American Journal of Multidisciplinary Research in Africa
Vol. 2(5), pp. 1-12, September, 2022

ISSN: 2769-0504
https://www.mprijournals.com/

Full Length Research

A Literature Review on Interaction between Sex and Genotype on Carcass Characteristics of Broiler Chickens

OJEDAPO, Lamidi Oladejo & **ADEWUYI,** Sofiat Adetola
Department of Animal Nutrition and Biotechnology
Ladoke Akintola University of Technology,
Ogbomoso, Nigeria
Principal Author Email: loojedapo@lautech.edu.ng

Corresponding Author Email: adewuyisofiatadetola&gmail.com

Accepted September, 14, 2022

The aim of this study is to conduct an extensive literature review on interaction between genotype and sex on carcass characteristics of broiler birds. This is because in recent studies, there is higher preference for broiler with higher carcass characteristics. Interaction between sex and genotype is being researched on to determine if each of this parameters depended on each other and how it affects the carcass characteristics of broiler birds. The methodology used in this study was review from secondary sources of information including journals, articles, newspaper, and textbooks. In this study, authors found that there is no significant interaction between genotype and sex of carcass characteristics of broiler birds. The carcass characteristics of broiler birds tends to vary across various genotypes while the males tend to have higher carcass characteristics irrespective of the genotype. Future researchers are encouraged to consider how broiler genotype with low carcass can be improved genetically to enhance higher carcass.

Keywords: Genotype: Sex: Broiler chicken: Carcass Characteristics

Cite this Article as: Ojedapo, L.O. & Adewuyi, S.A. (2022). Literature Review on Interaction between Sex and Genotype on Carcass Characteristics of Broiler Birds. American Journal of Multidisciplinary Research in Africa, 2(5): 1-12.

1.0 Introduction of the Study

Poultry production in the tropics possesses the quickest potential for bridging the protein supply – demand gap. It is an important means of rapidly increasing the availability of animal protein in the developing countries where malnutrition is a great problem (Anyawu & Okoro, 2006). Poultry product is considered to be one of the most popular options in Nigeria in reducing the incidence of malnutrition particularly protein deficiency in the diets of populace (Obasoyo *et al.,* 2005). The necessity of protein in man and animals diet cannot be overemphasized; the reason is that, protein plays a vital role in tissue synthesis and building of body structures.

The main goal of broiler rearing is production of quality broiler carcass that will be acceptable from the consumers. Acceptability depends on the quality and quantity of edible parts of carcasses and the amount of muscle in carcass. Broiler carcass are evaluated mainly through edible parts of which are expressed by dressing percentages (slaughter yield) and quality of edible parts of carcass. All quality characteristics of carcass are inherent in the genotype and therefore conditionally hereditary characteristics with precisely defined heritability proposed values (Chen *et al*., 1987). The marketing of poultry has been greatly diversified with a significant increase in cut - up (parts) and processed products (Le Bihan Duval *et al.,* 2001).

Broiler producers generally select broiler strains and sex that reach market body weight early with good carcass characteristics in order to maximize their profit margins. (Shim *et al*., 2012). In many least developed countries, there are many small scale farmers that lacks information on appropriate strain sex combinations to maximize profit. The aim of the experiment is to determine the interaction between genotype and sex on carcass characteristics of broiler chickens.

2.0 Literature Review of the Study

2.1 An Overview of Poultry Production.

Poultry is by far the largest group of livestock and estimated to be about 14,000 million, consisting mainly of chickens, ducks and turkey in the world (FAO, 1999). Poultry in Nigeria has undergone tremendous changes over the past decades in genotypes, management and technological advancement. Large poultry unit has replaced the backyard poultry units with more strains of meat or egg type birds, feed, intensive housing and better poultry equipment (Shehu et al., 2022; Ukonu et al., 2022a). Poultry production is an aspect of livestock farming important to the biological needs, economic and social development of the people of any nation (Oladeebo & Ambe-Lamidi, 2007).

In line with the increasing demand for poultry products, there has been a number of important scientific and technological developments which have resulted in the improvements of poultry production. These include the artificial incubator, effective

brooding system, increased understanding of nutritional requirements and formulations of balance diets (Shehu et al., 2022; Ukonu et al., 2022a). Better management and control of diseases, improved hygiene disinfectants, vaccination and antibiotics, environmental and photoperiod manipulation through housing design and the availability of electrical power and accurate control systems are also important factors which have elicited improved production outcomes.

