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CARCASS COMPOSITION OF SEXED NIGERIAN INDIGENOUS DUCKS RAISED IN DIFFERENT GEO-POLITICAL ZONES OF EKITI STATE, NIGERIA

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ABSTRACT

The study investigated physico-chemical, carcass and non carcass characteristics in sexed Nigerian local ducks raised under extensive system in different geographical locations of Ekiti State. A total of twenty-four of 24-months-old local ducks were obtained from three different households (8 per location). Average weights were taken prior slaughtering, carcass weight was determined immediately after evisceration and dressing percentage evaluated. Carcass was dissected into retail cuts. The breast muscle was used for the determination of physico-chemical analysis. Thigh, drum stick and breast muscles were dissected to determine the percentage yield of meat, skin, bone and meat to bone ratio. Dressing percentage ranged between 60 and 70 %, 54 and 74% in drakes and female ducks respectively. The carcass yield, water holding capacity, chilling loss and pH value differed significantly ($p<0.05$) between sexed ducks from different locations. Breast muscle colour for lightness (L^*), redness (a^*) and yellowness (b^*) was high ($p<0.05$) in drakes from location A. The highest meat to bone ratio (8:1) was recorded in drum stick muscle of drakes from location A. The dressing percentage, carcass yield and meat to bone ratio were appreciably high for sexed indigenous ducks. The study revealed appropriate physico-chemical properties in breast muscles of an indigenous duck; an evidence of good meat quality.

KEYWORDS: ***Indigenous breed, sexed ducks, carcass, muscle type, location***

1.0 INTRODUCTION

Nigerian local ducks genotypes have not been improved with exotic breeds of ducks. The population of Nigerian indigenous breed of ducks has not been ascertained because they are raised in their few numbers per household under extensive system. The production of local ducks on large scale is still a challenge due to many reasons such as unavailability of breeder stock, poor managements, high rate of mortality, low fecundity, high cost of feeds and feeding, lack of land space and lack of technical-know-how in terms of carcass handling [1]. In Nigeria, local ducks is one of the poultry species that was given lesser attention and popularity. This has resulted into discouragement in raising the local breed of ducks and this species of

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poultry is moving gradually to the brink of extinction [2].

The high demand for poultry products such as meat and eggs in Nigeria depend largely on poultry species especially chicken. This has contributed tremendously to the high cost of chicken meat and eggs which has made it almost impossible for low income earners not to be able to afford the products hence, the daily protein consumption requirement per man per day is far below the recommendations. The rate of nutritional deficiencies in Nigerian is outrageous due to shortage of animal protein in the diets resulting from high level of poverty. Also, the demand for red meat due to its high level of saturated fatty acids made it unsafe for many consumers who could afford it. This protein deficiency could be corrected by raising high economic value poultry species such as local ducks for high carcass yield and good quality meat that could promote increase for the demand of duck meat [3]. Improvement of the qualitative, quantitative characteristics and conservation of local domestic animals in developing countries is a good consideration for research [2]. Research that will provide base line information on the carcass characteristics of the local ducks in Nigeria will facilitate further studies on its improvement and its large scale production. The study aimed at investigating the quantitative and qualitative characteristics of the meat of the indigenous breed of ducks raised under extensive system from three different locations in Ekiti State, Nigerian.

2.0 MATERIALS AND METHODS

2.1 Experimental animals, management, slaughtering and carcass dissection

The experiment design was a Completely Randomized Design. Laboratory analysis was carried out at the Department of Animal Science, Faculty of Agricultural Sciences, Ekiti State University, Ado - Ekiti, Nigeria. Twenty four local ducks (eight per household per location comprising four drakes (male) and four female ducks), aged 24 months and raised strictly under extensive management system were obtained from the households within three different locations and kept at Poultry unit of the Teaching and Research Farm, Ekiti State University. The birds were quarantined in the pens, dewormed and deloused. The birds were weighed prior slaughtering, stunned by mechanical method and eviscerated to determine carcass weight and dressing percentage evaluated. Carcass was dissected into cut parts by the procedures of [4, 5]. Thigh muscle was separated from body and knee joint, drumstick muscle which is the distal portion of the leg was separated between the knee joint and ankle joint. The whole wing cut was obtained by cutting through the shoulder joint at the proximal end of the humerus. The whole breast portion was obtained by detaching through the ribs, thereby separating the breast portion from the back. The percentage of carcass cuts was determined based on the carcass weight. The thigh, drum stick and breast muscles were dissected into skin, lean and bone. The percentage proportion of skin, lean, bone and lean to bone ratio was determined.

