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# Effects of sex on meat quality of Noiler chicken reared under the semi-arid environment

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## ABSTRACT

This research evaluated the effects of sex on meat quality of Noiler chicken. A total of 100-day-old sexed (50 males and 50 females) Noiler chicks raised under an intensive management system and fed farm formulated feed with 22% and 20% crude protein at starter (1-4 weeks) and finisher (5-10 weeks) phases respectively, were used during the experiment. At four weeks, the chicks were divided into 2 groups by sex consisting of 50 birds each (50 Male and 50 Females) and then each group was divided into 5 replicates of 10 birds each in a Completely Randomized Design (CRD) with 10 birds per each replicate. At the end of the test period (10 weeks) 5 birds per replicate were sacrificed and their carcasses were evaluated for meat quality traits. From the results obtained, the mean values of meat quality traits (cooking loss, drip loss, colour, and pH) varied significantly among all the treatment groups ($P<0.05$). It was concluded that sex have significant effect on meat quality traits of Noiler chicken.

**Keywords**: Noiler chicken; intensive management system; meat quality trait

## INTRODUCTION

The Smallholder poultry sub-sector in Sub-Saharan Africa is beset with a myriad of problems among which are poor nutrition, limited technical know-how, vagaries of climatic factors, low-input, slow-growth, low meat yield, small size/number of eggs and high mortality rate. In order to address the factors militating against high chicken production and productivity at the smallholder level, research efforts in the area of genetics and breeding amongst others have been made in the past three decades (Sonaiya, 2016). Olawoyin (2006) concluded that genetic improvement of Nigerian indigenous chicken could help to alleviate the problems of animal protein shortage, especially in the rural areas. One of such is the


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development of chicken genotypes that are adapted to the prevailing tropical conditions (Adebambo *et al*., 2018).

Noiler chicken is an improved indigenous dual-purpose breed of chicken developed by Amo Farm Sieberer Hatchery Limited with the primary intention of improving the food and financial security of the Nigerian populace. Noiler chicken can be said to be the Nigerian version of Kuroiler chicken, the word Noiler was coined from the amalgamation of two words, "Nigeria" and "Broiler". Understanding the production, management, and breeding systems and the associated factors affecting indigenous chicken production is essential to develop holistic improvement strategies (Gueye and Branckaert, 2002).

Few researches available on Noiler chicken have proved the potential in this chicken for meat and egg production (Bamidele *et al*., 2019; Suleiman *et al*., 2019). The development of broiler strains has contributed greatly to bridging low animal protein intake in many tropical countries including Nigeria due to its fast growth, ability to efficiently convert feed into carcass and attainment of table size within a short period. However, a shift in demand from broiler meat to indigenous local chicken meat has been reported partly due to chewy texture, colour and flavour of their meats (Wattanachant *et al.,* 2004; Fanatico *et al.*,2007).

Similarly, it has been reported that sex affect poultry meat texture and flavour (Northcutt, 2009) and that meat from male chicken is said to be more tender compared to the meat of female chicken (Musa *et al.,* 2006). Moreover, it has also been reported that carcass traits such as drumstick yield, breast yield, and abdominal fat are also determined by the sex of birds (Holcman *et al*., 2003). However, there is dearth of information on whether sex affects the meat quality attributes of Noiler chickens. Thus, the objective of this study was to assess the effect of sex on meat quality of Noiler chickens.

## MATERIALS AND METHOD

### Experimental Site

This study was carried out at the Poultry Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, located at the Sokoto State Veterinary Clinic, along Aliyu Jedo Road, Sokoto is located between latitudes $12^0$ and $13^0$N, longitudes $4^0$ and $6^0$E in the northern part of Nigeria and lies on altitude of 350m above sea level (Mamman *et al.,* 2000). It is bordered to the north with the Niger Republic, Zamfara State to the East and Kebbi State to the South and West (SSMIYSC, 2010). The state falls within the Sudan savannah vegetation zone with an alternating short and dry season, short-cool dry period (harmattan) which occurs between October and February (Mamman *et al.,* 2000), annual rainfall of about 700mm and high temperature range of 35-40°C characterized by scanty vegetation, made up of few trees and abundant shrubs and grasses.

### Experimental design

A total of 100-day-old Noiler chicks raised under an intensive management system and fed farm formulated feed with 22% and 20% crude protein at starter (1-4 weeks) and finisher (5-10 weeks) phases respectively were used during the experiment, in a completely randomized design (CRD). At four weeks, the chicks were divided into 2 groups by sex

consisting of 50 birds (50 Male and 50 Females) per each group. Each group was then divided into 5 replicates with 10 birds per replicate making 100 birds for the two groups.