2.2 Broiler Production System

2.2.1 Origin of Broilers

The domestic chicken originated from the red jungle fowl (Gallus gallus Linnaeus, 1758), native to tropical South \ South East Asia. Contemporary, non-indigenous red jungle fowl occur in the Americas, Australia, Europe and Africa due to deliberate human translocation and are adapted to a much wider climatic range than indigenous birds **(**Bennet *et al.,* 2018). Before the development of modern commercial meat breeds, broilers were mostly young male chickens culled from farm flocks. The first attempt at a meat crossbred was introduced in the 1930s and became dominant in the 1960s where a crossbred variety was produced from a male of a naturally double – breasted Cornish strain and a female of a tall, large – boned strain of white Plymouth rocks. The original crossbred was plagued by problems of low fertility, slow growth and disease susceptibility (Damerow, 1995).

2.2.2 Broiler Industry

Standard intensively farmed broiler chickens are reared to their slaughtered weight (typically around 2kg, sometimes 3kg) very rapidly (Owhe-Ureghe et al., 2022). They reach slaughter weight of 2kg within about 40 days of being hatched, whereas they would not reach adulthood until about five or six months. Broilers are thus very young animals for the whole of their rearing period. By selective breeding, the length of time broiler chicks takes to grow to 2kg has been halved in the last 30 years and between 1976 to 2007, it is likely to have been reduced by 1 day every year. The amount of feed needed to achieve this weight gain has been reduced by almost 40% since 1976. Breeding for increased breast muscle means that broilers' centre of gravity has moved forward and their breast and their breast broadened compared to their ancestors (SCAHAW, 2000). The broiler industry was characterized based on age for weight. Therefore, emphasis was placed on rapid growth and early carcass development (Emmerson, 1997). The explanation was that processor's demand for chicken products including bone in and boneless pieces, within a narrow weight range, these forces producers to raise and market birds at a fixed target weight to satisfy market demands.

2.3 Breeds of Broilers

Poultry genetics has entered a new era with the completion of a century of investigative studies in chicken genetics, sequencing of the chicken genome and application of molecular genetic information in commercial breeding programs. Today's broilers industry has its origin from in the seasonal rearing of cockerels of eggs or dual purpose breeds for meat. With increasing demand for young chickens, breeds have been selected for rapid weight gain, feed conversion and high yield of valuable cut parts (Eitan & Solier, 2002). The structure of all breeder companies is quite standard, with the pure line elite stock in relatively small populations located at the apex and large numbers of broilers at the base. The mainline pedigree populations, categorized into male and female lines undergo genetic selection to obtain incremental improvements in the major economic trait. Owhe-Ureghe et al. (2022) argued that the major economic trait is improved by intensive selection (high intensity), which is regenerated from the best families. Minor traits such as fertility, hatchability and liveability are improved by eliminating the few worst families (low intensity) (Pollock, 1999). A number of broiler breeding companies have been in existence since the late 1940s and have contributed immensely to genetic improvements in broilers over the years. These companies are mostly located in the USA (North America) and Europe (England). The three major breeding companies in the world are Aviagen (with Cobb – Vantress and Avian) and Hubbard – ISA (with Hubbard and shaver).

2.3.1 Cobb: Cobb claims to be world's oldest poultry breeding company. Founded 1916 when Robert C. Cobb Senior purchased a farm in Littleton, Massachusetts, forming Cobb's pedigree Chicks. It was then purchased by Upjohn in 1974, sold to Tyson Foods in 1994. In 1947 Cobb begins a breeding line of all white birds called White Rocks. These birds along with the Vantress male provide the foundation of today's pedigree Cobb line.

2.3.2 Arbor Acre: Arbor Acrewas originally a family farm, started by an Italian immigrant Frank Sagio who purchased a Glastonbury, Connecticut farm in 1917. His third son Henry Saglio took over the poultry while in grade eight. Henry began trying to breed a white bird, because it is difficult to pluck black pin feathers. The white Arbor Acres' birds were preferred to the higher performing dark feathered Red Cornish crosses.

