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Full Length Research

Egg quality traits of Nigerian unimproved (Indigenous) and improved (Noiler) chickens as influenced by storage periods

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ABSTRACT: Nigerian chickens have recently been classified as unimproved and improved due to indigenous selection or crossing them with exotics. This study was conducted at Bauchi State College of Agriculture, Bauchi, to evaluate the influence of storage periods and genotypes on egg quality traits of unimproved (Indigenous) and improved (Noiler) chickens. One hundred and twenty chickens from each genotype were bought from local farmers within the Bauchi Local Government Area of Bauchi State and kept semi-intensively. Sixty eggs were collected from each genotype and divided into varied storage periods (Day 0, Day 3, Day 6, and Day 9), containing fifteen eggs. The external and internal egg quality traits were measured based on the respective periods. The data obtained were analysed using analysis of variance (ANOVA). The results show that both external and internal egg quality traits were significantly ($p<0.05$) influenced by storage periods, except egg width, eggshell index, yolk weight, and albumen length for the improved genotype, while only yolk length for the unimproved genotype. It is concluded that changes in storage periods significantly influence egg quality traits and eggs of both unimproved and improved Nigerian chicken genotypes. Eggs of the improved chicken genotype can be stored up to Day 9 based on the Haugh unit, as the higher the Haugh unit, the better quality of the egg.

Keywords: Duration external, progenitor, internal, variability.

INTRODUCTION

Recently, Nigerian chickens have been broadly classified into two groups: local and improved (Nweke-Okorocha *et al*., 2020). The improved chickens might be a result of the crossing of indigenous with exotics (Yakubu *et al*., 2020). Noiler chickens are improved Nigerian indigenous genotypes (Yahaya *et al*., 2023), dual-purpose purpose producing meat and eggs (Alabi *et al*., 2019). Most of the improvement programs were targeted at increasing production, adaptability, and to suit smallholder preferences of various genotypic and phenotypic traits of chickens (Esatu and Dessie, 2018). Interestingly, the introduction of improved chickens to the small household chicken farmers increases protein consumption substantially in terms of egg and meat in Nigeria (Alabi *et al*., 2019).

Phenotypically, avian eggs can be classified based on internal and external egg quality traits (Rath *et al*., 2015). Kumar *et al*. (2017) reported that egg quality has been defined as “the characteristics of an egg that affect its acceptability to the consumer.” Egg buyers consider qualities such as cleanliness, freshness, chemical composition, and external and internal characteristics when purchasing (Kabi *et al*., 2015). These qualities have been reported to be affected by many factors like temperature, storage facilities, and periods (Ahmed *et al*., 2019; Dogara *et al*., 2021; Yahaya *et al*., 2023).

Egg quality characteristics of local chickens have been studied in different parts of the world, including Nigeria (Bassey *et al*., 2016; Oleforuh-Okoleh and Eze, 2016; Dodamani *et al*., 2023), but there is inadequacy of information on the comparison of egg quality traits of Nigerian improved (Noiler) chicken genotypes with their progenitors, the unimproved (Indigenous). This study is therefore aimed at evaluating the influence of storage periods on egg quality traits of unimproved (Indigenous) and improved (Noiler) chickens.

MATERIALS AND METHODS

Study area

The study was conducted at Bauchi State College of Agriculture, Bauchi, in Bauchi Local Government Area of Bauchi State, North-Eastern Nigeria. The Local Government lies between latitudes 9^0N and 12^0N of the equator and longitudes 8^0E and 11^0E of the Greenwich Meridian, according to the 1999 Bauchi State Ministry of Land and Survey (Nuhu *et al*. 2014).

Experimental birds

Two hundred and forty point of lay Nigerian indigenous (unimproved) and Noiler (improved) chicken genotypes were bought from local farmers within the Bauchi metropolis and kept under a semi-intensive system. The chickens were allowed to scavenge at farm yard for 4 hours daily while layer’s mash was served for the remaining hours *ad libitum* in confinement.

Egg collection

Experimental eggs were collected from the birds at their third laying sets. One hundred and twenty eggs were randomly collected and used for the experiment (sixty from each unimproved and improved genotypes). The eggs were grouped into four groups (storage periods) as Day 0, Day 3, Day 6, and Day 9 respectively. Day 0 is served as control. The eggs were stored at room temperature. Each group contained 15 eggs.

