabro at different age group which might be due the breed characteristics. Berri *et al.* (2007) showed that mixed-sex commercial broiler breast muscles had higher weight than indigenous genetic lines. Knowles *et al.* (2008) also advocated that genetic selection in domesticated broiler chickens has brought about significant improvements in the form of increasing meat yields and growth performance.

Meat quality characteristics: The meat quality characteristics of the breast muscle depending on the broiler genetic lines was examined on the basis of pH, drip loss, grill loss and maximum shear force value and obtained data are shown in Table 1. Overall the non significant differences were observed in pH, drip loss and grill loss values between Cobb-400 and Chabro irrespective of the age of the birds. Individually, higher pH and drip loss was observed in Cobb-400 than Chabro. The scenario was reverse in grill loss and higher grill loss was noticed in Chabro as compared to Cobb-400. The shear force value indicates the higher values in Cobb-400 meat at the age of 21 days while Chabro showed significantly ($P<0.05$) higher values as compared to Cobb-400 at the age of 42 days.

Less drip loss indicates the better water holding capacity. It could be attributed to higher (extra) cellular protein concentration. It is also attributed that with increase in age, perimyseal space of breast muscle gets thickened and increases water holding capacity (Nakamura *et al.*, 2004). It is also evident that higher fibre cross sectional area enhances the water holding capacity. The higher grill loss volume of older birds could be that fluid not expelling from the tissues during drip loss analysis is forced from the meat during grill loss determination. It could be attributed to structural changes accompanied by distribution of cells and shrinkage of connective tissues. Increased shear force was due to increase in connective tissues within the muscle twice with increase in age.

Colour profile: Colour profile was assessed in terms of L*, a* and b* values. The colour profile of 21 days Cobb-400 meat was significantly ($P<0.05$) higher in L* value, while no significant ($P>0.05$) differences were observed in a* and b* values at the same age group (Fig.1 & 2). At 42 days birds, Cobb-400 meat was showing significantly ($P<0.05$) higher L* and a* values and no significant ($P>0.05$) difference in b* values.

The increased L* value in Cobb-400 than Chabro meat at 21 and 42 days age could be attributed to slight differences in muscle structure and composition. The inferior a* value in Chabro than Cobb-400 at the 42 days of meat could be due to decrease in heme pigment, myoglobin and iron concentration. Similarly decreased b* value in Chabro could be due to variation in variants of myoglobin. Bainy (2011) advocated the positive correlation between meat lightness and yellowness, and

Table 1

Different characteristics of Cobb-400 and Chabro lines (Mean+SE)

