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SHORT COMMUNICATION

Evaluation of carcass, organ and organoleptic properties of spent layers of different poultry types

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AAO, Conceived idea, designed study, collected data, animal slaughter& preparation of manuscript, OAA, conceived idea, designed study and prepared manuscript, OAB, designed study, laboratory analysis and preparation of manuscript, ATO, collected data, laboratory analysis and statistical analysis, RTA, collected data, laboratory analysis, animal slaughter and statistical analysis

ABSTRACT

This study was designed to assess carcass, organ and organoleptic properties of spent layers of different poultry species; comprising of geese, local chicken, commercial chicken and quails. Eight (8) birds of each species were used for data collection. Results indicated that quail birds had the highest ($P < 0.05$) proportion for bled weight (97.5%), pluck weight (94.6%) and dressing percentage (72.2%) while the least ($P < 0.05$) was from geese. The primal cut of quail gave the highest ($P < 0.05$) values for breast, thigh and back. Wing of geese was the heaviest ($P<0.05$) while the local chicken was observed to have the heaviest ($P < 0.05$) drumstick. All parameters for both external and internal offal were significantly ($P < 0.05$) different between the poultry species. Thermal loss ranged from 31.5- 46.3% in breast muscle and 34.5- 47.8% in the thigh muscle while cooking loss ranged from 19.9-39.8% in breast and 21.5 – 42.5% in the thigh of all the poultry types. Quail had the lowest cooking loss and also was the juiciest, the most tender and ranked the highest in terms of flavor. The overall acceptability of the taste panel was however in favour of exotic breed of chicken.

Keywords Poultry species, spent layers, carcass, organoleptic properties

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INTRODUCTION

Nigeria is richly endowed with a variety of animal protein sources, but the total production is not sufficient to meet the requirements of Nigerians (Ibe, 2000). Poultry production however remains one of the potential avenues to achieve sustainable and rapid production of high quality protein to meet the increasing demand for animal protein (Akpata and Ojo, 2000). Layer birds have been estimated to contribute 65-70% of the total poultry population, however after completing their laying cycles their meat is considered tough due to increased collagen content as compared to broiler (Munira *et al.,* 2006). Regardless of this perceived quality of their meat, sale of these spent layers is an important source of income to the poultry farmer and can also contribute to animal protein intake in Nigeria which is estimated at 8g *per* capita *per* day (caput) and is 27g less than the minimum requirement recommended by the National Research Council (NRC) of the United States of America (Ani and Okorie, 2003). Several authors (Siegel *et al.,* 1984, Young *et al.*, 2001) reported that strains, sex, age, health and nutrition affect yield of parts, dressing percentage and organ characteristics of birds. However, there is no information about carcass characteristics of meat from spent layers

from different poultry types that are typically encountered in markets in Nigeria. The present study was therefore designed to compare the carcass, organ and organoleptic characteristics of spent layers of different poultry species.

MATERIALS AND METHODS

Four poultry layer types (Geese, Local chicken, commercial chicken and Quail) were used for the experiment. The birds were raised at the Poultry Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Nigeria until regarded as spent layers after a year of production. Eight birds from each poultry type were slaughtered and carcass data analysed.

Prior to slaughtering, the animals were starved for about 12 hours, and live weights were recorded. They were bled immediately after stunning and hung upside down for complete bleeding. The bled carcasses were scalded, defeathered, singed and eviscerated according to Jones (1984). The carcass, external (head, shank and neck) and internal offal (liver, gizzard, proventiculus, spleen, heart, bile, lung, and kidney) were weighed and recorded and expressed as a percentage of the live weight of the birds. The dressing percentage was calculated as:

(Warm carcass/live weight) x 100

The breast and thigh meat of each of the poultry types were cut, weighed, cooked for 30 minutes in a water bath at 80^0C, cooled to room temperature, blotted dry and re-weighed to get the cooking loss, while the change in length was also recorded for thermal loss (Honickel, 1998). The cooking loss was calculated as the percentage change in weight of meat after cooking, while thermal loss was expressed as the percentage in length of the cooked meat (Honickel, 1998).Sensory evaluation was carried out on colour, flavour, tenderness, juiciness and overall acceptability of each poultry types (spent layers) on a nine point hedonic scale using a 10 member panel (Price and Schweight, 1971). The score was arranged in a descending order, the maximum score 9 was given to extremely like condition while the lowest score 1 was for the poorest condition.

