

## EFFECTS OF SEX AND AGE ON CHEMICAL COMPOSITION OF BROILER MEAT

Oyeleye, O.O.\*, Adeoye, A.A. and Ogedengbe, F.

Department of Animal Production and Health, Olusegun Agagu University of Science and Technology, Okitipupa, Nigeria.

\*Corresponding author: [olubisi.oluseun@gmail.com](mailto:olubisi.oluseun@gmail.com)

---

### ABSTRACT

*The purpose of this study was to determine the effect of age and sex on the chemical composition of broiler chicken meat. A total of 60 Cobb broiler birds (30 males and 30 females) were arranged in a 3x2 factorial design with 3 levels of age at slaughter (6, 8 and 10 weeks) and sex (male and female) in Completely Randomized Design (CRD). The chemical composition observed were fat, protein, ash, moisture, carbohydrate and fibre. In male, moisture content was significantly lowest at 10<sup>th</sup> week while no significant difference was observed at all ages for female. Age had no significant effect on ash contents for both sexes. At age 10<sup>th</sup> week, the fat content for male was significantly lowest while no significant level was observed for female at all ages. Protein content of male meat was significantly highest at 10<sup>th</sup> week while that of the female was significantly highest at 6<sup>th</sup> week. The carbohydrate content of male meat was significantly lowest at 10<sup>th</sup> week while that of the female was significantly lowest at 6<sup>th</sup> week. It can be concluded that sex and age had effect on the chemical composition of broiler chicken meat. It is therefore recommended that male should be slaughtered at older age of 10<sup>th</sup> week while female at 6<sup>th</sup> week respectively when the crude protein levels are at the highest percentages.*

**Keywords:** Sex, age, broiler meat, Cobb, chemical composition

---

### INTRODUCTION

Poultry production is one of the fastest growing sectors in animal production business at present. Broilers account for about 70% of the world poultry market (USDA, 2006), an indicator that broiler meat continues to be desired over other poultry meats. Broiler chicken meats are delectable with higher proteins and of much economic importance than those from plant sources (Olawumi and Fagbuaro, 2011). Recently, broiler meat production has been tremendously improved by numerous factors including the adaptation of diet composition to meet chicken needs, the improvement of environmental conditions, and the intensification of production to reduce production costs. Against this backdrop, the consumption of broiler chicken meat is on the increase mainly as a result of the affordability, high nutritive value of the animal protein and the fact that the meat is accepted by all, irrespective of religion (Olawumi and Fagbuaro, 2011; Adeyemo and Sani, 2013).

Meat quality is a term used to describe the overall meat characteristics including its physical, chemical, morphological, biochemical, microbial, sensory, technological, hygienic, nutritional and culinary properties (Ingr, 1989; Ristic, 1999). Meat quality is an important measure of meat palatability and acceptability to consumers. Poultry meat quality and/or organoleptic properties are, however, affected by numerous factors including but not limited to breed type, nutrition, genotype, age at slaughter, motor activity of birds, and their adaptation for outdoor production (Ojedapo *et al.*, 2009; Amao *et al.*, 2009; Ahmad *et al.*, 2018). It is generally acknowledged that nutrition, breed, age, and sex are major factors that influence carcass and meat quality of broiler chickens (Owen *et al.*, 2000; Saláková *et al.* 2009; Puchała *et al.* 2015; Uhlíová *et al.* 2018).

All animals within species or breeds or among sexes do not grow, develop, fatten, or mature at the same chronological age. The term physiological age refers to the stage of development of the animal that can be described by identifiable stages of the body development or function, such as body height and weight, body composition, or onset of puberty. Body composition and body form (shape) change dramatically and continually during growth. Studies on the effect of age at slaughter have focused mainly on the sensory attributes of meat in relation to the physico-chemical characteristics of muscle. Increasing the slaughter age for broilers increases the protein content of breast and thigh meat (Singh and Panda, 1992; Zanusso, 2002), but data for the lipid fraction of muscle are more equivocal.

