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Breed Effects on Nutritive Value, Carcass and Non-carcass Components of Spent Hens of Nigeria Region

Fajemilehin Samuel Oladipo Kolawole^{1*}

¹*Department of Animal Production and Health Sciences, Faculty of Agricultural Sciences, Ekiti State University, Ado-Ekiti, Nigeria.*

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

A study was carried out to determine the nutritive value, carcass and non-carcass characteristics of spent hens of Brown Nera exotic strain and the Normal-Feathered local hens in Nigeria with a view to ascertaining their suitability for consumption.

Twenty numbers of day old chicks each of local and exotic stocks were procured and kept intensively. The two breeds were offered the same feed with starter diet containing 2880 Kcal ME/kg and 186 g/kg of crude protein for the first 2 months; grower diet with 2970 KcalME/kg and 178g/kg crude protein for the next 3 months and layer diet with 2800 KcalME/kg and 178g/kg crude protein from onset of lay to the end of the experiment. At 72 weeks of age, 10 birds from each group were slaughtered, scalded in hot water, plucked and eviscerated. The plucked, eviscerated, carcass, cut-up parts - head, neck, drumstick, thigh, back, breast, wing shank and the non-carcass - heart, gizzard, lungs, liver, spleen, proventriculus, small intestine and abdominal fat weights were determined and expressed as percentages of the live weight.

The blood, plucked, eviscerated, carcass, breast, back, thigh, drumstick, neck, head, shank, gizzard, heart, lung, liver, spleen, proventriculus and intestinal weights were higher ($p < 0.05$) in the local chicken and rest were higher in the exotic breed. Crude protein content of the thigh, liver and

*Corresponding author: E-mail: dipofajemilehin@yahoo.com;

breast were higher ($p < 0.05$) in the exotic breed; the cholesterol content higher ($p < 0.05$) in the local breed and the rest were similar ($p > 0.05$) between them. The spent hens' major muscles had similar nutritional value to commercial broiler meat except that it has higher fat content but lower cholesterol which might probably confer health promoting benefits on spent hen meat.

Keywords: Carcass; cut parts; Nigeria; exotic birds; local birds; non-carcass; nutritive value.

1. INTRODUCTION

Chicken meat is a nutrient-dense and non-homogenous food with global production and consumption growing at more than 5 percent annually and this proportion is rising each year [1]. Although, meat-type chicken has been bred, meat from spent hens may equally provide valuable nutrients to man.

In Japan and United States of America spent hens are used in the pet food Industry [2] but in the developing countries, like Nigeria, spent hens are important in culinary practices [3] because the meat is a good source of nutrients such as proteins and omega-3 fatty acid; tough and chewy though poor in functional properties because of its increased collagen content and cross linkages [4].

In the past, the performance of birds was measured as the total body weight but now analysis of the prime cut-parts or body chemical composition or both are important. Prime parts include the yield and proportions of meat from the breast, thighs, drumsticks and wings which are affected by breeds, sex, age, health and nutrition [5].

There are presently no reports on the cut-parts and non-carcass parts of spent hens and the comparison between exotic and the local spent hens encountered in Nigerian poultry meat markets. Therefore, the objective of this study is to determine the effects of breeds on nutritive value, carcass and non-carcass components of spent hens.

2. MATERIALS AND METHODS

The study took place at the Layers' Unit of the Teaching and Research Farm, Ekiti State University, Ado Ekiti with two breeds of spent layers: Brown Nera (exotic stock) and normal feathered hens (local stock). Twenty numbers day old chicks each of local and exotic stocks were procured and kept intensively. They were

fed with the same diets: starter diet with 2880 Kcal ME/kg and 186 g/kg of crude protein for 2 months; grower diet with 2970 KcalME/kg and 178 g/kg crude protein for another 3 months and layer diet with 2800 KcalME/kg and 178 g/kg crude protein from onset of lay to the end of the experiment at 72 weeks. All other management conditions for rearing of both strains were the same.

2.1 Nutritive Composition Analysis

The nutritive compositions of thigh, liver and breast muscles were determined by [6] methods.

2.2 Carcass Characteristics

A sample of 10 birds from each group was slaughtered early in the morning after fasting over-night at 72 weeks of age by cutting the neck at the base of the head after stunning and hung in an upside-down position until bleeding stopped. The bled birds was scalded in boiling water, manually plucked and eviscerated. The legs were severed at the tibiotarsus-metatarsal joint and the head separated from the neck at the cranium-atlas junction. The bird was cut open at the anus and the abdominal and thoracic cavity organs and the abdominal fat were then removed. Live weight before slaughter, plucked, eviscerated and carcass weights were taken and expressed as percentages of the live weight. The carcass was dismembered and the weights of the cut-up parts: head, neck, drumstick, thigh, back, breast, wing and shank were determined and expressed as percentages of the live weight. Non-carcass measurements determined were the weights of the heart, gizzard, lungs, liver, spleen, proventriculus, small intestine and abdominal fats as percentages of the live weight.