2.2 Physico-chemical analysis

The breast muscle was deboned and used for the determination of physico-chemical properties (pH, water holding capacity, chilling loss and colour). The pH was measured by using a pH meter after calibration with pH 4, 10 and 7 buffers. Water holding capacity (WHC) was determined by pressing samples between two plexiglass plates for 3 min. The areas of pressed sample and water were measured using planimeter. Water holding capacity was evaluated as 100% minus free water percent [6]. The chilling loss was calculated by deducting chilled sample weight from weight of warm sample (before chilling) divided by weight of warm sample multiply by one hundred. The breast muscle colour was determined using a Hunterlab colorimeter (Colorflex Hunterlab Restonva, USA) as CIE colour profile of lightness (L^*), redness (a^*) and yellowness (b^*)[7]. The non- carcass components were excised and weighed separately.

2.3 Statistical analysis

All data were obtained in triplicates. Statistical analyses were performed using SAS 9.3 software [8].

3.0 RESULT

Average live weight of local drake of location A was 2000g while female duck was 1800g. Drake and female duck of location B had an average live weight of 2567g and 1367g respectively. Location C drake weighed 2233g while female ducks weighed 1733g. Average dressing percentage in drakes ranged from 60% (location A) to 76% (location B) while dressing percentage in female ducks ranged between 54 (location a) and 74 (location C). The water holding capacity in breast muscle of the local drake and female ducks were significantly higher ($p<0.05$) in location B than locations A and C. The pH of the breast muscle at 24 hour postmortem in the drake was between 5.80 and 6.0 while the female was between 5.67 and 6.00 ($p<0.05$). The percent chilling loss was similar between drake and female ducks of location B (7.00%) but values varied significantly between other locations($p<0.05$). Also, result showed that chilling loss was significantly increased ($p<0.05$) in location C for both sexes. The breast muscle colour of drake from location A had

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higher ($p<0.05$) value for lightness (L^*), redness (a^*) and yellowness (b^*) than locations B and C. The value of lightness (L^*) of female breast muscle colour was highest in location C with the least recorded in location B ducks. The value for redness (a^*) of female breast meat was significantly ($p<0.05$) higher in ducks from location A than those from locations B and C. Yellowness value (b^*) was significantly higher ($p<0.05$) in breast muscle of female ducks from location B than female ducks from locations A and C (Table 1.0).

The results of carcass yield of sexed Nigerian indigenous ducks raised in different locations (Table 2) shows that the thigh yield of drake had the highest percentage in location A and the lowest obtained from location C, while in the female, thigh yield was significantly higher ($p<0.05$) in birds of location B than birds of locations A and C. Neck yield of drake from location A had the highest value and lowest value found in location B drake. The wing yield of drake was between 16.0 and 18.0 ($p<0.05$) while the female was between 15.1 and 18.0 ($p<0.05$). The breast yield was significantly higher ($p<0.05$) in drake of location A than locations B and C. The breast yield was similar ($p<0.05$) between female from locations A and C. The vent had lowest yield among the carcass yield derived from both drakes and female ducks irrespective of their locations.

The result of the proportion of visceral organs and non-edible carcass determined relative to live weight is shown in Table 3. The proportional weight of gizzard ranged from 1.62 to 1.73, 1.51 to 1.99 in drakes and female ducks respectively. The heart yield did not differ significantly ($p>0.05$) between drakes of locations B and C, while heart yield was similar ($p>0.05$) between female ducks from locations A and C. The study showed that the proportion of feet and head were higher ($p<0.05$) in drakes than the female ducks across different locations. The proportion of lung was 1.72, 1.35 and 1.52% in drakes from locations A, B and C respectively while the female ranged from 1.04 (location A) to 1.26% (location B). The results of yields and ratios of different muscle types derived from carcass of the Nigerian indigenous ducks raised in different geo-political zones of Ekiti State are presented in Table 4. Thigh lean (meat), bone, skin yield and lean to bone ratio differed significantly ($p<0.05$) between ducks of either sex raised in different geo-political zones. Drum stick meat (lean), skin, bone yield and the lean to bone ratio were significantly higher ($p<0.05$) in drakes than its female counterpart across locations. Breast meat, skin, bone yield and lean to bone ratio differed significantly ($p<0.05$) between ducks from different locations for both the drakes and female ducks.

