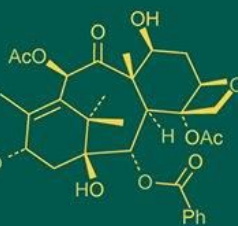
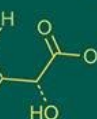


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Meat quality evaluation of native chicken and improved variety of chicken

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Abstract

Present study was undertaken to evaluate the carcass characteristics and meat quality traits of native chicken i.e. Aseel and Improved variety of chicken i.e. Indbro. A total of 120 birds were utilized for study i.e. 60 birds from each variety were taken. Results of carcass characteristics showed significantly ($p>0.05$) higher live wt., dressed carcass wt. and breast yield percentage for Indbro chicken, whereas the percentage yield of legs, back, wings, and neck were significantly ($p>0.05$) higher for meat of Aseel. Meat quality traits like proximate analysis and instrumental colour revealed significantly ($p>0.05$) higher values for moisture, protein, ash content and redness (a^*) values for meat of Aseel, while the fat content and lightness (L^*) values were significantly ($p>0.05$) higher for meat of Indbro. Significantly ($p>0.05$) higher values for hydroxyproline content, muscle fibre diameter and shear force values were noticed for meat of Aseel, whereas the pH , and WHC values were significantly ($p>0.05$) higher for meat of Indbro. When coming to sensory evaluation scores no significant difference was observed between both varieties except in scores for flavour. Though these varieties showed differences in some parameters, both of these are a good alternative to commercial broiler chicken and cater the demand for meat, and also fetching more price which will uplift the economic status of rural communities.

Keywords: Aseel, Indbro, backyard chicken, slow growing broilers

Introduction

Now a days, Backyard poultry is growing fast and playing a significant role in socio-economic status of rural people. The demand for native chicken increasing day to day, as a result, farmers in the rural areas establishing poultry farms for rearing native chicken breeds in small scale and generating income for uplifting their socio economic status. Some of the popular native chicken breeds like Aseel, Chittagong, Busra, Kadaknath etc. are reared for meat purpose and they fetch more price compared to commercial broilers because of high quality, texture and flavour of meat. Also these backyard poultry breeds can withstand adverse climatic conditions and are resistant to various diseases which are endemic to that area (Padhi, 2016) [19]. Though the source of income is high, these native breeds take more time to grow for attaining market weight.

In present days, there is increase in demand for meat due to increase in population resulting in growing of Commercial broilers at faster rate to attain market weight (about 2kgs) within short period (5 to 6 weeks), which ultimately leading to adverse effects in birds like damage to legs (Sanotra *et al.*, 2001) [23]. Woody breast condition where the meat become very tough (Petracci *et al.*, 2013, Soglia *et al.*, 2016) [21, 25]. To overcome this adverse effects, improved varieties of slow growing chicken were developed by rearing in semi intensive system. The demand for slow growing broilers increasing now a days, Indbro is one such kind which was developed by crossing native chicken and Commercial broilers by Indbro Research and Breeding forms PVT.LTD. This improved variety developed as an alternative to native chicken and Commercial broilers, these birds adopt both the characters of native chicken and commercial broilers. So, the study was undertaken to evaluate the carcass characteristics and various meat quality traits of Aseel and Indbro variety.

Materials and Methods

A. Procurement and slaughter, dressing of birds

Native chicken i.e. Aseel (35 weeks old) and improved variety i.e. Indbro (8 weeks old) were selected for study. These birds were procured from backyard poultry farms in rural areas and Indbro Research and Breeding Farms Pvt Ltd., respectively. For the research a total of 120 birds were utilized, 60 birds from each variety. After procurement, the birds were given adequate rest. Live weight of each bird was recorded then proceeded for slaughter and dressing at Department of Livestock Products Technology, College of Veterinary Science, P.V.N.R.T.V.U, Rajendranagar, Hyderabad.

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The dressed meat was then used for evaluating carcass characteristics and different meat quality traits.

1. Carcass traits

Live weight was recorded before the slaughter, then after slaughtering and dressing, the dressed carcass weight was recorded and expressed as percentage of live weight. Then, carcasses were fabricated into major cut up parts viz., breast, legs, wings, back and neck. The weight of each cut up part was recorded for individual bird (Aseel and Indbro) and expressed in percentage of dressed carcass weight.

