

*Original Research***Comparative Evaluation of Carcass Characteristics and Physico-Chemical and Sensory Attributes of Meat of Native×CSFL Crossbred Chickens and Commercial Broilers****S. S. Pandey¹, N. C. Behura², L. Samal^{3*}, P. K. Pati⁴ and G. D. Nayak⁵**

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Abstract

The present study was conducted to compare the carcass characteristics and meat quality of Native×CSFL (coloured synthetic female line) F1 crossbred chickens and the commercial broilers at 8th week of age. The liver weight (48.5 ± 2.06 g) and breast weight (357.5 ± 11.25 g) of commercial broilers was significantly ($P \leq 0.01$) higher than those of the crossbred chickens where as the drumstick weight of crossbred chickens (163.75 ± 12.2 g) was significantly ($P \leq 0.05$) higher than that of commercial broiler birds (152 ± 10.87 g). Dressing percentage, eviscerated weight percentage, giblet and breast percentage of commercial broilers were significantly ($P \leq 0.05$) higher than the crossbred chickens. The physico-chemical characteristics of breast and thigh muscles revealed that the crude protein content of breast and thigh muscles of crossbred chickens was higher and the crude fat contents were lower than that of commercial broiler birds. The taste panel scores of sensory attributes viz. appearance, flavor, juiciness and tenderness did not differ significantly between crossbred chickens and commercial broilers. It was concluded that the Native×CSFL crossbred chickens has all the potential to become an alternative to commercial broilers as the physico-chemical and sensory characteristics were comparable. Further, Native×CSFL F1 crossbred chickens could be suitable for small scale rearing in backyard considering the preferential pricing for coloured plumage over commercial broilers.

Key words: Commercial Broilers, Carcass Parameters, Native×CSFL Crossbred Chickens, Meat Quality

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Introduction

Backyard poultry sector plays a significant role in improving the socio-economic status of rural people by generating employment opportunity and augmenting family income particularly among landless labourers, small and marginal farmers and women in rural areas. The native chickens are highly adapted to the local climatic conditions and are highly resistant to adverse climate and endemic diseases (Padhi, 2016). Comparatively, little research and development work has been carried out on rural poultry, despite the fact that they are usually more numerous than the commercial chickens in most developing countries (Cumming, 1992). However, the local chickens are poor performers when compared to improved commercial chicken varieties. In order to increase the productivity of backyard chicken, introducing improved low technology inputs birds are necessary. To utilize the good adaptive characteristics of the indigenous chickens and possibly exploit the phenomenon of heterosis or hybrid vigour, crossbreeding programmes of local chickens with suitable exotic stocks would be more appreciable (Hoffmann, 2005). Crossbreeding could lead to production of birds that will be better in growth rate, efficiency of feed conversion and production traits without sacrificing adaptability to the local environment (Adebambo *et al.*, 2011). Poultry meat is considered as nutrient dense food which is desirable in planning health diets (Kondaiah *et al.*, 2002). It is playing an important role in providing nutritious diet to consumers with high protein and low-fat level and universal acceptability without any taboo. Considering the necessity to develop potential poultry crossbreds, suitable for backyard farming as well as commercial farming, the present study is undertaken to evaluate and compare the carcass characteristics and meat quality of Native×improved CSFL (coloured synthetic female line) F1 crossbred chickens and the commercial broilers at 8th week of age.

Materials and Methods

Experimental Birds, Housing and Management

Female CSFL breeder birds and males of a local native population were used to develop the F1 cross. Five native males and 40 broiler parent line females were housed in breeding pens in the ratio of 1:8, to produce fertile eggs. The eggs were incubated to produce Native×CSFL F1 progenies which were maintained up to eight weeks of age under intensive system of management. Routine feeding, medication and vaccination procedures were followed. The birds received water and feed ad libitum.