4.0 DISCUSSION

Average live weight of drakes from location C was closer to those observed in 12 weeks old male Turkish pekin genotype while the average live weight of female ducks from location B was similar to those observed in female Boz duck genotype at 8 weeks [9]. The variations observed in the study for the live weight may be due to several factors such as sex, age, genotype/ breed/ species, nutrition and management system which are known to determine live weight of poultry birds. The study revealed that dressing percentages above 70% were recorded in drake and female from locations A and C respectively. The dressing percentage was high for local drakes and female ducks, the dressing percentage obtained in the study aligned with values that have been reported for duck breeds [9, 10]. High dressing percentage in the local ducks under free range might have been influenced by quality and quantity of feed they were exposed to during foraging. This has led to increase live and live weights. The water holding capacity values obtained in the study from the drakes and female ducks were higher than those in chicken raised under free-range system [11]. The results of the water holding capacity showed that duck meat has high water retention ability that could influence a good meat quality and high product yield [12, 13]. The evidence of high water retention capacity was affirmed in the study by low percentage chilling loss in breast muscles in both male and female ducks. Factors such as net charge of myofibrillar proteins, structure and components of muscle cells and the amount of the extra-cellular space within the muscle determine the rate of water retention in meat [14].

The pH values in the breast muscle of drakes from locations A and B, also the female ducks from locations B and C were within the range considered normal for high quality attributes [15, 16]. The pH values of 6.00 in breast muscle of drake from location C and female ducks from location A were similar to other author [17], but relatively close to the pH 5.8 which is classified to be normal for meat quality [18]. The rate and the extent of pH decline which have major impacts on meat quality, such as water holding capacity and juiciness [19] were relatively appropriate in this study.

The study revealed that redness (a^*), lightness (L^*) and yellowness (b^*) values were significantly high in local duck breast meat especially in the drakes. This could make duck meat to be termed as red meat due to the presences of red muscle fibres [20] which makes it depart slightly from the nature of poultry meat known as white meat for their presence of white fiber [21]. This red nature of duck breast meat affirms that the physiological composition of duck differs from other

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poultry species [20]. Meat colour depends on pigment (myoglobin, hemoglobin) concentration, their chemical states, and the light scattering properties of meat [22, 23]. The colour of the meat greatly determines its salability [13], as it influences the appearance and attractiveness of meat to consumers [24].

The proportion of retail cuts showed high percentages in wing and breast parts of the local ducks of either sex. This indicates that these cut parts have high carcass yields, an important attributes for carcass quality [25]. Carcass yield which is the amount of carcass derived from live animals after slaughter and is available for sale or consumption, determines the potential profit and a larger muscle to bone ratio results to a greater profit for the producer [13]. The composition of carcass for skin, lean (meat), bone yields and meat to bone ratios of drakes and female ducks raised in different locations had similarity with earlier reports [9, 26]. The percentage of heart and liver of the drakes were related to observation of other authors [9, 10, 17], however, lower values were observed in female ducks. The study showed that the proportion of lean (meat) obtained from the muscle types of local ducks of either sex raised in different geo-political zones were more than the proportion of skin and bone. This indicates that only a little portion of duck meat contained skin and bone. The meat, skin, bone and its ratios obtained in the study from different muscle types of the Nigerian indigenous ducks of either sex were much higher than those reported for ducks [26]. The high values of ratios of meat to bone indicate more meat was derived from the muscles of duck and this contributes to high fleshing properties especially in the drakes [26]. The study revealed that lowest proportion of bone was found in the drum stick muscle than thigh and breast but this did not indicate that drum stick muscle was meatier in term of quantity than thigh and breast muscles.