Olawumi and Fagbuaro (2011) observed that sex affects the average daily weight gain, average daily feed intake and carcass characteristic of broiler chicken. It is generally acknowledged that nutrition, breed, age, and sex are major factors that influence carcass and meat quality of broiler chickens (Puchała *et al.* 2015 and Uhlířová *et al.* 2018). Compared to other animal species, the quality of poultry meat is now of major importance because poultry meat is usually consumed as cuts or processed products rather than as whole carcass. The quality of poultry meat can be observed by its safety, nutritive value and sensory characteristics. Most of the available studies mainly investigated the effect of the genotype and management system on the quality of the chicken meat and fiber diameter without considering the difference between the sex of the birds. Sex, however, is a vital factor determining both the physicochemical parameters as well as the growth and slaughter performance of chickens. Therefore, this study aims to investigate the effect of sex and age on the chemical composition of broiler chicken meat.

## **MATERIALS AND METHODS**

### **Site of the experiment**

The experiment was carried out at Adeomoh Farm located at about 1km from the Teaching and Research Farm and Analytical Laboratory, Olusegun Agagu University of Science and Technology, Okitipupa. Ondo State. Okitipupa lies between latitude 6.25° and 6.46° N and Longitude 4.35° and 4.50° E within the tropical rainforest zone of Nigeria. Okitipupa covers a landmass of 636 square km and has an estimated population of 233,565 people (Toponavi, 2023).

### **Experimental birds and designs**

A total of 60 vent sexed birds (30 females and 30 males) were studied regarding meat quality attributes at 6, 8 and 10<sup>th</sup> week. The birds were reared separately until 4 weeks of age, and then placed together and raised up till 10<sup>th</sup> week in deep litter system. The cages were properly cleaned and disinfected following which the birds were closely observed for any reaction and adequate measures were taken to ensure their healthy living. All the birds were fed *ad libitum* with commercial standard broiler starter mash containing 24% crude protein for four weeks, and a standard finisher afterwards throughout the experimental period. The birds were prevented against common poultry diseases and unhealthy animals were promptly treated. All other standard management and health practices were conformed to throughout the duration of the experiment. The broilers were arranged in a 3 x 2 factorial in a completely randomized design with three level of age at slaughter (6, 8, 10) and sex (male and female). it consists of two treatments with each treatment having 3 replicates of 10 males and 10 females.

### **Data collection**

Meat parts obtained from the thigh after carcass characteristics measurements were used for the chemical analysis, the meats were oven dried for an hour and then grounded up using a pestle and mortar and adequately packed and labelled. Protein, fat, moisture and ash content of oven dried thigh meat was each independently measured with three replications from each of 2 females and 2 male broilers. Samples for proximate analysis were adequately stored until analyzed at the Professor Julius Okojie Central Research Laboratory at Federal University of Technology, Akure. Protein, fat, moisture and ash content was measured following the AOAC methodology as modified by Lee, *et al.*, 1995.

### **Statistical analysis**

All data were analyzed using SAS and the effect of age (6, 8, and 10 weeks) and sex (Male and female) on chemical analysis of broiler meat were analyzed by the two-way ANOVA procedure. Duncan Multiple Range Test (DMRT) was used to separate the means when significant differences existed between them at 5% significance level.