2. Meat quality traits

Proximate Analysis

Moisture, protein, fat and total ash content of meat sample were determined according to AOAC (2005) [12]. The moisture content was determined by weight loss after 12 hours of drying at 100 °C in a hot air oven. Protein was determined by block digestion using an auto analyser and the fat content was estimated by an ether extraction procedure in an automatic Soxhlet Apparatus

Instrumental Color

The color measurement (Hunter L*, a* and b*) was performed using a X-Rite RM200QC Imaging Spectrocolorimeter, Lovibond. Color measurement was done on the surface of meat from the randomly chosen spots (Hunter and Harold, 1987). The values obtained for L*(lightness), a*(redness) and b*(yellowness) were recorded.

Muscle Fibre Diameter

Meat samples (approximately 1x 2 cm size) were fixed in 10% formal saline for 48 h, sliced and then homogenized with Ultra Turrax Tissue Homogenizer at a low speed for 30s. Few drops of homogenized tissue samples were poured into a clean glass slide, and a cover slip was placed and observed through a simple microscope at x100 magnification. The width of 15 randomly selected fibers per bird was recorded using ocular micrometer (Tuma *et al.*, 1962) [27].

Hydroxyproline content

Hydroxyproline content was estimated by taking six grams of meat sample which was cut into small pieces and kept in 20ml of water in a 50ml glass beaker before being heat treated for 2 h in a water bath at 90 °C. The pieces were cooled to room temperature and homogenized in a tissue homogenizer for one minute at 10000 rpm, which was flushed with 10ml distilled water. The homogenate was filtered through Whatman No. 1 filter paper, and 30ml of 6N HCL was added to the filtrate, whereas 50ml of 6N HCL was added to the residue. Both were then hydrolyzed overnight in an oven at 105 °C, and the concentration of hydroxyproline (HP) was determined (Newman and Lohan, 1950) [17].

pH

The pH for the meat sample estimated by following the method given by Trout *et al.* (1992) [26]. The pH recorded by digital pH meter by immersing the glass electrode into the homogenate of sample. The pH of the sample was measured with the pH meter, pH 4, 7 and 14 as per user manual instructions.

Water Holding Capacity (WHC)

The WHC of meat estimated by the process given by Wardlaw *et al.* (1973) [29]. Thoroughly minced meat sample weighing about 10g was stirred with 0.6M sodium chloride

(NaCl) about 15ml in a so called centrifuge tube. The tubes were then kept for 15 minutes at a temperature of 4±1 °C, the meat sample stirred again and centrifuged for 25 minutes at a speed of 5000 rpm. The supernatant obtained after centrifugation was measured and the difference between volumes i.e. initial (15ml NaCl) and the supernatant left over, used for calculation of WHC and is expressed in percentage of meat sample (i.e.10g) weight to calculate WHC.

Shear force value (SFV)

For estimating the Warner Bratzler shear force value the meat sample packed in low density polyethylene bags and sealed properly to avoid entry of water then the packed sample cooked in water bath for 10 to 20 minutes at 80 °C. After cooking, the cooked meat samples were made into cores and the cores from each sample were sheared across the length of the meat sample. These sample cores so prepared were placed under the V-notched shear blade of the Texture analyser. Cores were sheared perpendicular to the fiber orientation to measure the shear force. The peak shear force was recorded in newtons (N) and the average value from the three cores was recorded.

Sensory Evaluation

The sensory evaluation includes such as appearance, overall acceptability flavor, texture and juiciness of the meat samples evaluated using a descriptive scale (8 point) (Keeton, 1983) [14]. In the 8 point scale, highest quality of components characteristic given as 8 whereas scores were considered acceptable from 5 to 8 and scores from 1 to 5 were considered unacceptable. Minimum of 6 trained and experienced members of the institute were there in the panel, who were well familiar with all the characteristics of the meat. The meat samples were cooked in water bath for 20 minutes at 80 °C by adding salt (0.5% by weight of sample). After cooking, the cooked samples were cut into small equal sized pieces (square shape). At room temperature these coded samples are served in plates in separate sensory evaluation cabins, in between to avoid mixing of sensory attributes of different meat samples water served for cleansing the mouth.

Statistical analysis

The data obtained in this study for carcass characteristics and different meat quality traits were compiled and analyzed by SPSS. The entire data was subjected to analysis of variance, (one-way ANOVA) for both varieties. The least significant difference (LSD) and Duncan's multiple range tests are so applied to compare the means to find difference between both the groups. The smallest difference of about (5%) for two means was reported as different significantly.

