EFFECTS OF STRAIN AND MANAGEMENT SYSTEM ON THE WELFARE PARAMETERS OF BROILER CHICKENS

***Onawo, C.J., Yakubu, A. and Musa, I.S.**
Department of Animal Science, Nasarawa State University, Shabu Campus, Nigeria.
**Corresponding author: onasotuhinshiya@gmail.com; +2348167466431*

ABSTRACT
This study was embarked upon to determine the effect of strain (Marshall and Abor Acres) and management system (without or with access to pasture) on welfare parameters of broiler chickens. A total of 204 randomly selected day-old chickens were allotted to four treatment groups, each replicated three times, with 17 birds per replicate in a factorial arrangement. The trial lasted 8 weeks. Data collected included tonic immobility, number of wing flaps and flapping duration, gait score, foot pad lesion and hock burns. The welfare parameters were subjected to analysis of variance to test the interaction effect of strain and management system. Strain and management interaction significantly (P<0.05) influenced welfare parameters such as tonic immobility, duration of wing flaps and hock burns in broiler chickens. On the average, Arbor Acres birds are better in welfare parameters compared to their Marshall counterparts.
Keywords: Strain, Management, Chicken, Welfare, Nigeria

INTRODUCTION

Poultry production plays a key role in delivering high-quality meat to global markets. Modern breeding plans and conventional raising systems have enabled mankind to produce broiler chickens with more than 2 kg body weight in 35 days (Chen *et al*., 2013). Strains and rearing systems in broiler chicken production are being affected by so many factors. Among these are stress factors which can be attributed to bird welfare, and the combined effect of temperature, humidity and radiation. Tonic immobility is a major welfare concern in agricultural animal production systems. Prolonged and excessive tonic immobile in animals can result in, injuries, behavioral inhibition, reduced ability to adapt to change, delayed maturation, decreased growth and reproduction, wasted of energy and even death (Gregory, 2018). The concern about using tonic immobility of fear testing for the purposes of comparing rearing systems is that different testing methods may measure different types or aspects of fear and with differing degrees of reliability. For laying hens, fearfulness is also a contributor to the development and persistence of severe feather pecking behavior which is a widespread welfare problem in commercial flocks. In Nigeria, there is dearth of information on genetics, management systems and welfare parameters. Therefore, this study was carried out to evaluate the effect of strain and management system interaction on welfare parameters of broiler chickens

MATERIALS AND METHODS

This experiment was carried out at the Teaching and Research Farm of the Faculty of Agriculture, Nasarawa State University, Keffi, Shabu – Lafia Campus. Lafia is located on latitude 080 35″ and longitude 08° 33″. It is geographically located in Guinea Savanna Zone of North Central Nigeria. A 2x2 factorial experiment in a completely randomized design (CRD) was adopted for the project. There were four treatment groups (S_1H_1, S_1H_2, S_2H_1 and S_2H_2): S_1H_1=marshal+ Housing without access to pasture, S_1H_2= marshal + Housing with access to pasture, S_2H_1= Amo Arbor Acre Plus + Housing without access to pasture, S_2H_2= Amo Arbor Acre Plus + Housing with access to pasture. Each treatment group was replicated three times. There were 17 birds per replicate. The birds were randomly allocated to the experimental pens (14.3 birds/m^2) in a completely randomized design based on their strain and housing condition. From day-old to 4 weeks of age, the birds were raised on starter ration (22.00% crude protein, 2,800 kcal/ kgME, 8.50% fat, 5.00% crude fiber, 1.20% calcium, and 0.45% phosphorus). From weeks 5 to 8, the birds were fed commercial broiler finisher ration, (20.00% crude protein, 2,900 kcal/kg ME, 8.60% fat, 5.40% crude fiber, 1.20% calcium, and 0.41% phosphorus) (Yakubu, 2010). Routine vaccination and other management practices were strictly adhered to.

Two fear tests were conducted on each bird, as described below. The tests were conducted in 3 days apart and were counter-balanced to eliminate potential carry-over effects such that half of the birds were first tested on the tonic immobility and inversion test while test order was reversed for the remaining birds. These tests were then repeated on the same birds 30 days after the first testing period (Archer, 2018). The gait score, foot pad lesions and hock burns were also assessed. The General Linear Model (GLM) Procedure of IBM SPSS (2020)

software was used to determine the effect of strain and management system as well as their interaction on tonic immobility, number of wing flaps and flapping duration.

RESULTS

The effect of strain and management interactive on the welfare parameters of broiler chickens is presented in Table 1. The interaction of the Arbor Acre strain with or without access to pasture exhibited significantly ($P<0.05$) lower tonic immobility and increased duration of flaps compared to the Marshal strain regardless of the management systems. Interestingly, Arbor Acres with access to pasture had significantly ($P<0.05$) lower hock burns than the same strain without access to pasture and was statistically ($P>0.05$) similar to the Marshal strain without access to pasture.