## **RESULTS AND DISCUSSION**

### **Results**

Table 1 shows the means and coefficients of variation of the chemical compositions of broiler meat. The coefficients of variation of the chemical composition ranged between 2.93 to 55.34. The effect of sex on the chemical compositions on age basis is shown in Table 2. At 10<sup>th</sup> week, the moisture content of male broiler meat was significantly lower than that of the female. Ash contents were not affected by sex at all ages of slaughter. Fat content of the female was significantly higher at 10<sup>th</sup> week. At 8<sup>th</sup>

week, protein content of the male was significantly lower than that of the female while at 10<sup>th</sup> week, protein content of the male meat was significantly higher than that of the female. At 10<sup>th</sup> week, carbohydrate content of the male meat was significantly lower than that of the female. The effect of age on the chemical composition of broiler meat on sex basis is shown on Table 3. In male, moisture content was significantly lowest at 10<sup>th</sup> week while no significant difference was observed at all ages for female. Age had no significant effect on ash contents for both sexes. At age 10<sup>th</sup> week, the fat content for male was significantly lowest while no significant level was observed for female at all ages. Protein content of male meat was significantly highest at 10<sup>th</sup> week while that of the female was significantly highest at 6<sup>th</sup> week. The carbohydrate content of male meat was significantly lowest at 10<sup>th</sup> week while that of the female was significantly lowest at 6<sup>th</sup> week.

**Table 1: Means and coefficients of variation of chemical composition of broiler meat**

| PARAMETERS   | MEAN  | S. D | N | MINIMUM | MAXIMUM | C. O. V |
|--------------|-------|------|---|---------|---------|---------|
| Moisture     | 6.30  | 1.14 | 2 | 7.71    | 18.20   | 18.20   |
| Ash          | 3.55  | 1.20 | 2 | 5.36    | 33.77   | 33.77   |
| Fat          | 21.44 | 1.90 | 2 | 23.83   | 8.84    | 8.84    |
| Protein      | 68.44 | 2.01 | 2 | 71.04   | 2.94    | 2.94    |
| Carbohydrate | 0.28  | 0.15 | 2 | 0.50    | 55.34   | 55.34   |

**Table 2: Effect of sex on chemical composition on age basis**

| PARAMETERS (%) | WEEK 6                  |                         | WEEK 8                  |                         | WEEK 10                 |                         |
|----------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                | M                       | F                       | M                       | F                       | M                       | F                       |
| Moisture       | 7.05±0.27 <sup>a</sup>  | 6.67±0.37 <sup>a</sup>  | 7.49±0.23 <sup>a</sup>  | 6.66±0.36 <sup>a</sup>  | 4.81±0.00 <sup>b</sup>  | 5.06±0.91 <sup>a</sup>  |
| Ash            | 1.84±1.18 <sup>a</sup>  | 3.11±0.71 <sup>a</sup>  | 3.40±0.32 <sup>a</sup>  | 3.91±0.34 <sup>a</sup>  | 4.06±0.12 <sup>a</sup>  | 5.02±0.35 <sup>a</sup>  |
| Fat            | 23.56±0.26 <sup>a</sup> | 20.72±0.91 <sup>a</sup> | 23.26±0.37 <sup>b</sup> | 19.86±0.05 <sup>a</sup> | 20.00±0.15 <sup>b</sup> | 21.27±2.37 <sup>a</sup> |
| Protein        | 67.19±1.11 <sup>a</sup> | 96.43±0.60 <sup>a</sup> | 65.66±0.28 <sup>b</sup> | 69.23±0.08 <sup>a</sup> | 70.93±0.12 <sup>b</sup> | 68.21±1.86 <sup>a</sup> |
| Carbohydrate   | 0.35±0.05 <sup>a</sup>  | 0.08±0.03 <sup>b</sup>  | 0.20±0.10 <sup>a</sup>  | 0.35±0.05 <sup>a</sup>  | 0.25±0.16 <sup>b</sup>  | 0.45±0.05 <sup>a</sup>  |