Egg quality determination

Determination of internal and external egg quality traits was carried out immediately after collection for the control (Day 0) and the remaining based on their respective storage days (Day 3, Day 6, and Day 9). The external egg quality traits measured were egg weight (EWT), egg length (ELT), egg width (EWD), eggshell index (ESI), shell weight (SWT), and eggshell thickness (EST). The internal egg quality traits measured were yolk weight (YWT), yolk length (YLT), yolk width (YWD), yolk depth (YDP), yolk index (YID), albumen weight (AWT), albumen length (ALT), albumen width (AWD), albumen depth (ADP), albumen index (AID), and Haugh unit (HU).

Individual eggs were weighed using a digital weighing scale in grams (g). A pair of Steel Vernier callipers in centimetres (cm) was used to determine the length and width of individual eggs. The length was measured from the narrow end of the egg to the tip of the broad end. The width of the eggs was taken from the middle of the egg. Equation (1) was used to calculate ESI.

$$\text{ESI (\%)} = \frac{Width\ of\ egg\ (cm)}{Length\ of\ egg\ (cm)} \times 100 \quad (1)$$

To determine SWT, eggs were broken into two halves, and the egg content was removed. Shells were kept upside down for 24 hours to drain properly and placed on a digital weighing scale (g) to obtain SWT. Calibrated screw gauge in millimetre (mm) was used to measure EST.

After breaking the egg, the length and width of the yolk and albumen were measured using a Steel Vernier calliper (cm). The depth of the yolk and albumen was measured using the Depth Measuring Blade of the Vernier calliper (mm). The yolk and albumen were separated, and their weight was measured using a digital weighing scale (g) accordingly. The YID (equation 2), AID (equation 3), and HU (equation 4) were calculated according to the following formulae as stated by Bassey *et al*. (2016).

$$\text{YID (\%)} = \frac{Average\ width\ of\ yolk\ (cm)}{Average\ length\ of\ yolk\ (cm)} \times 100 \quad (2)$$

$$\text{AID (\%)} = \frac{Average\ width\ of\ albumen\ (cm)}{Average\ length\ of\ albumen\ (cm)} \times 100 \quad (3)$$

$$\text{HU} = 100\ log(H - 1.7W^{0.37} + 7.6) \quad (4)$$

Where: H = Height of thick albumen in mm; W = Weight of egg in grams.

Analysis of data

The data obtained were subjected to analysis of variance (ANOVA) using the General Linear Procedure (GLM) of Statistical Package for Social Science (SPSS) software version 20.0. Significantly different means were separated using Duncan’s Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The effect of storage periods on external egg quality traits of the Nigerian unimproved and improved chicken

Table 1. Influence of storage periods on external egg quality traits of Nigerian unimproved (Indigenous) chicken genotype.

Egg quality traits	Periods				p-value
	Day 0	Day 3	Day 6	Day 9	
EWT (g)	37.53±0.19[a]	35.53±0.13[b]	35.33±0.84[b]	35.20±0.55[b]	0.007
ELT (cm)	3.28±0.06[c]	3.48±0.05[b]	3.59±0.04[ab]	3.71±0.11[a]	<0.001
EWD (cm)	2.31±0.04[a]	2.03±0.04[b]	2.01±0.03[b]	1.84±0.07[c]	<0.001
ESI (%)	52.99±2.01[b]	54.76±1.98[b]	62.60±1.43[a]	64.45±0.96[a]	<0.001
SWT (g)	4.53±0.19[a]	3.67±0.19[b]	3.47±0.17[b]	3.27±0.13[b]	<0.001
EST (mm)	0.50±0.01[a]	0.35±0.40[b]	0.33±0.01[b]	0.26±0.02[c]	<0.001

abc = Means in the same row with different superscripts are significantly different (p<0.05). EWT, ELT, EWD, ESI, SWT, EST and HU referred to egg weight, egg length, egg width, egg shell index, shell weight, egg shell thickness and Haugh unit respectively.