Parameters	21 days old broilers		42 days old broilers	
	Cobb-400	Chabro	Cobb-400	Chabro
Carcass characteristics				
CW (g)	$1068.66^{a} \pm 15.76$	$934.67^{b} \pm 19.64$	$2077.67^{a} \pm 42.05$	$1664.33^{b} \pm 21.62$
Breast wt (g)	$203.76^{a} \pm 3.47$	$178.91^{b} \pm 4.18$	$446.57^{a} \pm 5.32$	$413.20^{b} \pm 2.51$
Leg wt (g)	$290.61^{a} \pm 5.81$	$263.10^{b} \pm 4.55$	$556.05^{a} \pm 5.21$	$496.20^{b} \pm 3.46$
Breast yield (% of CW)	19.34 ±0.54	19.15 ±0.291	$20.51^{b} \pm 0.60$	$24.63^{a} \pm 0.56$
Leg yield (% of CW)	27.54 ±0.36	27.85 ±0.58	$27.08^{b} \pm 0.29$	$30.75^{a} \pm 0.60$
Meat quality characteristics				
pH	5.95±0.03	5.86±.04	5.95± 0.06	5.67±0.17
Drip loss %	1.27±0.01	1.22 ±0.02	0.85±0.69	0.76± 0.62
Grill loss %	24.06±0.32	24.34 ±0.18	27.34±0.45	28.05±0.25
Maximum Shear force (N)	$22.80^{a} \pm 1.49$	$21.08^{b} \pm 0.45$	$23.26^{b} \pm 0.39$	$27.06^{a} \pm 1.06$
Mineral profile (mg/100 g)				
Sodium	$46.23^{a} \pm 0.14$	$36.22^{b} \pm 1.39$	$48.52^{a} \pm 1.08$	$37.82^{b} \pm 1.32$
Potassium	$100.17^{a} \pm 2.41$	$79.96^{b} \pm 3.02$	$108.70^{a} \pm 3.93$	$84.77^{b} \pm 1.95$
Iron	$5.95^{a} \pm 0.09$	$4.78^{b} \pm 0.03$	$7.96^{a} \pm 0.05$	$6.43^{b} \pm 0.11$
Zinc	$3.10^{b} \pm 0.01$	$5.78^{a} \pm 0.02$	$3.69^{b} \pm 0.02$	$5.97^{a} \pm 0.02$
Manganese	$0.06^{a} \pm 0.008$	$0.04^{b} \pm 0.017$	$0.09^{a} \pm 0.011$	$0.06^{b} \pm 0.023$
Muscle fiber and muscle bundle diameter (μm)				
Muscle fiber diameter	$9.37^{a} \pm 0.13$	$5.34^{b} \pm 0.17$	$10.78^{a} \pm 0.43$	$6.18^{b} \pm 0.08$
Muscle bundle diameter	$57.33^{a} \pm 79$	$45.93^{b} \pm 3.39$	$59.51^{a} \pm 0.48$	$49.99^{b} \pm 0.68$

Means bearing different superscripts (a, b) within row differ significantly ($P<0.05$).

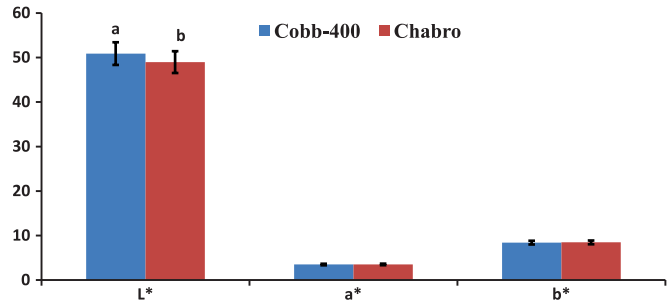


Fig. 1. Colour Profile of 21 days broiler lines

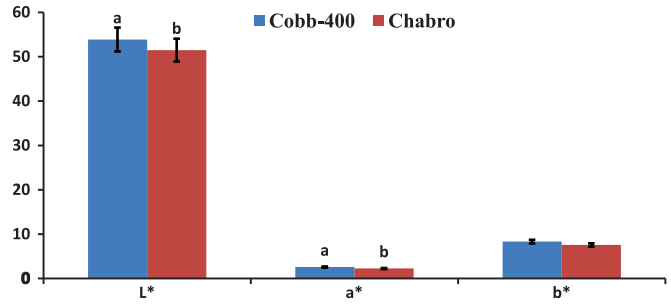
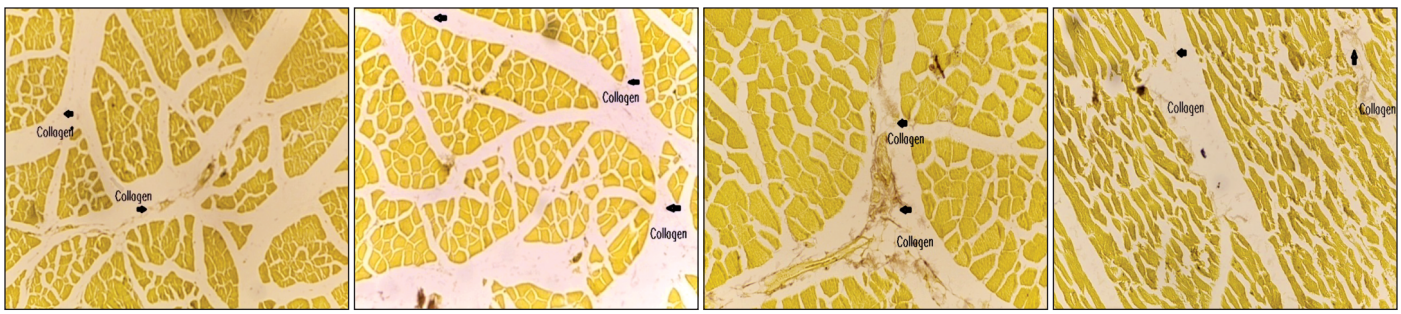