2.3.3 Ross: These Chickens are products of Aviagen and have been studied to have excellent live weight gain, low cost of finished meat, large and strong legs, excellent feed conversion, white and large breast, more muscle mass, rapid growth with possibility of early slaughtering and remarkable figure for survival. The optimal time for slaughtering the breed is considered to be from age six to nine weeks, at this point the chickens will have weighed up to two kilograms.

2.3.4 Marshall: Marshall breeds of broilers are noted for their tall growth with good breast attributes. They reach marketable age within six to eight weeks, depending on the quality of management as well as target weight.

2.4 Factors Affecting Carcass Characteristics of Broiler Chickens

The main goal of broiler rearing is production of quality broiler carcass that will be acceptable from the consumers. Acceptability depends on the quality and quantity of edible parts of carcasses and the amount of muscle in carcass (Ukonu et al., 2022b; Owolabi et al., 2022). Broiler carcass are evaluated through mainly through edible parts of which are expressed by dressing percentages (slaughter yield) and quality of edible parts of carcass. All quality characteristics of carcass are inherent in the genotype and therefore conditionally hereditary characteristics with precisely defined heritability proposed values (Chen *et al*., 1987). The marketing of poultry has been greatly diversified with a significant increase in cut - up (parts) and processed products (Le Bihan Duval *et al.,* 2001). The genetic constitution of the broiler chicken as well as the non-genetic factors such as nutrition, sex and age were reported in literature to have significantly influenced carcass value of broiler birds.

2.4.1 Housing and Stocking Density

Housing in poultry management is a technique involving the allocation of a specific floor space to bird to provide a comfortable environment for satisfactory performance. Stocking density is one of component of environment that plays a critical role in determining the wellbeing of a bird (Lee & Moss, 1995). Maintaining a high stocking density is a common practice of the poultry industry because it allows for an increase in economic return per unit floor space. Bandyopadhyay *et al.* (2006) reported that income per bird often decreases primarily due to reduction in growth rate, increased proportion of downgraded carcasses and greater risk of health related problems. (Estevez, 2007) reported that assigned densities have been primarily driven by cost – benefit analysis, but economic profit may come at the cost of reduced bird performance and welfare if the densities are excessive. Other studies have shown that that stocking rate affected feed consumption. Average daily weight gain, feed conversion efficiency and breast yield (Bilgi & Hess, 1995).

2.4.2 Age of broiler chickens

Traditionally, broilers have been bred to grow quickly so they reach their market weight by the age of 42 to 45 days. However, there is a growing trend in the poultry broiler industry to produce heavier birds for further processing (Lesson & Summer, 2001).

2.4.3 Diet Composition of broiler chickens

The importance of dietary feed intake cannot be overemphasized because increasing or decreasing the dietary energy has been reported to affect feed intake in addition to promoting or undermining efficient feed utilization and growth rate (Leeson & Summer, 1991; Dozier *et al.,* 2006; Dozier *et al.,* 2007; Ghaffari *et al.,* 2007). This scenario tends to lead to malnutrition, poor performance, increased deposition of excess abdominal fat or carcass fat in broilers (Ghaffari *et al.,* 2007; Singh & Panda, 1992; Summers *et al.,* 1992) and these fats are usually considered as waste product when the birds are processed.

2.4.4 Sex of broiler chickens

A number of studies demonstrated that female broilers have higher breast proportions, while in males the proportions of thighs were higher (Young *et al.,* 2001). In addition, Mendes *et al.* (2004) established lower abdominal fat percentage in males than females. The authors found that sex also significantly affected carcass traits through slaughter yield, percentages of wings and thigh and meat to bone ratio from the thigh. Castellini *et al.* (2014), have reported that carcass characteristics were not greatly affected by sex.

2.4.5 Genotype of broiler chickens

Genotype has been studied to have significant effects on carcass characteristics such as carcass fatness, meat quality, carcass weight, breast and leg muscle weight, fats and edible giblet weight and back and drumstick weights (Olawumi & Fagbuaro, 2011; Marcu *et al.,* 2013). On the other hand, Udeh *et al.* (2015) found no difference in the yield of carcass and cuts among Ross, Arbor Acres, and Marshall breeds. In the selection process, breeds were characterized and originated specific pedigrees with their own characteristics. Despite that, Hoofman (2005) argued that the genetic base of most commercial breeds are the same and therefore the selection pressures for traits such as performance and carcass yield results in distinct products. Souza *et al.* (1994) showed that some breeds have presented a continuous genetic progress in traits of economic interest. In this evaluation, the breeds Ross, Cobb, Hubbard had a higher breast yield than Arbor Acre breeds. In this way, the evaluation of breeds existing in the market should be periodical, once genetic advantages of economic importance such as breast and leg yield, can change between breeds. The molecular basis incorporated to the selection programs is already being done in order to achieve increasingly faster genetics (Boschiero *et al.,* 2009).