2.3 Statistical Analysis

All data obtained were subjected to t-test analysis [7] using SPSS version 18, 25 Statistical Package Software [8].

3. RESULTS

3.1 Proximate Composition

Table 1 shows the nutritive value of cut-up-parts of local and exotic spent layers. The thigh crude protein was significantly higher ($p < 0.05$) in exotic spent layers while the cholesterol content was significantly ($p < 0.05$) higher in local stock. The nutritive values of liver and breast muscles follow the same pattern as the thigh muscle.

3.2 Live Weight and Cut Parts as Percentages of Live Weight of Spent Layers of Exotic (Brown Nera) and Normal Feathered Local Chicken

Table 2 shows the live weight and cut-up-parts as percentages of live weight of spent layers of exotic and local chickens. The live weight was significantly ($p < 0.05$) higher in exotic ($1730 \text{ g} \pm 53.85$) than the local ($800 \text{ g} \pm 35.36$) breeds. The bled weight followed similar pattern as the live weight. The proportions of other traits: blood weight, plucked weight, eviscerated weight, carcass weight, breast weight, back weight, thigh weight, drumstick weight, neck weight, head weight and shank weight relative to the live weight were significantly higher ($p < 0.05$) in local breed.

3.3 Innards Expressed as Percentages of Live Weight of Spent Layers of Exotic (Brown Nera) and Normal Feathered Indigenous Chickens

Table 3 shows the innards as percentages of live weight in spent layers of local and exotic breeds. The % weights of gizzard, heart, lung, liver, spleen, proventriculus, abdominal fat and intestine of the local chicken were significantly ($p < 0.05$) higher in exotic breed.

4. DISCUSSION

The nutritive value revealed breed effects. However, the moisture, protein, and ash contents obtained were in the range of chicken *Pectoralis* muscle as observed by [9,10,11,12,13]. The fat content was higher than the value in broiler at 0.68-2.78% [13,11,12], probably due to differences in breeds and the age. This finding is strengthened from the recognition that fat content increases with age [14,15]. The cholesterol content obtained in this study is low compared to

earlier reports in breast muscle of spent hen at 34.29 mg/100 g [10], 43 mg/100 g [16], and 50.07-62.64 mg/100 g [17] and 81 mg/100 g in breast muscle of broiler [18]. It is important to note that numerous aspects of the biochemical compositions of meat vary probably because of differences in breeds, age, plane of nutrition and exercise the birds were exposed to as well as on the anatomical location of the musculatures involved.

The exotic spent layer had higher live weight at slaughter than the local spent layer. The difference in body weights of the two spent layers can be attributed to genetic effects since the experimental chickens were all reared under the same housing and management conditions and compared at the same age.

The body weight obtained in this study for the exotic stock is similar to the values reported by [19,20], low compared with the value obtained by [21] in the traditional breeding system of Benin Republic and [22] in Cameroon. The local spent layer of Benin decent had 992-1215 g live weight [20] which is higher than 800 g obtained in this study for local spent layer. However, the other traits measured in this study differed from the values reported by [20] most probably due to age differences.

The proportions of carcass weight, head weight and shank weight in layers of Barred Plymouth Rock, Rhode Island Red, White Leghorn and White Rock were 53.23-56.1%, 2.34-3.78% and 2.89-3.60%, respectively [19] which are higher than the values obtained in this study for the same traits. In the same study, [19] obtained 2.24-2.85%, 1.72-1.82% and 2.34-3.49% for gizzard, liver and abdominal fat, respectively which are higher than the values obtained in this study. The wide variation in the proportion of abdominal fat is because [19] defined abdominal fat as the fat surrounding the gizzard extending within the ischium and surrounding the Burza of Fabricus while in this study it was considered as fat surrounding the Burza of Fabricus alone. The heart falls within the range of 0.21-0.33% obtained by [19].

All the cut-up-parts differed between the two groups with the local spent layers displaying higher values. This shows the effect of past selection for egg rather than for meat production in the exotic spent layer. This disagrees with the reports from [23] and [24] that the exotic spent layers had higher values of cut-parts.