All data obtained were processed and subjected to analysis of variance (ANOVA) using statistical analysis software (SAS, 1999). Significantly different means were separated using Duncan's multiple Range (DMR) test (SAS 1999).

RESULTS

Carcass characteristics and primal cut of spent layers of different poultry types are presented in Table 1. The average mean live weight for Geese, Local chicken Exotic chicken and Quail layers were 944.6, 916.3, 986.1 and 115.1 g respectively and were different ($P<0.05$). Quail bird had the highest proportion of bled weight (97.48%), pluck weight (94.56%) and dressing percentage (72.24%) while the least values were from in Geese ($P < 0.05$). The primal cut of different spent layer types as expressed in percentage of live weight ranged as follows: wing (6.40-11.46%), breast (12.41-22.37%), drumstick (6.26-8.50%) thigh (5.04-10.2%) and back (14.13-16-18%). Again Quail was observed to have the highest ($P<0.05$) values for breast, thigh and back while the highest ($P<0.05$) for wing was found in Geese. The local chicken and exotic chicken was observed to have the highest ($P<0.05$) proportion of drumstick

Both external offal and internal organs are presented in Table 2. There was a significant ($P < 0.05$) difference in all parameters between the poultry types. Proportion of liver, lung and bile from geese were significantly ($P < 0.05$) high (2.99, 1.02 and 0.20% respectively) while heart and kidney from the quail were also statistically higher ($P < 0.05$) than other poultry species. Percentage gizzard and spleen were higher ($P < 0.05$) from local chicken (3.4 and 0.2% respectively). The neck made the highest ($P < 0.05$) portion of the live weight in the geese but lowest in local chicken. The panelist responded differently ($P < 0.05$) to the samples provided as shown in Table 3. The geese was significantly ($P < 0.05$) favoured in terms of colour, followed by commercial chicken, local chicken and Quail with score of 6.8, 6.6 and 6.0 respectively. Quail was found to have the highest ($P < 0.05$) flavor, juiciness and tenderness with score of 6.9, 6.4 and 6.10 respectively and closely followed by commercial chicken while the geese had significantly ($P < 0.05$) lower scores. The overall acceptability was however in favour of the commercial chicken with a score of 6.3. The values for cooking loss and thermal loss of breast and thigh muscles are presented in Table 3. Geese, local chicken, commercial and Quail layers had 39.84, 34.13, 33.46 and 19.90% cooking loss for breast, respectively. The portion which made the highest and lowest ($P < 0.05$) of the live weight was the thigh muscle from geese (42.54%) and quail (21.54) respectively. Thermal loss range from 31.53- 46.33% in the breast muscle and 34.50- 47.75% in the thigh muscle

Table 1 Carcass Characteristics and Primal Cut as percentage of live weight of Poultry Spent Layers