2.5 Genotype and Sex Interactions on Carcass Characteristics of Broilers

Broiler producers generally select strains and sex that reach market body weight early in order to maximize their profit margins (Shim *et al.,* 2012). Genotype and sex interactions effect on body weight, body weight gain, feed intake and feed conversion ratio have been reported by (Shim *et al.,* 2012; Udeh *et al.,* 2015). For example, Udeh *et al.* (2015) observed that Arbor Acre males were superior to males and females of Ross and Marshall. In addition, Olawunmi *et al.* (2012) reported strain x sex interactions on breast, back, thigh, drumstick, wing and leg weights while Ojedapo *et al*. (2008) reported non - significant breed x sex interactions effects on shanks, thigh and drumstick weights, and Olawunmi *et al*.(2012) observed non - significant effects on liver and gizzard weights.

2.6 Effect of sex on carcass characteristics and internal organs of broiler chickens

Benyi *et al.* (2015) reported that sex significantly affected carcass, back, wing, leg, liver, gizzard, and abdominal fat weights with higher means for males than females for all the traits except abdominal fat weight where females had higher means than males. Kryeziu *et al.* (2015) observed that the breast and whole legs weights of male broilers were significantly higher ($p < 0.05$) compared to those of the female broilers. Akintola *et al.* (2019) reported significant ($p<0.01$) effect of sex on carcass characteristics. Male broilers recorded higher mean values (2558.33g) of live weights, slaughter weight, dress eight and other carcass traits than its female counterpart. Isidahomen *et al*. (2012) reported that male chickens had significantly higher slaughter weight, carcass weight, and dressing percentage than females. Almasi *et al*. (2012) reported that females were fatter than males and suggested that it could be due to the fact that females start to store fat earlier than males. Females start to store fat from 6 weeks compared to 8 weeks in males.

2.7 Effect of genotype on carcass and internal organs of broiler chickens

Benyi *et al.* (2015) reported that sex significantly affected carcass, back, wing, leg, liver, gizzard, and abdominal fat weights with higher means for males than females for all the traits except abdominal fat weight where females had higher means than males. Fernandes *et al.* (2013) recorded significant interactions for breast yield, boned and deboned legs among breeds, sex and slaughter age, and sex being the determinant factor which favors male. Kryeziu *et al.* (2015) observed that the breast and whole legs weights of male broilers were significantly higher ($p < 0.05$) compared to those of the female broilers. Akintola *et al.* (2019) reported significant ($p<0.01$) effect of sex on carcass characteristics. Male broilers recorded higher mean values (2558.33g) of live weights, slaughter weight, dress eight and other carcass traits than its female counterpart.

Isidahomen *et al*. (2012) reported that male chickens had significantly higher slaughter weight, carcass weight, and dressing percentage than females. Young *et al.* (2001) demonstrated that female broilers have higher breast proportions, while in males the proportions of thighs were higher. Mendes *et al.* (2004) established lower abdominal fat percentage in males than females. The authors found that sex also significantly affected carcass traits through slaughter yield, percentages of wings and thigh and meat to bone ratio from the thigh. Castellini *et al.* (2014) reported that carcass characteristics were not greatly affected by sex. Le Bihan-Duval *et al*. (1998) had reported that pullets were fatter than cocks and attributed this to the greater impact of the hormones for fatness in females than males. Almasi *et al*. (2012) reported that females were fatter than males and suggested that it could be due to the fact that females start to store fat earlier than males. Females start to store fat from 6 weeks compared to 8 weeks in males.

