

COMPARISON ON MEAT QUALITY CHARACTERISTICS OF SPENT BREDER, LAYER AND BROILER BIRDS

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Abstract: An investigation was carried out for comparing the meat quality attributes of spent breeder, layers and broilers meat to assess the extent of suitability for preparing the processed chicken meat products. Spent breeder hen meat recorded significantly ($P < 0.05$) lower drip loss, highest water-holding capacity, lower shear force value, highest total protein extractability, lowest collagen, highest collagen solubility, lower cooking loss, highest protein content and superior sensory scores compared to spent layer and broiler meat. From these results, it is concluded that spent breeder meat is superior for preparation of processed and value added chicken meat products compared to spent layers and broilers birds meat.

Keywords: Meat quality, Spent Breeders, Spent Layers, Spent Broilers.

Introduction

Poultry meat quality is a complex issue that can be affected by many factors. Meat quality traits including physical characteristics (pH, drip loss, water holding capacity, muscle fibre diameter and shear force value), myoglobin content, collagen content and extractable proteins, chemical characteristics (proximate composition) and sensory attributes. A study was conducted to assess the comparative quality of chicken nuggets prepared from broiler, spent hen and combination meats. The individual meat quality traits of only spent layers have been widely researched in literature. However, the comparison of the meat quality characteristics of different types of spent hens have not been reported. Therefore, the objective of this study was to compare the meat quality characteristics of spent breeder hens, spent layers and spent broiler hens.

Materials and Methods

Meat from breast portion was obtained from spent breeder hen (5.0-5.5 kg live weight), spent layer hen (1.2-1.4 kg live weight) and broiler hen (2.4-2.6 kg live weight) separately from local retail chicken market of Tirupati and brought to the laboratory within one hour of birds slaughter. The samples were analysed immediately for various physico-

chemical and sensory characteristics. Cooking loss was determined the weight difference before and after cooking of muscle and expressed in percentage. The pH was measured using a standardized electrode attached to a digital pH meter. Muscle samples was individually weighed, packed and suspended in plastic bags at 4 °C for 24 h, and percentage weight loss during storage expressed as drip loss. Shear force value (SFV) was estimated by using Warner-Brazler shear force apparatus and SFV was recorded in kg/cm². Muscle fibre diameter was calculated with the help of calibrated eye piece micrometer. The following methods are adopted by estimation of water-holding capacity (WHC) (Wardlaw *et al.* 1973), total myoglobin (Warris 1979), Collagen content and solubility (Nueman and Logan 1950), total protein extractability (Joo *et al.* 1999), proximate composition (AOAC 2002) and sensory evaluation conducted by cooking the muscle pieces attained to 75°C and add salt and spice mix to taste then evaluated according to Keeton (1983). The experiment was repeated three times and the samples were analysed in duplicates and the data generated for different meat quality characteristics were compiled and analysed by using SPSS Ver.16.

Results and Discussion

Mean \pm S.E values of meat quality characteristics of different spent birds are presented in Table 1. The drip loss (%) and pH values was significantly ($P < 0.05$) highest in layer meat compared to breeder and broiler hen meat. Drip is a dilute solution of sarcoplasmic proteins. Immediately after slaughter, depending on age of birds protein degradation causes reduce water reservation among myofibrils, which increase juice loss of meat (Elisabath and Stevan 2005).

The difference in pH indicates that the rate or pattern, of pH decline immediately after post-mortem is vary and pH fall will result from denaturation of proteins, increase in actomyosin shortening and internal structural changes. A significant ($P < 0.05$) highest WHC was noted in spent breeder hen meat compared to others which is highly correlated with less drip loss. Spent breeder meat had significantly ($P < 0.05$) lowest SFV compared to the layer and broiler meat. There was no significant difference observed between the shear values of layer and broiler meat. Breeder birds are more live weight compared to the spent layer and broiler. Shear force values decreased with the increasing body weight of the birds which might be due to spent layer and broiler have collagen cross linking which increases with age and is often associated with increased shear values. Highest muscle fibre diameter observed in the spent layer meat and which is associated with high shear values. The differences in muscle fibre diameter might be due to the differences in the genotype, age, production systems, diets

etc. Muscle fibres from fast growing lines of chickens have larger fibre diameters than slow-growing lines and larger fibre diameters are often associated with meat toughening (Guan *et al.* 2013). Myoglobin content was significantly ($P<0.05$) high in spent layer meat compared to broiler and breeder meat. Satish Kumar *et al.* (2011) reported that highest myoglobin content in black turkeys than broiler spent hen. Total protein extractability significantly ($P<0.05$) highest in spent breeder hen meat compared to the spent layer and broiler hen meat. Highest body weight birds recorded highest protein extractability. The differences might be due to differences in pH of breast samples. Protein extraction increases with pH and salt concentration. Naveena and Mendiretta (2004) reported higher water holding capacity, lower salt soluble protein and myoglobin content for spent hen meat. The results are in accordance with Satish Kumar *et al.* (*loc.cit*) in turkeys and spent broiler hen meat.