Table 2. Influence of storage periods on external egg quality traits of Nigerian improved (Noiler) chicken genotype

Egg quality traits	Periods				p-value
	Day 0	Day 3	Day 6	Day 9	
EWT(g)	60.40±0.70[a]	59.80±0.56[a]	57.93±0.21[b]	57.80±0.20[b]	<0.001
ELT (cm)	4.34±0.06[a]	4.20±0.04[b]	4.16.04[b]	4.15±0.04[b]	0.011
EWD (cm)	2.77±0.02	2.75±0.05	2.77±0.03	2.77±0.02	0.976
ESI (%)	64.03±0.88	65.11±1.56	66.77±0.92	66.78±0.93	0.230
SWT (g)	6.60±0.18[a]	6.27±0.27[a]	5.67±0.16[b]	5.60±0.13[b]	<0.001
EST (mm)	0.62±0.02[a]	0.43±0.02[b]	0.41±0.03[b]	0.34±0.18[c]	<0.001

ab= means in the same row with different superscripts are significantly different (p<0.05). EWT, ELT, EWD, ESI, SWT, EST and HU referred to egg weight, egg length, egg width, egg shell index, shell weight, egg shell thickness and Haugh unit respectively.

genotypes is presented in Tables 1 and 2, respectively. The results revealed that storage periods influence (p<0.05) all the external egg quality traits for the Nigerian unimproved chicken genotype. The external egg quality traits in the Nigerian improved chicken genotype were similarly influenced (p<0.05) by storage periods, except EWD and ESI (p>0.05). Taha *et al*. (2019) reported similar findings in two breeds of quails and stated that storage periods influence egg quality traits.

The finding shows that ELT and ESI significantly (p<0.05) increased with an increase in storage periods (Day 0, Day 3, Day 6, and Day 9) respectively in the Nigerian unimproved chicken genotype (Table 1). However, EWT, EWD, and SWT were significantly (p<0.05) reduced as storage periods increased from Day 0 to Day 9. On the other hand, the results of external egg quality traits in Nigerian improved chicken genotype (Table 2) show that EWT, ELT, SWT, and EST were significantly (p<0.05) decreased by increased storage periods (Day 0, Day 3, Day 6, and Day 9). The changes suggest substantial moisture loss and structural alterations occurring in the eggs during storage.

Gandi *et al*. (2023) reported the range of EWT as 46.51 to 59.51g after storing eggs from Day 0 to Day 12, which is higher than the value obtained in this study (35.20 to 37.53) for the unimproved genotype but lower than 60.40 g for the improved genotype at Day 0. The differences might be due to the genetic make-up of the birds. Egg weight decreases with an increase in storage time (Oleforuh-Okoleh and Eze, 2016; Lee *et al*., 2016). This report is similar to what was obtained in this study. Furthermore, the results obtained by Gandi *et al*. (2023) correspond with those of this study, as the storage period increases, EWT decreases. The reduction in EWT might be due to the loss of moisture content through the pores of the eggs. However, contrary to the above pattern, the results obtained in a study conducted by Stojčić and Perić (2018) show that EWT decreases from day 0 to day 7, then increases at day 14 and decreases again at day 21. This discrepancy may reflect variations in storage conditions, genetic factors, or measurement protocols. Therefore, the better EWT is obtained at the beginning of the storage period (Feddern *et al*.,2017).

The observations of Oshibanjo *et al*. (2021) were similar to the findings in this study for the improved genotype, as storage time showed no influence (p>0.05) on EWD but had influences (p<0.05) on EWT and ELT. The resulting pattern of this study for SWT and EST for unimproved and

Table 3. Influence of storage periods on internal egg quality traits of Nigerian unimproved (Indigenous) chicken genotype.

Egg quality traits	Periods				p-value
	Day 0	Day 3	Day 6	Day 9	
YWT (g)	13.73±0.27^{a}	13.60±0.15^{a}	13.07±0.25^{b}	12.47±0.13^{c}	<0.001
YLT (cm)	3.33±0.03	3.50±0.35	3.66±0.30	4.42±0.52	0.223
YWD (cm)	1.89±1.03^{ab}	2.09±0.09^{a}	1.76±0.07^{b}	1.87±0.10^{ab}	0.049
YDP(mm)	0.12±0.00^{b}	0.12±0.00^{b}	0.12±0.00^{b}	0.13±0.00^{a}	<0.001
YID (%)	66.79±1.52^{b}	71.31±3.72^{b}	74.39±2.59^{b}	83.22±3.12^{a}	0.003
AWT (g)	16.33±0.54^{c}	17.47±0.11^{b}	18.87±0.19^{a}	19.53±0.48^{a}	<0.001
ALT (cm)	2.60±0.20^{a}	1.89±0.38^{b}	1.92±0.16^{b}	2.52±0.28^{a}	<0.001
AWD (cm)	2.60±0.04^{a}	1.89±0.08^{b}	1.92±0.05^{b}	2.52±0.07^{a}	<0.001
ADP (mm)	0.12±0.00^{b}	0.12±0.00^{b}	0.13±0.00^{a}	0.13±0.00^{a}	<0.001
AID (%)	47.98±1.67^{c}	56.07±2.15^{b}	65.20±1.33^{a}	66.24±2.11^{a}	<0.001
HU	82.75±0.08^{a}	82.65±0.07^{a}	82.65±0.05^{a}	66.24±0.04^{b}	<0.001