2.8 Effect of genotype and sex interactions on internal organs and carcass characteristics of broiler chickens

Genotype × sex interaction effects significantly influenced carcass, breast, back, wing, leg, and liver weights as reported by Benyi *et al.* (2015). Another study, Fernandes *et al. (2013)* reported that carcass and breast fillet yield showed significant differences, independent of breed, sex and slaughter age. Olusegun *et al.* (2020) reported that slaughter weight irrespective of sex and strains significantly influenced carcass yield ($p<0.0001$). Akinsola *et al.* (2019) indicated a significant ($p< 0.01$) effect of strain and sex interactions, and furher established that most carcass traits are sex and strain dependent. Udeh *et al.* (2015) reported that Arbor Acre males were superior to males and females of Ross and Marshall. Olawunmi *et al.* (2012) reported strain x sex interactions on breast, back, thigh, drumstick, wing and leg weights. Also, Olawunmi et *al*. (2012) observed non - significant effects on liver and gizzard weights. Ojedapo *et al*. (2008) reported non - significant breed x sex interactions effects on shanks, thigh and drumstick weights, and Ojedapo *et al*. (2008) observed non - significant interaction effects on gizzard, heart, and abdominal fat weights which implies that there was absence of joint effect of breed and sex on these traits. i.e., the two factors acted independently.

3.0 Methodology of the Study

The study adopts an extensive review of literature such as conference papers, journal articles, internet sources, books. The aim of this study is to conduct an extensive literature review on interaction between genotype and sex on carcass characteristics of broiler birds. This is because in recent studies, there is higher preference for broiler with higher carcass characteristics. Future findings will contribute to existing body of knowledge in the field of poultry production and future authors will be guided to adopt scientific approach to test the constructs that would emerge from this study, so as to provide more valid results.

4.0 Conclusion of the Study

Authors in this study found that broiler birds are economically valuable with regards to their carcass characteristics which is majorly influenced by genotype. They also added that different genotype of broilers has tended to exhibit different carcass characteristics when raised under the same conditions which then shows how their genetic potential tends to affect the carcass. Also sex of the chickens tended to affect the carcass characteristics with males having higher carcass characteristics when compared to the females regardless of their genotype. Findings in this study confirmed that there is no interaction between sex and genotype on carcass characteristics of broiler chicken as each factor does not depend on each other.

5.0 Acknowledgement of the Study

My profound gratitude goes to my supervisor Professor Ojedapo L. O. for his endless support and guidance towards getting my bachelor's degree project completed. I must appreciate my respondents who participated in this review. I must acknowledge with gratitude the effort of my mentor Dr. Akintunde Ajagbe, Publisher and Editor in Chief; Maryland Publishing and Research Institute, Inc. USA., for his powerful words of encouragements, guidance and most especially for making my dream of publishing this work come into fruition by funding the Publication. I am glad to be a member of your online mentoring program which has shaped me to become a better person in writing journal articles.

6.0 References of the Study

Akinsola K. L., Olawunmi, S. O., Obasi, E. N., Nathaniel, J., Adesina E. O., Obike, O. M., Nosike, R. J. & Oke, U. K. (2019). Effect of Strain X Sex Interaction on Carcass Traits and Meat Quality on Three Strains of Commercial Meat Type Chicken. *Nigerian Journal of Animal Science*, 21(3):12:21.

Almasi, A., Suto, Z., Budai, Z., Donko, T., Milisits, G. & Horn, P. (2012). Effect of Age, Sex And Strain on Growth, Body Composition and Carcass Characteristics of Dual Purpose Type Chicken. *World Poultry Congress 2012, Salvador, Bahia, Braz1il, 5–8 August, 2012. World's Poultry Science Journal, Supplement 1, Expanded Abstract, Oral Presentation, Genetics and Breeding*, Pp.: 47-50.

Anyawu, G.A. & Okoro, V. M. O. (2006) . Performance of Finisher Broilers Fed Graded Levels of Bread Waste. *Proceeding Of 11th Annual Conference of Animal Science of Nigeria (ASAN) 18th – 24th Of September 2006, I.A.R & T. Ibadan*, Pp:138 – 140.

Bandyopadhay, P. K., Bhakta, J. N. & Shukla, R. (2006). Effect of Stocking Density on Feed and Water Intake, Behavior and Growth of Both Australop and Rhode Island Red for Production of Three Weeks Bird. *Tamilnadu Journal of Vertinary and Animal Science*, 2: 96-101.

Bennet, C. E., Richard, T., Mark, W., Jan, Z., Matt, E., Holly, M., Ben, C., Alison, F., Emily J. & Upenyu, M. (2018). The Broiler Chicken as Signal of Human Reconfigured Biosphere. *Royal Society Open Science*, 5(12): 44-57.