**Experimental Birds and their Management**

A total of 100 sexed day-old chicks (50 males and 50 females) for this study were purchased from Amo Farm Sieberer Hatchery Limited in Ibadan, Oyo State, Nigeria. A week prior to the arrival of the chicks, the house was cleaned, washed, and disinfected. The birds were managed on deep litter in tropical house type, with open side walls and concrete floor. Feed and water were given to the birds at free choice (*ad libitum*) and their health care was ensured by giving them normal vaccination and medication as at when due while proper sanitation and hygiene was ensured. Adequate floor spacing was maintained to accommodate the birds in each replicate to avoid variation in size and growth (Oluyemi and Roberts, 2000).

**Experimental Diets**

Starter and finisher diets for this experiment targeting 3000kcal/kg ME and 22%CP and 2800kcal/kg ME and 20%CP respectively were formulated for the starter and finisher phases using commonly available feed ingredients (Table 1).

Table 1: Gross and calculated composition of experimental diets

| Ingredients | Starter (%) | Finisher (%) |
|---|---|---|
| Maize | 53.5 | 50.5 |
| Soybean meal | 14.0 | 15.0 |
| Groundnut cake | 15.0 | 13.0 |
| Fish meal | 2.0 | 0 |
| Wheat offal | 11.0 | 12.0 |
| Limestone | 2.0 | 5.40 |
| Bone meal | 1.5 | 3.0 |
| Vitamin and Mineral Premix | 0.25 | 0.25 |
| Salt | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 |
| Lysine | 0.25 | 0.30 |
| TOTAL | 100 | 100 |
| | Calculated values | |
| Metabolisable Energy(kcal/kg) | 3000 | 2800 |
| Crude Protein (%) | 22 | 20 |
| Lysine | 1.0 | 1.0 |
| Methionine | 0.5 | 0.5 |
| Calcium | 1.3 | 1.8 |
| Phosphorus (Available) | 0.5 | 0.7 |
| Crude Fibre (CF) | 5.3 | 5.5 |

**Data Collection**

At the end of the growth period (70 days), data were collected according to the treatment groups on meat quality parameters such as pH, colour, drip loss and cooking loss.

***pH*:** The procedure described by Garba *et al*. (2019) was used to measure pH. Briefly, 20g of meat samples were blended with de-ionized water using an electric blender until an aqueous mixture was achieved. 20ml of the mixture was measured in a graduated test tube and the electrode of the pH meter was immersed into the test tube for 5 minutes until a stable pH reading was achieved.

***Colour*:** The colour of the meat was determined using U/V visible spectrophotometer (Roper Scientific, Trenton, NJ) at 500nm. The absorbance of the meat sample was used to measure the intensity of the redness.

***Drip loss (%)*:** Twenty (20) grams of fresh meat samples were collected from the breast muscle which was weighed and sealed. The samples were kept for 24 hours at $4^0$C. The paper towels were used to dry the samples and weighed. Drip loss was calculated using the formula below:

$$Drip\ loss = \frac{Weight\ of\ fresh\ sample - Weight\ after\ chilling}{Weight\ of\ fresh\ sample} \times 100$$

***Cooking loss (%)*:** Twenty (20) grams of fresh meat samples were collected from the breast muscle. The samples were cooked in a water bath at $85^0$C for 10 min using vacuum-packaged technology in non-permeable polyethylene bags. The samples resulted in a core temperature of about $75^0$C, removed, and cooled for 15 minutes at room temperature. The samples were blotted dry using paper towels and weighed. The cooking loss was calculated using the formula below:

$$Cooking\ loss = \frac{Weight\ of\ uncooked\ sample - Weight\ cooked\ sample}{Weight\ of\ uncooked\ sample} \times 100$$

**Sampling and Meat Preparation**

At the end of the test period (10 weeks), a stratified sampling method was used to select five (5) birds per replicate, making 25 birds per each group (male and female) and 50 birds from the two groups respectively. The sampled birds were starved of feed but left with drinking water for 8 hours prior to slaughter. The slaughter was done by severing the jugular vein closest to the head. Then the birds were defeathered and eviscerated and then cut into primal parts after which the samples were collected from the thigh and breast muscle for meat quality traits evaluation.

**Data Analysis**

Data collected were analyzed using the descriptive statistics and independent samples t-test of SPSS package to determine if there is a significant difference between the means of male and female sexes in term of meat quality attributes. Statistical significance was set at $P<0.05$.