abc = Means in the same row with different superscripts are significantly different (p<0.05). YWT, YLT, YWD, YDP, YID, AWT, ALT, AWD, ADP, AID stand for yolk weight, yolk length, yolk width, yolk depth, yolk index, albumen weight, albumen length, albumen width, albumen depth, albumen index respectively.

Table 4. Influence of storage periods on internal egg quality traits of Nigerian improved (Noiler) chicken genotypes.

Egg quality traits	Periods				p-value
	Day 0	Day 3	Day 6	Day 9	
YWT (g)	20.47±0.64	20.20±0.28	20.53±0.13	20.47±0.13	0.918
YLT (cm)	3.50±0.02^{b}	3.15±0.30^{b}	7.13±0.22^{a}	6.84±0.73^{a}	<0.001
YWD (cm)	2.09±0.56^{b}	1.39±0.07^{c}	2.43±0.03^{b}	3.05±0.20^{a}	<0.001
YDP(mm)	0.12±0.00^{b}	0.12±0.00^{b}	0.13±0.00^{ab}	0.14±0.00^{a}	<0.001
YID (%)	60.65±2.28^{a}	59.09±3.13^{a}	44.53±4.80^{b}	57.09±4.14^{b}	0.013
AWT (g)	9.73±0.18^{c}	31.93±0.26^{a}	30.67±0.40^{b}	30.73±0.16^{b}	<0.001
ALT (cm)	9.73±0.28	10.03±0.18	9.91±0.03	9.51±0.41	0.640
AWD (cm)	3.30±0.14^{a}	2.96±1.18^{ab}	2.51±0.16^{b}	2.45±0.23^{b}	0.004
ADP (mm)	0.12±0.00^{b}	0.12±0.00^{b}	0.13±0.00^{a}	0.13±0.00^{a}	0.002
AID (%)	37.77±1.99^{b}	45.08±1.43^{b}	61.39±3.52^{a}	59.43±4.14^{a}	<0.001
HU	81.35±0.10^{b}	81.44±0.07^{ab}	81.45±0.03^{ab}	81.47±0.01^{a}	<0.001

abc = Means in the same row with different superscripts are significantly different (p<0.05). YWT, YLT, YWD, YDP, YID, AWT, ALT, AWD, ADP, AID stand for yolk weight, yolk length, yolk width, yolk depth, yolk index, albumen weight, albumen length, albumen width, albumen depth, albumen index respectively.

improved genotypes agreed with the study of Lee *et al*. (2016), where both of the traits decreased with increased storage duration. The consistency in SWT and EST reduction across genotypes suggests that shell degradation may follow a universal pattern regardless of genetic improvement, though the rate of decline could vary based on breed-specific characteristics. Further supporting this observation, the improved genotype exhibited a more gradual decrease in EST compared to the unimproved genotype, potentially indicating enhanced shell stability due to selective breeding.

Tables 3 and 4 present the values of internal egg quality traits of Nigerian unimproved and improved chicken genotypes. All the internal egg quality traits in both the Nigerian unimproved and the improved chicken genotypes were influenced (p<0.05) by the storage periods, except YLT (p>0.05) in the unimproved genotype and ALT (p>0.05) in the improved genotype. These findings suggest that while most internal egg components undergo measurable changes during storage, certain structural dimensions demonstrate remarkable resistance to temporal effects. The differential response patterns between genotypes may reflect inherent variations in their biochemical composition and membrane integrity, potentially influenced by genetic selection pressures during breed development programs.