Slaughtering Procedure and Carcass Characteristics

The carcass traits were determined at 8th week of age and compared with those of commercial broilers procured from the market with similar mean body weight. Six birds each from Native×CSFL F1 crossbreds and commercial broilers were sacrificed for study of their carcass quality traits. The selected

birds were off fed overnight and submitted to water dietary regimen for 12 hours prior to evaluation. The birds were slaughtered by rupture of the jugular vein and carotid artery below the left ear. After complete bleeding and cessation of movement, the carcass weight was recorded. The carcass was then scalded at 55-58°C for 90 seconds and defeathered. Left over pin feathers were removed manually with a pinning knife. Evisceration was performed by giving a transverse incision at the abdomen between the keel and vent and then a circular incision around the vent to cut open the abdominal cavity. The entire visceral organs were then pulled out through the opening. The inedible organs like wind pipe, oesophagus, crop and all portions of the intestinal tract, vent, spleen, lungs, epicardium, ovaries and testis and gall bladder were removed. The giblet weight [liver (without gall bladder), gizzard (without mucous membrane) and the heart (after removal of blood clot and pericardium)] and cut-up parts (drumsticks, thighs, breast, wings, back and neck) weights were recorded. Carcass weight was calculated based on eviscerated weight. Percentage yield of edible offal or giblet and cut-up parts yield was calculated based on eviscerated carcass weight. Dressing percentage was calculated as the ratio between carcass weight and pre-slaughter live weight.

Physico-Chemical Attributes of Thigh and Breast Meat

Meat samples were collected from thigh and breast muscles, minced, mixed and then random samples were taken for further analysis of physico-chemical characteristics. Six replicates were done for each parameter. Moisture, protein, ash and fat contents were determined according to AOAC (1990).

Sensory Attributes of Meat

The meat was cooked in a pressure cooker for 15 minutes. The sensorial evaluations were performed according to Dutcosky (2007) methodology, using 10 non-trained testers. For sensorial test trial, a hedonic rating scale from 1 to 9 (1: disliked extremely; 2: dislike very much; 3: dislike moderately; 4: dislike slightly; 5: neither like nor dislike; 6: like slightly; 7: like moderately; 8: like very much; 9: like extremely) was used to evaluate the following characteristics of the chicken meat: appearance, flavour, juiciness and tenderness.

Data Analysis

Data collected were subjected to t-test. The results are presented as least square Means $\pm$ Standard error (SE). The difference between means was declared significant at $P \leq 0.05$.

Result and Discussion

Carcass Characteristics

Carcass yield and composition is affected by several factors such as diet, age, sex, live weight, genotype and slaughtering conditions (Havenstein *et al.*, 2003; Brickett *et al.*, 2007). The results (Table 1) showed that the eviscerated weight % of commercial broiler birds (72.32 ± 0.75) was significantly higher than that of Native×CSFL (66.48 ± 1.11) birds.

Table 1: Comparison of pre-slaughter weight and carcass weight and percentage of Native×CSFL and commercial broiler birds

Traits	Native×CSFL	Commercial Broiler	T value	P value
Pre-slaughter weight (g)	1610±86.79	1567±69.85	0.69	0.53
Eviscerated weight (g)	1072±70.00	1132±40.62	- 1.06	0.36
Eviscerated weight %	66.48±1.11 ^a	72.32±0.75 ^b	-5.11	0.01
Carcass weight (g)	1149.25±73.98	1222.50±45.75	- 1.24	0.30
Dressing %	71.23±1.02 ^a	78.02±0.68 ^b	-6.05	0.00

^{a,b}Mean with different superscripts in a row differ significantly

Dressing% was higher in commercial broiler birds (78.02 ± 0.68) than in Native×CSFL (71.23 ± 1.02) birds. Liver weight of commercial broiler birds (48.50 ± 2.06) was significantly higher than that of Native×CSFL (34.50 ± 3.50) birds. Overall percentage yield of giblet was also higher in commercial broiler birds (5.70 ± 0.14) than in Native×CSFL (4.74 ± 0.26) birds (Table 2).