Benyi K., Tshilate T. S., Netshipale A. J., & Mahlako K. T. (2015). Effects of Genotype and Sex on the Growth Performance and Carcass Characteristics of Broiler Chickens. *Tropical Animal Health Production. 47(7):1225-1231*

Bilgi, S. F. & Hess, J. B. (1995). Placement Density Influences Broiler Carcass Grade and Meat Yields. *Journal of Applied Poultry Research*, 4:384-389.

Boschiero, C., Rosario, M. F., Ledur, M. C., Campos, R. L. R., Ambo, M., Coutinho, L. L. & Moura, A. S. A. M. T. (2009). Association Between Microsatellite Markers and Traits Related to Performance, Carcass and Organs in Chickens. *International Journal of Poultry Science*, 8(7): 615-620.

Castelinni, C., Mugnai, C., Pedrazzoi, M. & Dal Bosco (2014). Productive Performance and Carcass Traits of Leghorn Chickens and their Crosses Reared According to the Organic Farming System.*Wwwequizoobio.It/Downloads/Castelinni-01.Pdf.*

Chen, T. C., Omar, S., Schulty D., Dilworth, B.C. & Day, J. E. (1987). Processing, Parts and Deboning Tool of Four Ages of Broilers. *Poultry Sciences*, 8: 1334 – 1340.*Conference Nigerian Society of Animal Production* (NSAP), Bayero University Kano, Nigeria. Pp: 304-306.

Damerow, G. (1995). Storey's Guide to Raising Chickens. *Storey Publishing,* Pp: 352.

Dozier, W. A., Corzo, A., Kidd, M. T. & Branton, S. L. (2007). Dietary Apparent Metabolizable Energy and Amino Acid Density Effects on Growth and Carcass Traits of Heavy Broilers. *Journals of Applied Poultry Research,* 16:192-205.

Dozier, W. A., Price, C. J., Kidd, M. T., Corzo, A. And Anderson, J. & Branton, S. L. (2006). Growth Performance, Meat Yield and Economic Responses of Broilers Fed Diets Varying In Metabolizable Energy from Thirty to Fifty-Nine Days of Age. *Journals of Applied Poultry Research,* 15: 367-382.

Eitan, Y. & Solier, M. (2002). Associated Effect of Sixty Years of Commercial Selection for Juvenile Growth Rate in Broiler Chickens: Endo/Exophysiological or Genetic? *Proceedings of 7th World Congress on Genetics Applied to Livestock Production, Montpellier, France, August 19-23, 2002.*Vol 2002, Pp: 19.1

Emmerson, D. A. (1997). Commercial Approaches to Genetic Selection for Growth and Feed Conversion in Domestic Poultry. *Poultry Science,* 76(8): 1121 – 1125.

Estevez, I. (2007). Density Allowances for Broiler: Where to Set the Limits. *Poultry Science,* 86:1265-1272.4

Fernandes, J. I.M., Bortouzzi, C., Triques, G. E., Neto, A. F. G. & Peiter, D. C. (2013). Effect of Sex and Age on Carcass Parameters of Broilers. *Actascientiarum*, 35: 99-105.

FAO (1999). Food and Agriculture Organisation of the United Nations, Rome, Italy. Statistical Data Base.

Ghaffari, M., Shivazad, M., Zaghari, M. & Taherkhani, R. (2007). Effects of Different Levels of Metabolizable Energy and Formulation of Diet Based on Digestible and Total Amino Acid Requirements on Performance of Male Broiler. *International Journal of Poultry Science*, 6:276-279.

Hoofman, I. (2005). Research and Investment in Poultry Genetic Resources. *World's Poultry Science Journal*, 61(1): 57-70.

Isidahomen, C.E., Iori, B. M. & Akano, K., (2012). Genetic and Sex Differences in Carcass Traits of Nigerian Indigenous Chickens. *Journal of Animal Science Advances*, 2: 636-648.

Kokoszynski, D., Bernacki Z., Salen M., Steczny, K. & Binskowska, M. (2020). Body Conformation and Internal Characteristics of Different Commercial Broiler Lines. *Brazilian Journal of Poultry Science*, 19(1): 047-052.