Fig. 2. Colour Profile of 42 days broiler lines

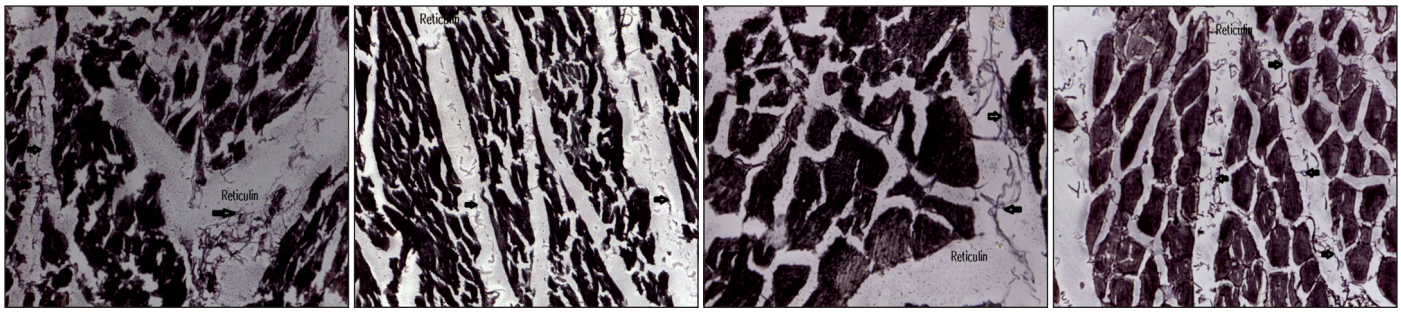
Castro *et al.* (2008) reported negative correlations between water-holding capacity and lightness and yellowness. The greater protein denaturation leads to more damage in the muscle fibers, consequently reducing its capacity to retain water and negatively affecting their functional properties. It is also evident that denatured protein transmits less light through the muscle surface and disperses more light, leading to pale colour of meat.

Mineral Profile: In general, higher mineral contents were noticed in 42 days old meat than 21 days meat of both Cobb-400 and Chabro (Table 1). Quantity wise significantly ($P<0.05$) higher sodium, potassium, iron and manganese were present in Cobb-400 than Chabro meat in respective of age. However, zinc was significantly ($P<0.05$) higher in Chabro as compared to Cobb-400 in both of the age groups. The advancement of bird's age showed higher minerals irrespective of broiler line. It indicates the tendency of enhancement of minerals in meat on advancement of the age of chicken. The similar pattern