Parameter	Geese	Local chicken	Commercial chicken	Quail
Live weight (g)	944.6±34.86^{b}	916.3± 29.10^{c}	986.14±33.50^{a}	115.1±29.00^{d}
Bled weight	96.2± 0.96^{b}	97.1± 0.93^{a}	96.8±1.01^{b}	97.5±1.00^{a}
Pluck weight	90.5± 1.58^{d}	93.7±1.43^{b}	92.5±2.17^{c}	94.6±1.21^{a}
Feather weight	5.7 ± 0.05	3.5 ± 1.51	4.4 ± 1.43	2.9±1.11
Dressing %	56.4 ±1.64^{d}	66.9± 1.73^{b}	64.5 ± 2.05^{c}	72.2±1.32^{a}
Wing	11.5 ± 0.17^{a}	9.6 ± 0.11^{b}	8.2 ± 0.07^{c}	6.4±0.06^{b}
Breast	15.7 ± 0.49^{b}	12.4 ± 0.42^{d}	14.1± 0.61^{c}	22.4±0.40^{a}
Drumstick	6.3 ± 0.02^{c}	8.5 ±0.13^{a}	8.5± 0.05^{a}	6.9 ±0.10^{b}
Thigh	5.04 ± 0.41^{c}	8.4 ± 0.29^{b}	8.6 ± 0.07^{b}	10.2±0.12^{a}
Back	15.1 ± 0.93^{ab}	14.3±0.43^{b}	14.1 ± 0.54^{b}	16.2±0.33^{a}
Head	8.8 ± 0.10^{a}	5.1 ± 0.38^{d}	5.2 ± 0.21^{c}	7.7±0.44^{b}
Neck	6.3 ± 0.15^{a}	2.3 ± 0.34^{b}	3.1 ± 0.33^{d}	3.7±0.23^{c}
Shank	2.6 ± 0.04^{b}	3.1 ± 0.03^{a}	2.0 ± 0.05^{c}	1.9±0.04^{c}

^{abcd}: *Means in the same row with different superscripts are significantly different (P<0.05)*

Table 2. External offal and internal organ weight as percentage of live weight of different Spent Layers.

Parameters (%)	Geese	Local chicken	Commercial chicken	Quail
Liver	3.0 ±0.08^{a}	2.0±0.85^{b}	1.8±0.05^{c}	1.6±0.12^{d}
Gizzard	3.2 ±0.45^{b}	3.4±0.28^{a}	3.2±0.25^{b}	2.2±.24^{c}
Proventiculus	0.6 ±1.50^{d}	0.7 ± 1.25^{c}	0.5 ± 0.14^{b}	0.4±1.45^{a}
Spleen	0.1 ± 0.69^{b}	0.2 ± 0.56^{a}	0.1 ± 0.25^{ab}	1.0±0.44^{b}
Heart	0.8 ± 0.64^{b}	0.5 ± 0.71^{c}	0.4 ± 0.12^{c}	1.1±0.33^{a}
Bile	0.2 ± 0.13^{a}	0.1 ± 0.08	0.1 ± 0.15	0.1±0.09
Lung	1.0 ± 0.18^{a}	0.5 ± 0.15	0.5 ± 0.16	0.4±0.20
Intestinal Weight	6.3 ± 0.05^{b}	8.8 ± 0.08^{a}	9.1 ± 0.15^{a}	6.1±0.32^{b}
Kidney	0.7 ± 0.11^{b}	0.4 ± 0.16^{c}	0.2 ± 0.06^{d}	0.9±0.28^{a}

^{abcd}: *Means in the same row with different superscripts are significantly different (P<0.05)*

Table 3 Sensory properties, cooking and thermal loss of different spent layers

Parameters (%)	Geese	Local chicken	Commercial chicken	Quail
Colour	7.2 ± 0.56^{a}	6.6 ± 0.43^{c}	6.8 ± 0.38^{b}	6.0±0.22^{d}
Flavour	5.0 ± 0.11^{c}	6.0 ± 0.82^{b}	6.8 ± 0.53^{a}	6.9±0.26^{a}
Juiciness	3.8 ± 0.03^{d}	4.1 ± 0.41^{c}	5.1 ± 0.56^{b}	6.4±0.03^{a}
Tenderness	3.7 ± 0.43^{d}	4.2 ± 0.41^{c}	5.4± 0.23^{b}	6.1±0.31^{a}
Overall Acceptability	5.3 ± 0.06^{a}	6.1 ± 0.05^{c}	6.3 ± 0.03^{b}	6.1±0.07^{c}
Cooking loss %				
Breast	39.8 ± 2.25^{b}	34.1 ± 1.51^{a}	33.5 ± 1.34^{a}	19.9±0.16^{c}
Thigh	42.5 ± 1.46^{b}	39.9 ± 1.62^{c}	35.3 ± 0.69^{c}	21.5±0.37^{a}
Thermal loss %				
Breast	44.7±0.63^{c}	46.3±0.45^{a}	40.4±0.62^{d}	31.5±0.24^{a}
Thigh	47.8±1.50^{b}	45.3±1.32^{c}	44.3±0.73^{d}	34.5±0.45^{a}