Table 2: Comparison of edible offal weight and percent yield of Native×CSFL and commercial broiler birds

Traits		Native×CSFL	Commercial Broiler	T value	P value
Giblet (g)	Heart	7.00±0.81	7.25±0.25	-0.29	0.78
	Liver	34.50±3.50 ^a	48.50±2.06 ^b	-5.71	0.01
	Gizzard	35.00±2.54	33.75±3.61	0.53	0.63
Giblet % yield [#]		4.74±0.26 ^a	5.70±0.14 ^b	-4.20	0.02

^{a,b}Mean with different superscripts in a row differ significantly; [#]Percentage yield of eviscerated weight

Breast weight and percentage of commercial broiler birds (357.50 ± 11.25 g, $22.91 \pm 0.98\%$) were significantly higher than that of Native×CSFL (263.50 ± 13.10 g, $16.39 \pm 0.40\%$) birds whereas drumstick weight was higher in Native×CSFL birds (163.75 ± 12.20 g) than commercial broiler birds (152 ± 10.87 g) (Table 3). Arora *et al.* (2011) reported that there was no difference in the percentages of abdominal fat, gizzard, liver, heart, breast, legs and back among various skin colour groups of F2 chicken involving Kadaknath and White Plymouth Rock. Factors that can impact the carcass quality of chickens include genotype, age, sex, diet, density, environment, exercise, and pasture intake (Fanatico *et al.*, 2005), because different fast- or slow growing chickens can show different behavior or muscle metabolism (Castellini *et al.*, 2002). In an experiment by Nielsen *et al.* (2003), slower-growing chickens were

characterized by a significantly ($P<0.05$) lower breast muscle yield, but higher ($P<0.05$) yield of thigh and drumstick muscles than fast-growing chickens.

Table 3: Comparison of cut-up parts (%) of Native×CSFL and commercial broiler birds

Traits	Native×CSFL	Commercial Broiler	T value	P value
Drumsticks (g)	163.75±12.20 ^b	152.00±10.87 ^a	3.43	0.04
Drumsticks %	10.13±0.21	9.69±0.53	1.18	0.32
Thighs (g)	174.50±13.94	183.50±11.46	-0.64	0.56
Thighs %	10.80±0.37	11.68 ±0.26	02.07	0.13
Breast (g)	263.50±13.10 ^a	357.50±11.25 ^b	-4.33	0.02
Breast %	16.39±0.40 ^a	22.91±0.98 ^b	-8.80	0.00
Wings (g)	131.25±7.82	118.75±7.13	1.44	0.24
Wings %	8.16±0.34	7.56±0.17	1.85	0.16
Back (g)	226.75±17.06	219.00±51.64	0.41	0.42
Back %	14.04±0.37	14.00±0.44	0.08	0.93
Neck (g)	101.25±9.37	94.75±5.10	1.04	0.37
Neck %	6.24±0.24	6.04±0.17	0.90	0.43

^{a,b}Mean with different superscripts in a row differ significantly; ^aPercentage yield of eviscerated weight

Mikulski *et al.* (2011) observed that at 65 days, the breast muscles %, thigh muscle % and drumstick muscle% were lower for slower-growing chicken than fast-growing chicken genotypes. The crossbred chicken under study are slow growing as compared to commercial broilers which could have resulted in lower values for different cut up part percentages.

Physico-Chemical Attributes of Thigh and Breast Meat

Physico-chemical attributes of poultry meat may be affected by a number of factors such as genotype, diet, stocking density, rearing condition, temperature, exercise, pasture intake, age at slaughter and motor activity of the birds that impact on muscle metabolism as well as on chemical composition (Castellini *et al.*, 2008; Gordon and Charles, 2002). Meat quality is a function of the interaction of genotype and other environmental factors. Xlong *et al.* (1993) reported that breeds affected chemical composition of chicken meat. The crude protein content (percent on DM basis) of thigh and breast muscles of Native×CSFL birds were 70.00±2.03 and 82.24±0.43 respectively and the corresponding values for commercial broilers was 69.08±0.98 and 80.98±1.04. Similarly crude fat content (percent on DM basis) of thigh and breast muscles of crossbred chickens were 13.43±0.23 and 4.80±0.75. The crude protein and crude fat content of thigh and breast muscles of crossbred chickens and commercial broilers did not differ significantly ($P\geq 0.05$). Khawaja *et al.* (2012) in a similar experiment reported no significant ($P\geq 0.05$) difference in the composition of breast and thigh meat among pure and crossbred chickens. However, the crude protein content of both thigh and breast meat of crossbred chickens was numerically higher and fat content was numerically lower than that of commercial broilers. Similar findings were reported by Castellini *et al.*

(2006), Pietrzak *et al.* (2006) and Fanatico *et al.* (2007). In contrast, Tang *et al.* (2009) observed a higher fat content in slower-growing birds. Ekka *et al.* (2017) reported a lower fat % and higher protein % in native Hansli birds as compared to the Hansli×CSML (coloured synthetic male line) crossbred chickens. The high crude protein and low crude fat content of the crossbred chickens is a very important observation as regards the nutritional value of meat is concerned. When compared the meat composition, the crossbred chickens could have a nutritional and economic advantage over commercial broilers.