Table 1. Nutritive value of cut-parts in spent layers of Brown Nera exotic and normal feathered indigenous chickens

Parameters	Local spent layer	Exotic spent layer
Thigh		
Moisture content	58.05±1.29	56.32±1.13
Fat content	9.60±0.18	10.45±0.17
Crude protein content	25.51±1.24 ^b	31.70±0.74 ^a
Ash content	2.21±0.08	2.15±0.06
Cholesterol content	4.34±0.67 ^a	2.60±0.18 ^b
Liver		
Moisture content	54.40±0.60	53.45±0.25
Fat content	8.46±0.15	8.58±0.04
Crude protein content	26.17±1.09 ^b	33.16±0.55 ^a
Ash content	1.40±0.06	1.52±0.05
Cholesterol content	3.31±0.53 ^a	2.80±0.63 ^b
Breast		
Moisture content	55.19±0.53	58.40±2.08
Fat content	7.00±0.20	6.59±0.17
Crude protein content	28.61±2.44 ^b	33.57±0.68 ^a
Ash content	1.36±0.08	1.41±0.08
Cholesterol content	3.72±0.76 ^a	1.87±0.02 ^b

Means with different superscripts along the same row are significantly different ($p < 0.05$)

Table 2. Live weight (g) and percentage content of cut-up-parts in the live weight of exotic and local spent layers (mean± SD)

Parameters	Local spent layer	Exotic spent layer
Live weight (g)	800 ±35.36 ^b	1730 ±53.85 ^a
Bled weight (%)	87.40± 0.56 ^b	94.20 ±0.18 ^a
Blood weight (%)	12.60 ±0.56 ^a	5.80 ±0.18 ^b
Plucked weight (%)	84.14 ±2.80 ^a	63.66± 1.03 ^b
Eviscerated weight (%)	71.80± 1.30 ^a	55.74± 0.60 ^b
Carcass weight (%)	66.10 ±1.40 ^a	51.75± 0.53 ^b
Breast weight (%)	18.10 ±1.21 ^a	14.52± 0.10 ^b
Back weight (%)	12.39 ±0.66 ^a	9.70 ±0.20 ^b
Thigh weight (%)	4.66± 0.25 ^a	2.87 ±0.10 ^b
Drumstick weight (%)	4.35± 0.05 ^a	2.87 ±0.08 ^b
Neck weight (%)	4.01± 0.19 ^a	2.65± 0.15 ^b
Head weight (%)	3.85± 0.17 ^a	1.90 ±0.04 ^b
Shank weight (%)	1.43 ±0.08 ^a	0.79 ±0.18 ^b
Wing weight (%)	4.40± 0.13	4.13± 0.10

Means with different superscripts along the same row are significantly ($p < 0.05$) different

Table 3. Innards as percentages of live weight in exotic and local spent layers of exotic (mean± SD)

Parameter	Local spent layer	Exotic spent layer
Gizzard weight (%)	1.92±0.01 ^b	2.90±0.15 ^a
Heart weight (%)	0.29±0.02 ^b	0.35±0.04 ^a
Lung weight (%)	0.42±0.03 ^b	0.77±0.10 ^a
Liver weight (%)	1.16±0.07 ^b	2.19±0.06 ^a
Spleen weight (%)	0.10±0.02 ^b	0.18±0.03 ^a
Proventriculus (%)	0.32±0.01 ^b	0.36±0.06 ^a
Abdominal fat weight (%)	0.10±0.06 ^b	0.32±0.03 ^a
Intestinal weight (%)	3.62±0.02 ^b	3.98±0.10 ^a

Means with different superscripts along the same row are significantly different ($p < 0.05$)

However, [25] studied native Mos rooster and the hybrid Sasso T-44 and concluded that live weight and carcass weight were higher in the hybrid line but Mos breed had a significantly higher percentage of edible products.

[5] had observed that strains of birds would affect yield of parts, dressing percentage and organ characteristics of bird. Indeed, according to [26], the breast weight in relation to carcass weight is an important criterion in the broiler poultry production. Thus, the carcass weight and the higher breast proportion of the local spent layer make it a better meat source compared to the exotic spent layer. Several authors [27,28,29,30] obtained a range of mean yield for breast, leg and abdominal fat for slow-growing chickens at 13.4-26%, 24.6-37.4% and 4-17%, respectively which is confirmed in this study. The extremely low abdominal fat could be attributed to the speed of growth of the exotic spent layers since this can influence the body composition of the animals, abdominal fat being deposited later during the growth period, after the inflexion point. Thus, at equal age, the exotic layer is characterized by a lower abdominal fat, than the local chicken. Generally, the extremely low abdominal fat found in this study compared to other values in literature suggests that the spent layers' meat is lean [22].

5. CONCLUSION

The differences observed for these two populations have a true genetic basis. It is remarkable to observe that the two strains produced meats that can match broiler meat standard. This is because the spent hens' major muscles had similar nutritional value comparable with commercial broiler meat. It has higher fat content but lower cholesterol which might probably confer health promoting benefits on spent hens' meat. Therefore, the use of spent layers which hitherto had been cherished by Nigerians is supported by the outcome of this study.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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