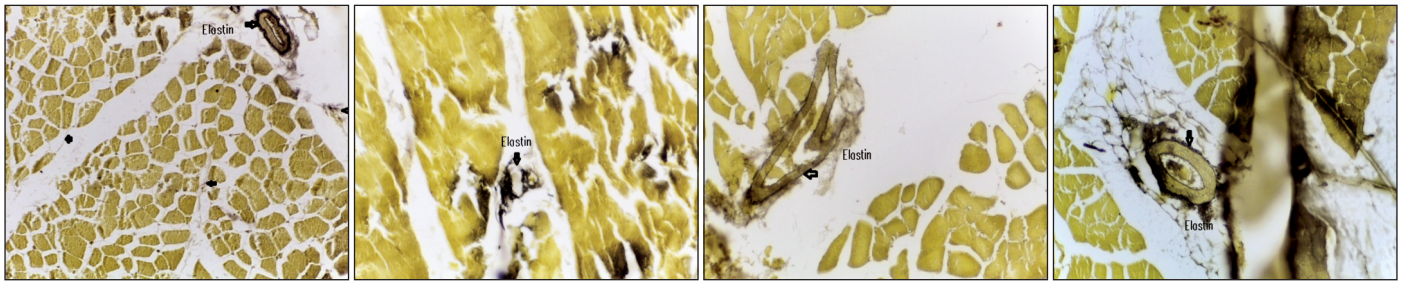
Cobb-400 (Thigh) Chabro (Thigh) Cobb-400 (Breast) Chabro (Breast)

Fig. 3: Histoghraph showing collagen in breast and thigh meat of 21 days old Cobb-400 and Chabro



Cobb-400 (Breast) Chabro (Breast) Cobb-400 (Thigh) Chabro (Thigh)

Fig 4: Histoghraph showing reticulin in breast and thigh meat of 21 days old Cobb-400 and Chabro



Cobb-400 (Breast) Chabro (Breast) Chabro (Thigh) Cobb-400 (Thigh)

Fig. 5: Histoghraph showing elastin in breast and thigh meat of 21 days old Cobb-400 and Chabro

of minerals was reported by Kokoszynski *et al.* (2016) in spent broiler breeders and broilers.

Muscle fibre and muscle bundle diameters: The data obtained on muscle fibre and muscle bundle diameter are depicted in Table 1. The muscle fibre diameter of 21 days old Cobb-400 and Chabro both was less than 42 days old birds. It could be due to the muscular development with advancement of the age. The significant ($P<0.05$) differences in muscle fibre diameter of both the age groups were noticed which might be due to the tendency of the birds' muscular development.

Muscle bundle diameters were showing the same pattern, bundle diameter was higher in 42 day old birds' meat than 21 days. Within the age group, Cobb-400 showed significantly ($P<0.05$) higher muscle bundle diameter than Chabro. The reason might be the fast growing muscle of Cobb-400 than Chabro muscles. Rehfeldt *et al.* (2000) reported that most studies in pigs have indicated that selection for lean growth is associated with increases in both fiber size and number. The extent to which fiber number can be modified to increase breast muscle mass in the chicken has still to be investigated.

Collagen: Comparison of 21 days thigh and breast muscles of Cobb-400 and Chabro meat indicated that Cobb-400 thigh and breast meat both had comparatively more collagen than Chabro meat (Fig. 3). It could be due to inherent property of greater development of muscle in Cobb-400 than Chabro. However, no significant differences in intramuscular collagen were reported by Roy *et al.* (2006) in Red Cornish and New Hampshire stock. The total collagen content was reported higher in leg muscles than breast muscles of chicken by Voutila (2009). However, in present study breast muscles of both lines were showing higher collagen than thigh muscle which could be due to the age of chicken.

Reticulin: Reticulin fibres in muscles of 21 days Cobb-400 and Chabro thigh and breast muscles was showing higher presence in Cobb-400 than Chabro (Fig 4). It could be attributed to the higher muscle development in commercial broiler like Cobb-400 than originally backyard poultry breed like Chabro. These differences might be due to growth tendency as reported by Mahon (1999) and differences between the breeds as advocated by Voutila (2009).

Elastin: The pattern of elastin fibres present in Cobb-400 and Chabro was not clearly defining the differences in between because they are mostly present surrounding the blood vessels. So it can be illustrated that both of the strains of chicken were having almost similar pattern (Fig. 5). These differences might be due to age of the studied chicken and differences between the breeds as suggested by Voutila (2009). The histological pattern on 42 days meat of both Cobb-400 and Chabro was not conducted in the study. So it can't be commented on the quality of structural fibres present in meat of these birds.

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