Kryeziu, A. J., Kamberi, M., Muji, S., Mestani, N. & Berisha, S. (2018). Carcass Traits of Broilers as Affected by Different Stocking Density and Sex. *Bulgarian Journal of Agricultural Science,* 24(6): 1097–1103.

Le Bihan- Duval, E., Berri, C., Baeza, E., Millet, N. & Beaumont, C. (2001). Estimation of the Genetic Parameters of Meat Characteristics and of their Genetic Correlation with Growth and Body Composition in an Experimental Broiler Line. *Poultry Science,* 9(2):171 – 176.

Lee, K. & Moss, C. N. (1995). Effects of Population Density on Layers' Performance. *Poultry Science,* 74:1754-1760.

Lesson, S. & Summer, J. D. (1991). Broiler Diet Specifications. In: *Commercial Poultry Nutrition*. University Books, Guelph, Canada, Pp.: 151.

Lesson, S. & Summer, J. D. (2001). Scott's Nutrition of the Chicken.4th Edition. University Books, Belgium.

Marcu, A., Vacaru-Opris, I., Danaila, L., Dronca, D. & Kelciov, B. (2013). The Influence of Genotype and Sex on Carcass Characteristics of Broiler Chickens. *Lucraristiintifice-Seriazootehnie*, 59: 17-21.

Mendes, A.A., Moreuira, J. & Oliveira, E.G. (2004). Effect of Dietary Energy on Performance, Carcass Yield and Abdominal Fat of Broiler Chickens. *Revistabrasileira De Zootecnia*, 33(6): 2300 – 2307.

Obasayo, D.O., Bamgbose, A.M. & Omoikhoje, S.O. (2005). Blood Profile of Broilers Fed Diets Containing Different Animal Proteins Feedstuff. *10th Annual Conference of Animal Science Association of Nigeria,* Pp: 176-178.

Ojedapo, L.O., Akinokun, J.O., Adedeji, T.A., Olayeni, T.B., Ameen, S.A. & Amao, S.R. (2008). Effect of Strain and Sex on Carcass Characteristics of Three Commercial Broilers Raised in Deep Litter System in Derived Savanna Area of Nigeria. *World Journal of Agricultural Sciences*, 4: 487- 491.

Oladeebo, J. O. & Ambe – Lamidi, A. I. (2007). Profitability, Input Elasticities and Economic Efficiency of Poultry Production among Youth Farmers in Osun State, Nigeria. *International Journal of Poultry Science*, 6(12): 994-998.

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

Olawunmi, S. O., Ogunlade, J. T. & Fajemilehin, S. O. (2012). Production Trait of Broiler Chicken Strains Fed Ad Libitum and Raised on Deep Litter System in the Humid Tropics. *Animal Research International*, 9(1):1529-1536

Owolabi, B. J., Adewole, E. A., Olunaike, J. H. & Oni, E. A. (2022). Empirical Analysis of Synthesis and Antimicrobial Activities of 1-Methyl-4-Nitro-Imidazole-5-N, N-Diethylsulphonamide. *American Journal of IT and Applied Sciences Research*, 1(4): 1-11.

Owhe-Ureghe, U. B., Okorie, E. C., Olunaike, J. H. & Okhani, P. (2022). Empirical Analysis of Enteric Pathogens in Raw Milk Sold at Aduwawa, Agbor, Asaba, Auchi and Warri, Nigeria. *American Journal of Information Technology and Applied Sciences Research*, 1(3): 1-12

Olusegun, O. I., Andrew, B. F., Conference, T. M., Titus, J. Z. & Anthony, I. O. (2020). Effect of Strains, Sex and Slaughter Weights on Growth Performance, Carcass and Quality of Broiler Meat. *Open Agriculture*, 5: 607-616.

Pollock, D.L. (1999). A Geneticist's Perspective from Within a Broiler Primary Breeder Company. *Poultry Science*, 78: 414 – 418.

Richards, M. P. (2003). Genetic Regulations of Feed Intake and Energy Balance in Poultry. *Poultry Science*, 82(6): 907 – 916.

Robertson, S. K. & Perez- Maldonado, R. A. (2005). Nutritional Characteristics of Sorghums from QSL and MSW. *Zootecnica International*, 32: 38-43.