The findings in this study for unimproved genotype (Table 3) are supported by the report of Oleforuh-Okoleh and Eze (2016) in a study conducted on egg quality traits of Nigerian heavy chickens which stated that as storage period increases, AWT, AID, YWT, and YID decrease. The values of internal egg quality traits for the improved genotype (Table 4) obtained in this study were ranged from 20.20-20.58 g, 3.15-7.13 cm, 1.39-2.43 cm, 0.12-0.14 mm, 9.73-31.93 g, 9.51-10.03 cm, 2.45-3.30 cm, and 0.12-0.13 mm for YWT, YLT, YWD, YDP, AWT, ALT, AWD, and ADP respectively. However, when compared with the overall means observed in Noiler chickens by Dogara *et al*. (2023), lower values were found in YWT (14.99 g) and ALT (7.55 cm), higher in YWD (3.62 cm), YDP (1.49 mm), AWT (34.04 g), AWD (6.14 cm), and ADP (5.40 mm), while YLT was in between the range at 3.79 cm. The variation might be due to the differences in management systems adopted. The system adopted in this study was semi-intensive, while Dogara *et al*. (2023) adopted an intensive (deep litter and battery cage) system.

It is reported that better egg quality is related to a higher HU value (Joubrane *et al*., 2019). The results of HU obtained in this study for unimproved genotypes were significantly ($p<0.05$) decreased with increased storage periods from 82.75 at Day 0 to 66.24 at Day 9. This is supported by the findings of Feddern *et al*. (2017). However, the finding is in contrast with the results in this study in improved genotypes, where it was found that HU increases as storage period increases from 81.35 at Day 0 to 81.47 at Day 9. This variation might be due strength of selection, as the improved chicken genotype undergone various selection processes. Therefore, improvement in some traits leads to declining in others.

Conclusion and Recommendations

The study revealed that egg quality traits are significantly affected by varying storage periods. Specifically, it was observed that egg weight tends to decline as the storage period increases. When assessing Haugh unit (HU), which is a key indicator of egg quality, the findings suggested that eggs from improved chicken genotype maintain optimal quality up to Day 9 of the storage, as higher HU values correspond to better egg freshness. To further explore these trends, extending the storage period in future research is recommended to evaluate the long-term effects on Noiler chicken egg quality. Additionally, a comparative analysis between Noiler chickens and common layer breeds could provide valuable insights, helping to address existing knowledge gaps in poultry science and enhance breeding strategies for improved egg production and preservation.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Ahmed, A. M., Hassan, S. A. O., Omer, A. A., Abdlhafeeze, M., Gibril, S., & Habi, A. B. (2019). Effect of handling and storage on eggs quality in Khartoum State. *Merit Research Journal of Agricultural Science and Soil Sciences*, *7*(9), 098-105.

Alabi, O., Shoyombo, A., Jegede, S., Oluba, O. and Akpor, O. (2019). Rural production of tropically adapted breeds of chickens in rural areas of Kwara State, Nigeria. *Potravinarstvo Slovak Journal of Food Sciences*, *13*(1), 1013-1017.

Bassey, O. A., Akpan, U., Ikeobi, C. O. N., Adebambo, O. A., & Idowu, O. M. O. (2016). Egg production and quality assessment of Nigerian indigenous chicken genotypes and their crosses with Marshall. *Nigerian Journal of Animal Production*, *43*(2), 28-36.

Dodamani. S., Vidyasagar. V., Naveen K. S., Waghmare, P., Biradar, S., Meenaxi, M., & Bhatambr, P. (2023). Relationship between plumage colour and egg production traits in native chicken. *Indian Journal* of *Animal Production and Management*, *37*(2), 114-117.

Dogara, M. U., Kalla, D. J. U., Mancha, Y. P., & Shuaibu, A. (2021). Evaluation of egg production and egg quality traits of Noiler chickens. *Nigerian Journal of Animal Science*, 23(2),100-113.

Esatu, W., & Dessie, T. (2018). Testing and delivering tropically-adapted chickens for productivity growth in Sub-Saharan Africa. *FAO-ILRI Regional Training Workshop on Proven Livestock Technologies ILRI*, Addis Ababa, 3-5 December 2018.