Table 4: Comparison of physico-chemical characteristics of breast and thigh muscles of Native×CSFL and commercial broiler birds

Attributes	Breast Muscle			Thigh Muscle		
	Native×CSFL	Commercial Broiler	P value	Native×CSFL	Commercial Broiler	P value
Moisture %	74.73±0.31	74.93 ±0.16	0.66	73.88±1.01	68.68±3.82	0.32
Crude protein %	82.24±0.43	80.98±1.04	0.44	70.00±2.03	69.08±0.98	0.57
Crude fat %	4.80±0.75	4.95±0.44	0.83	13.43±0.23	14.33±0.73	0.26
Total ash %	5.23±0.07	4.68±0.25	0.12	4.96±0.29	5.23±0.43	0.65
Acid insoluble ash %	0.19±0.04	0.22±0.04	0.64	0.21±0.04 ^a	0.38±0.05 ^b	0.02

^{a,b}Mean with different superscripts in a row differ significantly

Sensory Attributes of Meat

The score colour values did not differ significantly between Native×CSFL crossbred chickens and commercial broiler chickens (Table 5).

Table 5: Comparison of sensory characteristics of Native×CSFL and commercial broiler birds

Sensory attributes (10 point scale)	Native×CSFL	Commercial Broiler	T value	P value
Appearance	7.50±0.17	7.65±0.13	0.71	0.49
Flavour	7.25±0.11	7.55±0.14	1.69	0.11
Juiciness	7.15±0.11	7.45±0.16	1.58	0.13
Tenderness	7.20±0.13	7.30±0.15	0.49	0.63

Flavour is a contribution of taste and smell. The score values for Native×CSFL crossbred chickens and commercial broiler chickens were 7.25±0.11 and 7.55±0.14, respectively without any significance difference between them. The mean score for juiciness for Native×CSFL crossbred chickens and commercial broiler chickens were 7.15±0.11 and 7.45±0.16, respectively. Castellini *et al.* (2006) demonstrated that a lower fat content was accompanied by lower meat juiciness in slower-growing broilers. Tenderness is the most important attribute in consumers' final satisfaction with poultry meat (Fletcher, 2002). The texture or tenderness is a sensory property that consumer uses commonly to

determine the quality and acceptability of the meat (Issanchou, 1996) and the best quality is expressed in terms of higher tenderness. The mean score value of tenderness for Native×CSFL crossbred chickens and commercial broiler chickens were 7.20 ± 0.13 and 7.30 ± 0.15 , respectively without any significance difference between them. The taste panel scores for sensory attributes of appearance, flavor, juiciness and tenderness did not differ significantly between Native×CSFL crossbred and commercial broiler chickens. The palatability of the meat is associated to the texture and according to Baracho *et al.* (2006) it can be affected by ante-mortem factors such as: species, genetic factors, age, nutritional status and stress. Rigor mortis, electric stimulus, cooling speed and pH are post-mortem factors that also influence the texture of the chicken meat. The mean grade 7, corresponding to “liked regularly” in the hedonic scale, observed in this study, indicates a good acceptability of both meat by the consumers.

Conclusion

Based on the findings of the present experiment it may be concluded that the Native×CSFL crossbred chickens has all the potential to become an alternative to commercial broilers as the physico-chemical and sensory characteristics were comparable. Native×CSFL F1 crossbred chickens could be suitable for small scale rearing in backyard considering the preferential pricing for coloured plumage over commercial broilers. Further, the crossbred chickens being developed using local native germplasm, the birds could thrive and perform better in local climatic conditions in rural small scale farming. Moreover, the characteristics like high protein and low fat content in Native×CSFL crossbred chicken meat is a desired feature considering the recent trends of non-vegetarian population.

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