**Table 3: Effect of age on chemical composition of broiler meat on sex basis**

| PARAMETERS<br>~% | MALE                    |                         |                         | FEMALE                  |                         |                         |
|------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                  | 6                       | 8                       | 10                      | 6                       | 8                       | 10                      |
| Moisture         | 7.05±0.27 <sup>a</sup>  | 7.49±0.23 <sup>a</sup>  | 4.81±0.00 <sup>b</sup>  | 6.67±0.37 <sup>a</sup>  | 6.66±0.36 <sup>a</sup>  | 5.06±0.91 <sup>a</sup>  |
| Ash              | 1.84±1.18 <sup>a</sup>  | 3.40±0.32 <sup>a</sup>  | 4.06±0.12 <sup>a</sup>  | 3.11±0.71 <sup>a</sup>  | 3.91±0.34 <sup>a</sup>  | 5.02±0.35 <sup>a</sup>  |
| Fat              | 23.56±0.26 <sup>a</sup> | 23.26±0.37 <sup>a</sup> | 20.00±0.15 <sup>b</sup> | 20.72±0.91 <sup>a</sup> | 19.86±0.05 <sup>a</sup> | 21.27±2.37 <sup>a</sup> |
| Protein          | 67.19±1.11 <sup>b</sup> | 65.66±0.28 <sup>b</sup> | 70.93±0.12 <sup>a</sup> | 96.43±0.60 <sup>a</sup> | 69.23±0.08 <sup>b</sup> | 68.21±1.86 <sup>b</sup> |
| Carbohydrate     | 0.35±0.05 <sup>a</sup>  | 0.25±0.10 <sup>a</sup>  | 0.20±0.16 <sup>b</sup>  | 0.08±0.03 <sup>b</sup>  | 0.35±0.05 <sup>a</sup>  | 0.45±0.05 <sup>a</sup>  |

## DISCUSSION

The protein content of male was found to significantly increase with age. Fakolade (2015) reported a significant decrease in moisture content, increase in protein content, decrease in fat content and a significant ( $P<0.05$ ) increase in ash content with increase age were reported in Harco Black chicken in contrary to the present study. The protein content of the meat was a bit higher than range (46- 66%) reported by Adebajo and Oluyemi (1981). The values of fat content for both sexes were within the normal range of meat fat content (1.2 to 15%). Female fat content was significantly higher than that of male chicken meat which was contrary to the report of Cygan-Szczegielniak and Bogucka (2021) that male breast meat had a significantly higher fat content than female breast meat ( $1.47 \pm 0.078$  vs.  $1.14 \pm 0.058\%$ ). Suryanto *et al.* (2021), however, showed that female meat had a higher fat content than male meat ( $6.73 \pm 2.84$  vs.  $2.21 \pm 0.91\%$ ). Male chicken also had higher protein content than the female which was contrary to the report of Cerolini *et al.* (2019) that female chicken meat had a higher protein content than male.

## CONCLUSION

It can be concluded that sex and age had effect on the chemical composition of broiler chicken meat. It can be recommended that male should be slaughtered at older age of 10<sup>th</sup> week while female at 6<sup>th</sup> week respectively when the crude protein levels are at the highest percentages.