Feddern, V., Celant De Prá, M., Mores, R., Nicoloso, R. S., Coldebella, A. and Abreu. P.G. (2017). Egg quality assessment at different storage conditions, seasons and laying hen strains. *Ciência e Agrotecnologia*, *41*(3), 322-333.

Gandi, B. R., Barnabas, J. C., Mallam, I., Aliyu, Z. I., Kaboshio, K. Y., & Yayi, J. (2023). Effects of storage duration and season on egg quality parameters of laying Chickens. *Nigerian Journal of Animal Science and Technology*, *6*(2), 83-92.

Joubrane, K., Mnayer, D., Hamieh, T., Barbour, G., Talhouk, R. & Awad, E. (2019). Evaluation of quality parameters of white and brown eggs in Lebanon. *American Journal of Analytical Chemistry*, 10, 488-50.

Kabi, F., Masembe, C., Negrini, R. and Muwanika, V. (2015). Patterns of indigenous female cattle morphometric traits variations in Uganda: Evidence for farmers' selection to enhance agro-ecological fitness. *Animal Genetic Resources*, *56*, 79-90.

Kumar, S., Desai, B. G., Chauhan, H. S., Burte, R. G., Parhad, M., Dhekale, J. S., Dandekar, V. S., Mayekar, A. J., Bello, A. A., & Bhagat, D. J. (2017). Study of external and internal egg geometry traits of Vanaraja and Giriraja in Konkan region of Maharashtra, India. *Journal of Experimental Zoology India*, *20*(2), 1017-1020.

Lee, M. H., Cho, E. J., Choi E. S., Bang M. H., & Sohn S. H. (2016). The effect of hen age on egg quality in commercial layer. *Korean Journal of Poultry Science*, 43(4): 253-261.

Nuhu, H. S., Donye, A. O., & Bawa, D. B. (2014). Barriers to women participation in agricultural development in Bauchi Local Government Area of Bauchi State, Nigeria. *Agriculture and Biology Journal of North America*, *5(*4), 166-174.

Nweke-Okorocha, G. O., Agaviezor, B. O. and Chineke, C. A. (2020). Effects of breed and sex on serum biochemical indices of local and improved Nigerian chickens raised in the South-south Region of Nigeria. *Journal of Bioscience and Agriculture Research*, *23*(2), 1931-1936.

Oleforuh-Okoleh, V. U., & Eze, J. (2016). Effect of storage period and method on internal egg quality traits of the Nigerian native chicken. *Livestock Research for Rural Development*, *28*, 115. Retrieved 7th October 2024 from http://www.lrrd.org/lrrd28/6/olef28115.html.

Oshibanjo, D. O., Sati, N. M, Emennaa, P. E., Okpanchi, U., Nwamo, A. C., Mbuka, J. J., Njam R. L., Mwadkon, P. B., Ejidare, D. A., Kaze, A. D., & Ene, P. N. (2021). Effect of storage duration and temperature on external and internal egg quality characteristics of fertile and non-fertile egg. *Nigerian Journal of Animal Production*, *48*(2), 63-74.

Rath, P. K., Mishra, P. K., Mallick, B. K., & Behura, N. C. (2015). Evaluation of different egg quality traits and interpretation of their mode of inheritance in White Leghorns. *Veterinary World*, *8*(4), 449-452.

Stojčić, M. D., & Perić, L. (2018). Influence of the storage period on the quality characteristics of table eggs. *Contemporary Agriculture*, 67(3-4) 202-206.

Taha, A. S., El-Tahawy, M. E., Abd El-Hack, A. A. Swelum, §., & Saadeldi, I. M. (2019). Impacts of various storage periods on egg quality, hatchability, post-hatching performance, and economic benefit analysis of two breeds of quail. *Poultry Science*, 98, 777-784.

Yahaya, B., Abdu, I., Adamu, J. L., & Khalid, S. A. (2023). Phenotypic correlation between egg quality traits of Nigerian unimproved (indigenous) and improved (Noiler) chicken genotypes. *Nigerian Journal of Animal Science and Technology*, 6(2), 57-70.

Yakubu, A, Bamidele, O., Hassan, W. A, Ajayi, F. O., Ogundu, U. E., Alabi, O., Sonaiya, E. B., & Adebambo, O. A. (2020). Farmers' choice of genotypes and trait preferences in tropically adapted chickens in five agro-ecological zones in Nigeria. *Tropical Animal Health and Production*, 52, 95-107.