Results and Discussion

Carcass traits

Table 1 showing the mean ± SE values of carcass characteristics of both Aseel and Indbro variety. The results of carcass characteristics showed a significant ($p < 0.05$) difference between both the varieties. Characteristics like live weight, dressed carcass weight, breast weight mean ± SE values, were significantly ($p > 0.05$) higher for Indbro birds when compared with Aseel variety, however the mean ± SE values for weight of thighs, back, neck and wings were significantly ($p > 0.05$) higher for Aseel birds than Indbro

variety. Composition and yield of carcass is greatly affected by several factors such as age, sex, live weight, genotype and slaughtering conditions (Havenstein *et al.*, 2007; Brickett *et al.*, 2007) ^[11, 6]. Higher thighs in Aseel chicken might be because of genetic differences in breeds, these

findings were coinciding with Rahayu *et al.*, 2008 ^[13] who reported higher thighs and drumstick weights in red jungle fowl than in Commercial broilers. Moreover, birds of either fast or slow growing can show different behaviour or muscle metabolism (Castellini *et al.*, 2002) ^[7].

Table 1: Showing the Carcass characteristics for the meat of Aseel and Indbro chicken

Carcass characteristics	Aseel chicken	Indbro chicken
Live weight (g)	1461.9±0.03 ^a	1859.8±0.03 ^b
Dressed carcass weight (g)	1107.8±0.02 ^a	1396.8±0.02 ^b
Cut up parts Breast (%) *	14.19±0.15 ^a	15.84±0.27 ^b
Legs (%) *	21.33±0.19 ^b	20.68±0.14 ^a
Back (%) *	10.09±0.10 ^b	9.19±0.16 ^a
Wings (%) *	9.53±0.09 ^b	8.13±0.14 ^a
Neck (%) *	3.22±0.04 ^b	3.05±0.05 ^a

*Cut up parts expressed as percentage of live weight. Means bearing lowercase alphabets-a, b within the rows are significantly ($p \leq 0.05$) different.

Meat Quality Traits

Proximate Analysis

The mean $\pm$ SE values of proximate analysis, instrumental colour, muscle fibre diameter, hydroxyproline content, pH, WHC, Shear force and sensory evaluation scores for meat of Aseel and Indbro chicken were presented in Table 2. Results of present study showed significantly ($p > 0.05$) higher mean $\pm$ SE values for moisture, protein and ash contents for meat of Aseel chicken when compared with meat of Indbro, whereas significantly ($p > 0.05$) higher mean $\pm$ SE values for fat content was noticed in meat of Indbro compared Aseel chicken. Ullengala *et al.* (2020) ^[28] studied the proximate composition of different Aseel crosses and revealed that the protein and fat proportion ranged from 23.56% to 23.78% and 3.25% to 3.69%, respectively. Boskovic *et al.* 2010 ^[5] stated that the variations in the composition of meat might be due to many factors like type of meat, breed, age, sex, nutrition, and rearing systems.

Instrumental Colour

Significantly ($p > 0.05$) higher mean $\pm$ SE lightness (L^*) values was noticed for meat of Indbro variety, whereas results of redness (a^*) values were significantly ($p > 0.05$) higher for meat of Aseel chicken. No Significant ($p < 0.05$) difference was observed in yellowness (b^*) values among both the varieties. Studies conducted by Rajkumar *et al.* (2016) ^[22] revealed higher lightness (L^*) values in Commercial broilers, indicating low levels of myoglobin in the muscle, whereas higher redness (a^*) values in Aseel meat which is known for its red meat with high myoglobin content coinciding with the present study results. According to Lonergan *et al.*, 2003 ^[15] differences in the redness (a^*) values among different genotypes might be due to the differences in muscle fibre type.

Hydroxyproline Content

Aseel meat showed significantly ($p > 0.05$) higher mean $\pm$ SE values for hydroxyproline content when compared with meat of Indbro variety. Weston *et al.*, 2002 stated that the hydroxyproline content is directly proportional to the collagen content of the meat, and it has been used for estimating the collagen content of the meat. Present study findings were coinciding with studies of Rajkumar *et al.*

(2016) ^[22] who also noticed significantly ($p \leq 0.05$) higher hydroxyproline content in Aseel chickens when compared with Commercial broiler chicken meat.

Muscle Fibre Diameter

The mean $\pm$ SE values of muscle fibre diameter for meat of Aseel was higher significantly ($p > 0.05$) in comparison with meat of Indbro variety. Muscle fibre diameter is a function of muscle texture and tenderness. Higher muscle fibre diameter values for breast muscle were noticed in meat of Aseel when compared with Commercial broilers in the findings of Devatkal *et al.* (2018) ^[9], whereas studies of Muthukumar *et al.* (2011) ^[16] revealed significant increase ($p < 0.05$) in fibre diameter with increase in body weight of broilers.

pH

Present study revealed significantly ($p > 0.05$) higher mean $\pm$ SE values for pH of meat of Indbro variety compared with meat of Aseel chicken. According to Allen *et al.*, 1997 ^[1] pH is the important factor in determining the meat quality and also affects the different attributes of meat. Barbut 1997 ^[4] stated high pH results in dark, firm and dry (DFD) meat with poor storage quality due to accelerated microbial growth, whereas the low pH improves the shelf life of meat but results in pale colouration. Results were similar with the studies of Sarsenbek *et al.*, 2013 ^[24] who noticed that during slaughter heavier birds do not struggle much as a result the pH decline is very low.