A significant ($P<0.05$) differences in both collagen content and collagen solubility was observed in different types of spent hen meat. Greater collagen content was found in spent layer meat and lowest collagen content was found in breeder hen meat. There was non-significant ($P>0.05$) difference observed between collagen content of spent layer and broiler hen meat. Highest collagen solubility was observed in spent breeder meat compared to spent layer and broiler meat. Collagen content of chicken meat becomes less soluble when the animal is more mature and in present investigation, differences in live weights, age and utilization patterns of spent birds are the main factors for recording differences in both collagen content and collagen solubility. Spent layer meat recorded significantly ($P<0.05$) highest cooking loss compared to spent broiler and breeder hen meat. Cooking loss decreased significantly with increasing the live weight of the birds showing the advantage of spent breeder birds for further processed and value added chicken products. Higher cook loss in spent hen meat might be due to higher proportion of oxidative fibre which in turn related to water holding capacity of meat causing more moisture loss during cooking compared to other spent birds meat. These results are in agreement with Satish Kumar *et al.* (*loc.cit*) in turkeys and spent broiler meat. A significant ($P<0.05$) highest moisture and fat contents were found in spent broiler meat, whilst the lowest protein was also found in broiler meat. Highest protein content was found in spent breeder hen meat compared to other spent birds meat. Total ash content did not significantly ($P>0.05$) influenced in different types of spent birds. The range of moisture per cent in spent birds are 71.05 to 73.15, protein content are 21.25 to 23.46, fat content are 1.62 to 2.78 and total ash contents were 1.22 to 1.29. This condition could possibly due to different of environmental condition, feeding, birds maturity and

rearing systems. According to Xiong *et al.* (1993), the chemical composition of chicken meat was affected by breed, sex, age, feeding regime, meat yield, composition, part of meat as well as carcass processing.

Mean \pm S.E values of sensory characteristics of different spent birds are presented in Table 2. Spent breeder hen meat recorded significantly ($P < 0.05$) superior colour, flavour, juiciness, tenderness and overall acceptability scores compared to the other spent birds meat. These results are coincide with various physico-chemical characteristics like water-holding capacity, shear force value, drip loss, pH and muscle fibre diameter which cumulatively influence the sensory characteristics of cooked meat samples. For chicken meat, colour, tenderness and flavour are the main factors contributing the overall palatability of meat. Guan *et al.* (*loc.cit*) found that meat from hen (72 weeks) was tougher than other birds and having lower sensory scores.

Conclusion

The present investigation revealed that the spent breeder hen meat recorded significantly highest quality characteristics and superior sensory scores compared to spent layers and spent broilers meat and better useful in preparation of value added and processed chicken meat products.

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Table 1. Mean \pm S.E values of meat quality characteristics of spent breeder hen, spent layers and spent broiler hens meat (n=6)

Meat quality characteristics	Spent breeder hens	Spent layers	Spent broilers
Drip loss (%)	1.31 \pm 0.14 ^c	2.31 \pm 0.27 ^a	2.09 \pm 0.28 ^b
pH	5.87 \pm 0.23 ^c	6.42 \pm 0.10 ^a	6.10 \pm 0.13 ^b
WHC (%)	14.41 \pm 0.11 ^a	9.65 \pm 0.27 ^c	11.45 \pm 0.52 ^b
SFV (kg/cm ²)	2.61 \pm 0.20 ^b	3.11 \pm 0.31 ^a	3.09 \pm 0.19 ^a
Muscle fibre diameter (μ m)	34.48 \pm 0.10 ^c	41.29 \pm 0.31 ^a	38.96 \pm 0.17 ^b
Myoglobin content (mg/gm)	0.51 \pm 0.19 ^c	0.87 \pm 0.26 ^a	0.64 \pm 0.35 ^b
Total protein extractability (%)	14.09 \pm 0.17 ^a	9.46 \pm 0.23 ^c	11.71 \pm 0.4 ^b
Collagen content (mg/gm)	3.25 \pm 0.33 ^b	4.89 \pm 0.47 ^a	4.93 \pm 0.20 ^a
Collagen solubility (%)	28.43 \pm 0.22 ^a	17.42 \pm 0.16 ^c	24.63 \pm 0.44 ^b
Cooking loss (%)	23.18 \pm 0.51 ^c	28.07 \pm 0.17 ^a	27.19 \pm 0.22 ^b
Moisture (%)	72.19 \pm 0.19 ^b	71.05 \pm 0.27 ^c	73.15 \pm 0.39 ^a
Protein (%)	23.46 \pm 0.45 ^a	21.39 \pm 0.36 ^b	21.25 \pm 0.58 ^b
Fat (%)	1.96 \pm 0.20 ^b	1.62 \pm 0.31 ^c	2.78 \pm 0.17 ^a
Total ash (%)	1.24 \pm 0.19	1.29 \pm 0.27	1.22 \pm 0.34

Note: Mean values within row bearing different superscripts are differ significantly (P<0.05).

Table 2. Mean \pm S.E values of sensory characteristics of spent breeder hen, spent layers and spent broiler hens meat (n=18)

Sensory characteristics	Spent breeder hens	Spent layers	Spent broilers
Colour	5.92 \pm 0.31 ^a	5.18 \pm 0.45 ^c	5.50 \pm 0.60 ^b
Flavour	6.23 \pm 0.20 ^a	5.70 \pm 0.13 ^c	6.01 \pm 0.28 ^b
Juiciness	5.52 \pm 0.17 ^a	5.03 \pm 0.40 ^b	5.47 \pm 0.17 ^a
Tenderness	5.30 \pm 0.30 ^a	4.60 \pm 0.27 ^c	5.11 \pm 0.44 ^b
Overall acceptability	5.58 \pm 0.42 ^a	5.16 \pm 0.19 ^c	5.33 \pm 0.27 ^b

Note: Mean values within row bearing different superscripts are differ significantly (P<0.05).