Table 1. Dressing percentage and physico-chemical properties of sexed Nigerian indigenous ducks raised in different geo-political zones

Items	sex	Location A (Ekiti Central)	Location B (Ekiti North)	Location C (Ekiti South)	SEM	p-value
Live weight (g)	Male	2000^{c}	2567^{a}	2233.3^{b}	30.6	0.10
	Female	1800^{a}	1367^{c}	1733.3^{b}	21.9	0.07
Carcass weight (g)	Male	1200^{c}	1933.3^{a}	1533.3^{b}	21.0	0.01
	Female	967.0^{b}	933.3^{c}	1267.0^{a}	23.5	0.05
Dressing percentage (%)	Male	60.0^{c}	76.0^{a}	68.0^{b}	0.64	0.04
	Female	54.0^{c}	66.0^{b}	74.0^{a}	0.48	0.00
W HC (%)	Male	58.7^{c}	61.0^{a}	60.0^{b}	0.42	0.80
	Female	60.0^{b}	63.3^{a}	56.0^{c}	0.41	0.10
pH @ 24 hrs	Male	5.90^{b}	5.80^{c}	6.00^{a}	0.02	0.50
	Female	6.00^{a}	5.67^{c}	5.73^{b}	0.03	0.30
Chilling loss (%)	Male	6.00^{c}	7.00^{b}	7.67^{a}	0.13	0.30
	Female	7.00^{b}	6.33^{c}	8.67^{a}	0.14	0.10
Color	Male					
	L^{*}	41.3^{a}	38.9^{c}	39.4^{b}	0.09	0.01
	a^{*}	18.35^{a}	17.5^{c}	17.6^{b}	0.05	0.10
	b^{*}	5.37^{a}	4.85^{c}	5.00^{b}	0.05	0.40
	Female					
	L^{*}	35.5^{b}	33.9^{c}	36.8^{a}	0.06	0.00
	a^{*}	17.5^{a}	16.2^{b}	15.9^{c}	0.03	0.00
	b^{*}	4.95^{b}	5.02^{a}	4.80^{c}	0.02	0.50

WHC – Water holding capacity; L^{*}- lightness, a^{*}- redness, b^{*}- yellowness; $^{a, b, c}$- means with different superscripts on same row are significantly different ($P<0.05$), SEM- standard error of means, p - probability of mean effects

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Table 2. Carcass yields of sexed Nigerian indigenous ducks raised in different locations based on carcass weight (%)

Items	sex	Location A (Ekiti Central)	Location B (Ekiti North)	Location C (Ekiti South)	SEM	p-value
Thigh	Male	8.84[a]	8.06[b]	7.69[c]	0.11	0.40
	Female	6.80[b]	7.37[a]	6.33[c]	0.16	0.70
Neck	Male	13.4[a]	8.25[c]	11.0[b]	0.18	0.02
	Female	11.1[a]	9.37[b]	7.85[c]	0.34	0.50
Drum stick	Male	11.4[a]	9.67[c]	9.74[b]	0.17	0.40
	Female	11.6[b]	13.7[a]	10.0[c]	0.34	0.40
Rib	Male	12.2[b]	10.6[c]	13.0 [a]	0.24	0.50
	Female	11.7[a]	11.6[a]	9.23[b]	0.15	0.10
Back	Male	8.68[b]	8.75[a]	8.10[c]	0.22	0.90
	Female	7.76[b]	7.07[c]	7.97[a]	0.09	0.40
Vent	Male	5.72[a]	4.99[c]	5.46[b]	0.12	0.70
	Female	6.13[a]	5.33[b]	4.83[c]	0.15	0.60
Wing	Male	17.3[b]	16.0[c]	18.0[a]	0.25	0.50
	Female	15.1[c]	18.0[a]	17.4[b]	0.27	0.50
Breast	Male	24.0[a]	16.2[c]	18.0[b]	0.42	0.10
	Female	22.0[b]	28.0[a]	22.0[b]	0.33	0.07

[a, b, c]- means with different superscripts on same row are significantly different (P<0.05), SEM- standard error of means, p - probability of mean effects

Table 3. Proportion of visceral organs and non-edible carcass relative to the live weight (%) of sexed Nigerian indigenous ducks raised in different geo-political zones