Water Holding Capacity (WHC)

Significantly ($p > 0.05$) higher mean $\pm$ SE water holding capacity values were noticed for meat of Indbro variety compared to meat of Aseel chicken. Studies of Olsson, 2003 ^[18] revealed that WHC influences the appearance of the muscle before cooking, during cooking and its juiciness when consumed. Fanatico *et al.* (2007) ^[10] stated that WHC is important in whole meat and further processed meat products, which can be measured by drip loss or cook loss. Poor WHC affects functionality and sensory characteristics. Barbut, 1993 ^[3] stated that poultry meat with low pH associated with low WHC, resulting in decreased tenderness of meat.

Table 2: Mean $\pm$ SE values of proximate analysis, instrumental colour, muscle fibre diameter, hydroxyproline content, pH, WHC, Shear force values and sensory evaluation scores for meat of Aseel and Indbro chicken.

Parameter	Aseel chicken	Indbro chicken
Moisture (%)	74.24 $\pm$ 0.04 ^b	72.38 $\pm$ 0.04 ^a
Protein (%)	22.16 $\pm$ 0.04 ^b	21.05 $\pm$ 0.04 ^a
Fat (%)	2.41 $\pm$ 0.01 ^a	3.81 $\pm$ 0.14 ^b
Ash (%)	1.74 $\pm$ 0.02 ^b	0.89 $\pm$ 0.01 ^a
Colour (L*)	33.90 $\pm$ 0.38 ^a	45.49 $\pm$ 0.94 ^b
a*	6.29 $\pm$ 0.01 ^b	5.50 $\pm$ 0.05 ^a
b*	16.46 $\pm$ 0.06 ^a	16.50 $\pm$ 0.17 ^a
Hydroxyproline content (μ g/g)	182.52 $\pm$ 0.71 ^b	125.21 $\pm$ 0.84 ^a
Muscle fibre diameter (μ m)	61.83 $\pm$ 0.48 ^b	56.45 $\pm$ 0.14 ^a
PH	6.07 $\pm$ 0.01 ^a	6.13 $\pm$ 0.01 ^b
WHC	38.66 $\pm$ 0.55 ^a	41.01 $\pm$ 0.41 ^b
Shear force values	13.18 $\pm$ 0.09 ^b	10.91 $\pm$ 0.22 ^a
Appearance	7.01 $\pm$ 0.03 ^a	7.00 $\pm$ 0.02 ^a
Flavour	7.21 $\pm$ 0.08 ^b	6.99 $\pm$ 0.02 ^a
Juiciness	7.06 $\pm$ 0.04 ^a	6.98 $\pm$ 0.01 ^a
Texture	6.97 $\pm$ 0.00 ^a	6.92 $\pm$ 0.02 ^a
Overall Acceptability	7.08 $\pm$ 0.02 ^a	7.02 $\pm$ 0.01 ^a

Means bearing lowercase alphabets-a, b within the rows are significantly ($p \leq 0.05$) different.

Shear Force Value (SFV)

Aseel meat showed significantly ($p > 0.05$) higher mean $\pm$ SE shear force values compared to Indbro meat. Correlated results were noticed in findings of Devatkal *et al.* (2019) [8] who revealed significantly higher SFV of thigh meat in slow growing broilers when compared to Commercial broilers. However according to Sarsenbek *et al.*, 2013 [24] SFV tend to increase with age and body mass Rajkumar *et al.*, 2016 [22]. In findings of Ullengala *et al.* (2020) [28] lower SFV values for meat of different Aseel crosses was observed, and stated that this low values might be due to the age of slaughter and body weight of the birds.

Sensory Evaluation

The present study sensory evaluation scores revealed, only slight differences in sensory attributes like appearance, flavour, juiciness and overall acceptability was noticed between meat of both the varieties and the differences are non-significant except the flavour scores. Results were in correlation with the studies of Rajkumar *et al.* (2016) [22] who also reported no significant difference in sensory scores between broilers and Aseel meat. Also Pandey *et al.* (2018) [20] observed no significant difference in sensory scores between slow growing Native x CSFL crossbred chickens and Commercial broilers.

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