## REFERENCES

- Adebanjo, A. and J.A. Oluyemi, 1981. Etudes sur le potentiel de production de effets de L'âge Sur la quantité et la qualité de la viande. *Bulletin of Animal Health Production in Africa*, 29: 425-429.
- Adeyemo I.A and Sani A. 2013. Physical appearance and organoleptic properties of poultry meat fed *Aspergillus niger* hydrolyzed cassava peel meal-based diet. *International Journal of Agricultural Policy and Research* Vol.1 (6), pp. 166-171. Available online at <http://journalissues.org/ijapr/>.
- Ahmad, R. S., Imran, A., & Hussain, M. B. 2018. Nutritional Composition of Meat. InTech. doi: 10.5772/intechopen.77045.
- Amao, S.R., Akinokun, O., Ojedapo, L.O., Adedeji, T.A., Sodeinde, F. G. 2009. Estimate of genetic variabilities of growth traits of two strains of starter broiler chickens reared in derived savanna environment of Nigeria. *Proceeding of the 14th Annual Science Association of Nigeria*. Lautech Ogbomoso; 14: 103-105.
- Cerolini, S., Vasconi, M., Abdel Sayed, M., Iaffaldano, N., Mangiagalli, M. G., Pastorelli, G., 2019. Free-range rearing density for male and female Milanino chickens: Carcass yield and qualitative meat traits. *Journal of Applied Poultry Research*, 28, 1349–1358.
- Cygan-Szczegielniak, D., & Bogucka, J. 2021. Growth performance, carcass characteristics and meat quality of organically reared broiler chickens depending on sex. *Animals*, 11, 3274
- Fakolade, P. O. 2015. Effect of age on physico-chemical, cholesterol and proximate composition of chicken and quail meat. *Afr. J. Food Sci.*, 9 (4): 182-186.
- Ingr I. 1989. Meat quality: defining the term by modern standards. *Fleisch*. 69:1268–1277.
- Lee, K. H. ; Qi, G. H. ; Sim, J. S., 1995. Metabolizable energy and amino acid availability of full-fat seeds, meals, and oils of flax and canola. *Poult Sci.*, 74 (8): 1341-1348.
- Olawunmi, S O & Fagbuaro, S. 2011. Productive Performance of Three Commercial Broiler Genotype Reared in Derived Savanna Zone of Nigeria. *International Journal of Agricultural Research*, 6:798–804.
- Ojedapo, L.O., Adedeji, T.A., Amao, S.R., Ameen, S.A., Ige, A.O., Olaniyi, O.A. and Sanyaolu, V.F. 2009. The influence of strain and sex on carcass on three commercial strains reared in cage system. *Tropical Journal of Animal Science*, 11:1-7.
- Owen C. M., Hirschler E. M., McKee S. R., 2000. The characterization and incidence of pale, soft, exudative turkey meat in a commercial plant. *Poult Sci.* 79:553–558. doi: 10.1093/ps/79.4.553
- Puchała M, Krawczyk J, Sokołowicz Z, Utnik-Banaś K, 2015. Effect of breed and production system on physicochemical characteristics of meat from multi-purpose hens. *Ann Anim Sci* .2015: 15: 247–61. doi: 10.2478/aoas-2014-0082.
- Ristic M (1999). Sensory and chemical criteria for broiler meat of different breeds from alternative livestock keeping. *Proceedings of XIV European Symposium on the Quality of Poultry Meat*, 19-23 September, Bologna, Italy: pp. 291-294.
- Saláková A, Straková E, Válková V, Buchtová H, Steinhauserová I. 2009. Quality indicators of chicken broiler raw and cooked meat depending on their sex. *Acta Vet Brno* 78:497–504. doi: 10.2754/avb200978030497.
- Singh, K. S. & Panda, B. 1992. *Poultry Nutrition*. Kalyani Publisher; New Delhi India, Pp: 5761.
- Suryanto, E. Jamhari, Rusman, N. D. Dono, Triyannanto, E., Sujarwanto, R. O., Habibi, M. F., & Aljiansyah, R. (2021). The Effect of Sex and Slaughter Ages on the Chemical Composition, Physical and Sensory Qualities of Merawang Chicken. *Advances in Biological Sciences Research*, 18 2nd ICAPFS. (In press).

- Toponavi 2023. Okitipupa on the Map, Nigeria. Toponavi.com. <https://ng.toponavi.com/166948> Accessed May 10, 2023.
- Uhlířová L, Tmová E, Chodová D, Vlková J, Ketta M, Volek Z, 2018. The effect of age, genotype and sex on carcass traits, meat quality and sensory attributes of geese. *Asian-Australasian J Anim Sci.* ;31:421–8. doi: 10.5713/ajas.17.0197.7
- USDA, 2006. Poultry quality institute. Natural resources conservation service. <https://poultry.usda.gov/sqi/>. Accessed 20.
- Zanusso J. 2002. Engraissement, Structure des muscles et qualite de la viande de volailles, exemple du gavage chez le canard de Barbarie et de la castration chez le poulet. PhD. Thesis, ENSA, Toulouse, France.