## RESULTS AND DISCUSSION

**Meat Quality Parameters**

The meat quality traits which include colour absorbance, colour concentration, pH, drip loss and cooking loss are presented in Table 2. The result shows that there was a significant difference ($P<0.05$) in the values of the meat quality parameters measured. Colour

absorbance (1.99 nm), colour concentration (1.96 nm), pH (4.58) and cooking loss (18.11%) values of the females' meat were higher than that of the male ones. However, drip loss value of the meat from the male birds (16.24%) was higher than the females (15.99%).

**T**able 2: Meat quality parameters of Noiler chicken as affected by sex

| Meat Quality Traits | Sex | Mean | P-value |
|---|---|---|---|
| Colour Absorbance (nm) | Male | 1.94[b] | 0.002 |
| | Female | 1.99 [a] | |
| Colour concentration (nm) | Male | 1.95[b] | 0.005 |
| | Female | 1.96[a] | |
| pH | Male | 4.58[b] | 0.012 |
| | Female | 4.75[a] | |
| Drip loss (%) | Male | 16.24[a] | 0.003 |
| | Female | 15.99[b] | |
| Cooking loss (%) | Male | 17.66[b] | 0.007 |
| | Female | 18.11[a] | |

[a,b] = means bearing different superscripts along the same column differ significantly (P<0.05).

Colour is an important indicator of quality for fresh or cooked meat; as such the appearance of meat influences the consumer acceptance of the meat (Van-Oeckel *et al.*, 1999). The presence of difference in colour absorbance and colour concentration, among the treatments might be attributed to factors that may influence colour such as heme pigments, strain, sex, moisture content, physical state of the protein, and stress, among other post and ante-mortem factors (Le Bihan-Duval *et al*., 1999; Mehaffey *et al*., 2006; Jaturasitha *et al*., 2008). The findings of this research show that there was a significant difference (P<0.05) between the sexes in terms of meat colour. This contradicts the findings of López *et al*. (2011) who reported in their study, that no sex or strain effects were observed for meat colour measurements among broiler chickens, although the female broilers exhibited a higher yellowness value than the male counterparts,

Similarly, the pH value is one of the important parameters for quality profiling of meat (El Rammouz *et al*., 2004). A dramatic pH decline is associated with protein denaturation and can negatively affect meat quality attributes by causing pale colour, low water-holding capacity (WHC), and soft texture (Mehaffey *et al*., 2006; Schilling *et al*., 2010). The values of the pH of the meat from female birds were higher (P<0.05) than meat from the male birds under this study, which shows a significant difference exist among them (P<0.05). This also contradicts the findings of López *et al*. (2011) who reported in their study that no significant strain or sex effects were observed in muscle pH among broiler chickens.

Furthermore, cooking loss is an indicator of WHC, which is an important attribute of meat because of its relationship with other attributes that can critically affect meat quality. Meat with less cooking loss will invariably give a higher yield per unit cut. This study showed that there was a significant (P<0.05) difference in the cooking loss values as influenced by the sex of the birds. Results of this study is in contrast with the findings of López *et al.* (2011) who reported that no effects were found of strain and sex on cooking loss of broiler breast meat among broiler chickens that were slaughtered at 42 days of age. However, the result of this study is consistent with the findings of Abdullah and Matarneh (2010) who reported statistical sex effect on cooking loss (P<0.05).

On the other hand, drip loss is of high importance due to its financial implications. Low water holding capacity reduces meat yield during processing. Generally, meat with high drip loss has an unattractive appearance and therefore has low consumer acceptance, which leads to loss of sales (Lawrie, 1974). It also decreases meat tenderness and juiciness which lessen consumers' demand for it.

Results of this study showed that there was a significant ($P<0.05$) difference in the drip loss values as influenced by the sex of the birds, though the drip loss values for the male birds were numerically higher than that of the female birds. This agrees with the findings of Kamporn *et al*. (2022) who reported significant differences ($P<0.05$) in drip loss, cooking loss and shear force value between sexes in their research on effect of strain and sex on production performance, carcass characteristics and meat quality of broiler chickens.

## CONCLUSION

Sex has significant effect on meat quality traits of Noiler chicken at slaughter age of 10 weeks, with females having higher values for colour and pH while the males had better result for drip loss and cooking loss. Therefore, meat retailers and processors should utilize the findings of the present study particularly to lower drip loss and cook loss associated with the male Noiler chickens. Low drip and cooking losses are considered very important for palatability, overall quality and acceptability of meat.

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