Shehu, D., Okhani, P., Olunaike, J. H. & Adewole, E. A. (2022). A Literature Review of Antimicrobial Activity of Allium Sativum (Garlic) Extract on Bacteria Isolated from Smoked Fish. *American Journal of IT and Applied Sciences Research*, 1(2): 1-9

SAS (2003). Statisticaal Analysis System, Version 8.1, SAS Institute Incorporation Cary, NG, USA.

SCAHAW (2000). Scientific Committee on Animal Health and Welfare (European Commission). *The Welfare of Broiler Chicken in The European Union*, Sect 4.2.

Shim, M. Y., Tahir, M., Karnuah, A. B., Miller, M., Primgle, T.D., Aggrey, S. E. & Pesti G.M., (2012). Strain and Sex Effects on Growth Performance and Carcass Trait of Contemporarry Commercial Broiler Crosses, USA. *Poultry Sciences*, 91: 2942 -2948.

Singh, K. S. & Panda, B. (1992). Poultry Nutrition. Kalyani Publisher; New Delhi India, Pp: 57-61.

Skinner, J. T., Waldroup, A. I. & Waldroup, P. W. (1992). Effects of Dietary Nutrient Density on Performance and Carcass Quality of Broilers 42 To 49 Days of Age. *The Journal of Applied Poultry Research*, 1: 367-372.

Souza, P. A, Souza, H. B. A., Campos, F. B. & Brognoni, F. (1994). Desempenho E Caracteristicas De Carcaca De Diferenteslinhagens Commercials De Frango De Corte. *Revista Da Sociedadebrasileira De Zootecnia*, 23(5): 782 – 791.

Summers, J. D., Sprat, D.T. & Atkinson, J. L. (1992). Broiler Weight Gains and Carcass Composition When Fed Diets Varying in Amino Acid Balance, Dietary Energy and Protein Level. *Poultry Science*, 71: 263-273.

Taha, A. E., Abd El-Ghany, F. A. & Sharaf M. M. (2011). Strain and Sex Effects on Productive and Slaughter Performance of Local Egyptian and Canadian Chicken Strains. *Journal of World's Poultry Research*, 1: 11-17.

Tewe, O. O. & Egbunike. G. N. (1992). Utilization of Cassava in Non-Ruminant Feeding. In: Cassava as Livestock Feed in Africa Addis Ababa: *IITA, Ibadan And ILCA*, Pp.: 28 – 38.

Thutwa, K., Nsoso, H. J., Kgwatalala, P. M. & Moreki, J. C. (2012). Comparative Live Weight, Growth Performance, Feed Intake, Carcass Trait and Meat Quality in Two Strains of Tswana Chickens Raised Under Intensive System. *International Journal of Applied Poultry Research*, 11: 121- 126.

Ukonu, C. U., Lasisi, H. O., Adewole, E. A. & Okorie, E. C. (2022). Health Risk Associated with Cassava and its Cyanogenic Properties: A Review of the Literature. *American Journal of Multidisciplinary Research in Africa*, 2(4): 1-11.

Ukonu, C. U., Lasisi, H. O., Adewole, E. A. & Olunaike, J. H. (2022). Empirical Analysis of Hydrogen Cyanide in Streams Used for Commercial Fermentation of Cassava. *American Journal of IT and Applied Sciences Research*, 1(3): 1-9.

Udeh, I., Ezebor, P. N. & Akporhuarbo, P. O. (2015). Growth Performance and Carcass Yield of Three Commercial Strains of Broiler Chickens Raised in a Tropical Environment. *Journal of Biology, Agriculture and Healthcare.* 2: 62-67.

USDA (2013). International Eggs and Poultry Report. United States Department of Agriculture.

Vanderklis, J. D., Kwakernaak, C., Jansman, A. & Blok, M. (2010). Energy in Poultry Diets: Adjusted AME Or Net Energy. In: *Proceedings of Australian Poultry Science Symposium, Sydney Australia,* Vol.21; *The Poultry Research Foundation (University of Sydney) and the World's Poultry Science Association (Australian Branch),* Pp. 44-49.

Watts, G. & Kenneth, C. (1995). The Broiler Industry. *Poultry Tribune,* 7: 6-18.

Young, L. L., Northcutt, J. K., Buhr, R. J.,Lyon, C. E. & Ware, G. O. (2001). Effect of Age, Sex and Duration of Postmortem Aging on Percentage Yield of Parts from Broiler Chicken Carcasses. *Poultry Science,* 80(3): 376- 379.