^{abcd}: *Means in the same row with different superscripts are significantly different (P<0.05)*

DISCUSSION

Dressing percentage is a better index of total edible meat after the visceral organs, blood and feathers have been removed (Ugwu and Onyimonyi, 2008). Based on present the study, quails surprisingly have more edible meat followed by the local chicken even though they have the least body weight. Ikeme (1990) and Akinwumi (2006) have earlier reported that bled weight, plucked weight and dressed weight followed the same trend with the pre-slaughtered weight.

The weight of primal cuts of the chicken such as breast, thighs, drumsticks, wings and back is very important as whole carcass is no longer popular but preference given to cuts .This study corroborated the work of (Young *et al.,* 2001) who stated that strains and species of animals could affect the yield of carcass after slaughter. They (Young *et al.,* 2001) also added that yield of body component or primal cuts changes with the increase in body weight. This could be the reason for the changes in the internal organ weight as revealed in the study.

The mean panel rating for colour in all the poultry layer species showed a generally high score, meaning that all the poultry type has meat of good characteristics in terms of colour. Colour of meat depends upon the pigment changes that take place during cooking (Price and Schweigert, 1978). The older the animal or the more active the animal, is, the higher the myoglobin concentrations in the muscle of such an animal (Jeremiah, 1978). Appearance of meat influences the consumer's acceptance of meat since colour is the first criterion consumers' use to judge meat quality and acceptability (Comfort, 1994). According to Qiao *et al.,* (2001) consumers reject products in which the colour departs from the expected normal appearance. Therefore geese spent layer meats may be attractive to consumers in terms of colour than meat from other poultry types tested in the present study.

It is known that tenderness varies with the muscle age and depends on changes in the proportion and types of tissue supporting the muscle fiber (Lawrie, 1998). On the other hand, flavor tends to develop with age while juiciness depends largely on the fat content of the carcass (Lawrie, 1998). The present work however showed that quail spent layer had a better consumer preference for juiciness, flavor and tenderness as compared to others. This was also reflected by having the least water loss during cooking. But the overall rating for acceptability was in favor of commercial chicken closely followed by quail and local chicken.

It is normal for meat to shorten during heating because of protein denaturation, which causes water within the myofibrils in the narrow channels between the filaments to exudates as meat shrinks within the tissue matrix (Dabes, 2001; Akinwumi, 2006). High cooking loss leads to reduced juiciness, tougher meat and loss of profit (Ikeme, 1990; Dabes, 2001). This is evident in the present study as the birds with higher values of cooking and thermal losses (Geese, local and exotic chicken) were also observed to have a lower rating for juiciness and tenderness than Quail. Cooking loss has an inverse relationship with the water holding capacity (WHC) (Akinwumi *et al.,* 2012) and this showed that the water retention will be low. The juiciness is a function of WHC and cooking loss (Lawrie, 1998; Akinwumi *et al.,* 2012). Though cooking loss and thermal loss negatively affected both tenderness and juiciness in the present study, this has justified the reason spent layer meat is considered tough which may also be due to its increased collgen (Munira *et al.,* 2006). Meat from spent quail was less affected when compared to other poultry types studied in the present experiment.

Conflict of interest None

CONCLUSION

It can be concluded that quail spent layers offered a better dressing percentage, juiciness, flavor and tenderness. It also had reduced cooking loss, however the general acceptability in terms of organoleptic properties favoured the exotic layer chicken.

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