Table 1: Effect of strain and management system interaction on welfare parameters

Parameters	Without Access to Pasture		With Access to Pasture		P- value
	Marshal	Arbor acre	Marshal	Arbor acre	
Gait score	0.38±0.07	0.26±0.07	0.23±0.07	0.08±0.07	0.82
Tonic immobility	384.80±11.88[a]	264.64±11.88[b]	103.73±11.88[a]	43.11±11.88[b]	0.01
Number of flaps	12.03±0.77[a]	4.12±0.77[a]	14.99±0.77[a]	8.60±0.77[a]	0.32
Duration of flaps	5.50±0.55[b]	13.15±0.55[a]	5.96±0.55[b]	10.52±0.55[a]	0.01
Foot pad lesion	0.27±0.07[a]	0.96±0.07[a]	0.12±0.07[a]	0.86±0.07[a]	0.73
Hock burns	0.25±0.07[b]	0.65±0.07[a]	0.14±0.07[a]	1.01±0.07[b]	0.01

[ab] Means on the same row bearing different superscripts are significantly ($P<0.05$) different

DISCUSSION

The significantly lower values of gait score, tonic mobility, number of flaps, and food pad lesion in Arbor acre strain suggest that this strain is more likely to be hardy than Marshal strain irrespective of accessibility to pasture. Trocino *et al*. (2020) emphasized that genotype and sex interactions can affect broiler welfare under intensive rearing conditions. This suggests that strain selection is vital for optimal welfare. Different strains possess varying genetic predispositions that can influence their specific welfare outcomes. For instance, certain strains might be more susceptible to footpad dermatitis due to their genetic make-up. Additionally, the bone structure in different strains can influence the gait score of broilers (Talaty *et al*., 2010). The resulting lower cases of gait score, tonic immobility, and number of flaps in animals on pasture compared with those with access to pasture suggests the importance of pasture in livestock welfare systems. Management practices, especially those related to housing and environment, play a pivotal role in broiler welfare outcomes. Outdoor access can potentially influence the tonic immobility and foot pad lesions of broilers (Ventura *et al*., 2010). However, high stocking densities can lead to poorer walking ability and increased foot and hock burns (Sánchez-Casanova *et al*., 2020).

CONCLUSION

Strain and management interaction affected welfare parameters such as tonic mobility, duration of wing flaps and hock burns in broiler chickens, with better performance by Arbor Acres. It is therefore recommended that strain and management system of broiler chickens should be closely considered when making decisions for the improvement of their welfare.

REFERENCES

Archer, G.S. (2018). Sex, Genetics and Test Type Affect the Responses of Chickens to Fear Testing. *International Journal of Poultry Science,* 17: 320-326. **DOI:** 10.3923/ijps.2018.320.326

Chen, X., Jiang, W., Tan, H.Z., Xu, G.F and Zhang, X.B. (2013). Effects of outdoor access on growth performance, carcass composition and meat characteristics of broiler chickens. Poultry Science, 92: 435-443.

Gregory, A. S. (2018). Sex, Genetics and Test Type Affect the Responses of Chickens to Fear Testing. *International Journal of Poultry Science*, 17: 320-326.

IBM SPSS (2020). Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp, 2020.

Sánchez-Casanova, R., Sarmiento-Franco, L., Phillips, C. and Zulkifli, I. (2020). Do free-range systems have potential to improve broiler welfare in the tropics? *World's Poultry Science Journal*, 76: 34 - 48. https://doi.org/10.1080/00439339.2020.1707389.

Talaty, P., Katanbaf, M., and Hester, P. (2010). Bone mineralization in male commercial broilers and its relationship to gait score. Poultry Science, 89: 342-348. https://doi.org/10.3382/ps.2009-00382.

Trocino, A., White, P., Bordignon, F., Ferrante, V., Bertotto, D., Birolo, M., Pillan, G., *et al*. (2020). Effect of Feed Restriction on the Behaviour and Welfare of Broiler Chickens. *Animals*, 10(5); 830.

Ventura, B., Siewerdt, F., and Estevez, I. (2010). Effects of barrier perches and density on broiler leg health, fear, and performance. *Poultry Science*, 89: 1574-83. https://doi.org/10.3382/ps.2009-00576.

Yakubu, A., Ayoade, J. A., and Dahiru, Y. M. (2010). Effects of genotype and population density on growth performance, carcass characteristics, and cost-benefits of broiler chickens in north central Nigeria. *Tropical animal health and production*, *42*, 719-727.