Items	sex	Location A (Ekiti Central)	Location B (Ekiti North)	Location C (Ekiti South)	SEM	p-value
Gizzard	Male	1.62[c]	1.68[b]	1.73[a]	0.03	0.80
	Female	1.51[c]	1.99[a]	1.61[b]	0.03	0.10
Liver	Male	1.53[b]	1.32[c]	1.55[a]	0.02	0.30
	Female	1.51[c]	1.92[a]	1.61[b]	0.03	0.20
Heart	Male	0.70[b]	0.74[a]	0.74[a]	0.01	1.00
	Female	0.39[b]	0.44[a]	0.39[b]	0.01	0.50
Feet[1]	Male	2.65[a]	2.24[c]	2.53[b]	0.03	0.10
	Female	1.50[b]	1.20[c]	1.61[a]	0.03	0.20
Head[2]	Male	5.85[a]	4.50[c]	5.15[b]	0.06	0.06
	Female	3.20[c]	4.36[a]	3.38[b]	0.06	0.06
Lung	Male	1.72[a]	1.35[c]	1.52[b]	0.02	0.08
	Female	1.04[c]	1.26[a]	1.06[b]	0.02	0.30

[1, 2]- non-edible carcass, [a, b, c]- means with different superscripts on same row are significantly different (P<0.05), SEM- standard error of means

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Table 4. Proportion of skin, meat, bone and ratio meat to bone of muscle type of indigenous ducks raised within three geo-political zones in Ekiti State

Muscle type		male					female				
		Location A(Central)	Location B(North)	Location C(South)	SEM	p-value	Location A(Central)	Location B(North)	Location C(South)	SEM	p-value
Thigh	Skin	18.2[a]	17.4[b]	17.0[b]	0.39	0.89	15.0[a]	11.4[b]	12.1[c]	0.21	0.20
	Lean	69.0[c]	70.0[b]	73.0[a]	0.48	0.52	66.3[c]	71.1[a]	67.0[b]	0.64	0.60
	Bone	14.0[a]	13.3[b]	11.0[c]	0.20	0.16	20.1[a]	14.0[c]	18.3[b]	0.19	0.01
	Lean : bone ratio	5.11[c]	5.48[b]	6.88[a]	0.11	0.14	3.29[c]	5.29[a]	3.66[b]	0.11	0.11
Drum stick	Skin	13.1[c]	16.0[b]	18.0[a]	0.39	0.30	14.4[a]	8.45[c]	9.21[b]	0.22	0.02
	Lean	78[a]	74.3[b]	55.1[c]	0.81	0.02	65.1[c]	74.1[a]	70.1[b]	0.68	0.30
	Bone	9.73[b]	10.0[a]	9.00[b]	0.08	0.25	21.1[a]	18.0[b]	21.0[a]	0.50	0.70
	Lean : bone ratio	8.0[a]	7.40[b]	6.10[c]	0.07	0.03	3.14[c]	4.59[a]	3.52[b]	0.14	0.40
Breast	Skin	20.0[a]	15.0[b]	12.2[c]	0.13	0.00	13.4[a]	9.70[c]	11.1[b]	0.13	0.02
	Lean	66.0[b]	73.1[b]	77.0[a]	0.16	0.00	75[a]	74.4[b]	74.2[b]	0.45	1.00
	Bone	15.0[a]	12.2[b]	11.2[c]	0.03	0.00	17.1[a]	16.1[b]	16.3[b]	0.17	0.70
	Lean : bone ratio	4.43[c]	5.98[b]	6.82[a]	0.02	0.00	4.44[c]	4.64[a]	4.57[b]	0.05	0.80

[a, b, c]- means with different superscripts on same row are significantly different (P<0.05), SEM- standard error of means, p - probability of mean effects

5.0 CONCLUSION

The study revealed that the dressing percentage, carcass yield and organ composition were high in both sex of local ducks reared in different locations. The percentage of meat portion was considerably high compared with skin and bone present in the retail cuts irrespective of sex and locations. The drum stick muscle of the drake raised in location A had the highest meat to bone ratio, this indicates high meat turn over as compared with other muscle types. The drake showed higher redness of breast meat color than its female counterpart which may influence consumer's interest. Raising ducks under free range system at minimal cost of production could be a means by which ducks production could be facilitated within locality in Nigeria while the local ducks genotype awaits upgrade with exotic breeds for better performance and yields.

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7.0 CONFLICT OF INTEREST

Authors declare that no conflict of interest exist between them.

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