EFFECT OF TWO HOUSING SYSTEMS (CAGES VS DEEP LITTERS) ON EXTERNAL AND INTERNAL EGG CHARACTERISTICS OF A COMMERCIAL LAYING BIRDS REARED IN DERIVED SAVANNA ZONE OF NIGERIA

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Abstract:

This study was carried out to investigate the effect of two housing systems on external and internal egg characteristics of a commercial laying bird. Two hundred and eighty pullet of Nera layers were divided into two even group kept in different housing systems (deep litter vs cage). External and internal egg quality traits were examined at 26, 30, 34 and 38wk. Data were then collected on egg weight, egg length, egg breadth, shell weight and shell thickness (external egg quality); yolk weight, yolk colour, yolk height, albumen weight, albumen height (internal egg quality). There were significant ($P < 0.05$) differences that exist between housing system and egg quality traits. Interaction between housing system and layer age was found in all the external egg traits to be better in deep litter system than caged eggs. Significantly higher value in deep litter than that of eggs from the cage birds for internal egg traits was observed only differed for yolk height that had higher value for yolk height in cage eggs. The result suggests that an appropriate housing system for a particular layer chickens should be considered to maximum egg quality traits.

Keywords: Nera birds, Egg quality traits, cage, deep litter, Derived savanna,

Introduction

Poultry breeding is generally acceptable to people all over the world and provides an excellent source of protein especially for poor rural communities, because it requires little capital, labour and land. Poultry birds are good converters of feed into usable protein in meat and egg (Abanikannda *et al*., 2007). In commercial egg laying farming enterprise, the success depends on the total number and size of egg produced. Commercial layer strains produce eggs for food and egg processing industries (Olawumi and Adeoti, 2009). Egg consumptions

on regular basis can effectively correct nutritional imbalance among vulnerable group's particularly nursing mothers and children (Olawumi *et al*., 2006).

The knowledge and information on the structure of egg and its various parameters are essential for an understanding of egg quality fertility embryo development and diseases of the poultry. Age, feed, protein levels and temperature are some of the factors that affect egg size in chickens (Banerjee, 1992). Economically important egg quality traits such as weight, size, yolk and albumen contents are quantitative traits with continuous variability (Das, 1994). The relationship between external traits, yolk and albumen had contributed to the egg weight increases with hen's age, reaching an apex by the end of the laying cycle (Danilov, 2000). Thus egg external qualities are one of the important phenotypic traits which influence egg quality and reproductive fitness of the chicken parent, (Islam and Dulta, 2010). It is real that beneficial egg quality traits are of immense importance to poultry breeding industries (Bain, 2005). In addition, embryonic development of hen's egg is dependent on traits like egg weight, yolk and albumen weights, genetic line and age of hen (Onagbesan *et al*., 2007) effects of feed (Shapira, 2010), hormone (Guzel *et al.*, 2009) and housing system (Williams, 1992) on egg composition and its faulty have been investigate.

Continuous selection for egg qualities traits led to highly performing laying hens, selected on the basis of their performance in a defined environment. The change in housing system which is imposed by poultry management on many strains of laying birds has created a new challenge for breeders (Ferante *et al*., 2009). Poultry production has a relevant role in Nigerian animal production due to its economic impact and to its ability to adapt to the market and consumers demands. In recent years, food safety and naturalness are becoming increasingly important consumer demands. This has resulted in the development of different production methods able to satisfy consumer requests regarding product quality, while also taking into consideration animal welfare and environment protection in the whole production chain, (Michel and Huonnic, 2003).

A number of studies have shown that rearing systems affect the egg qualities of hens in cage and deep litter systems. Jin and Craig (1994) reported that rearing conditions can affect growth, egg production and qualities in laying hens. Hens reared in cages produce heavier eggs and less fearful at the end of production cycle than floor reared hens (Anderson and Adams, 1994). However, Tauson *et al*., (1999) also reported that floor reared pullets are subjected to a drastic change in environment when housed in cage, the hypothesis considered was that adaptation problems can cause significant economic losses in terms and impair animal production. However, the aim of the study was to determine the effect of two housing

systems (cages vs deep litters) on external and internal egg characteristics of Nera layer birds in derived savanna zone of Nigeria.

MATERIALS AND METHODS

Site of the study

The study was carried out at the Poultry Unit of Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso. Ogbomoso is a derived savanna lies on longitude 4^0 15^1 East of Greenwich meridian and Latitude 8^0 15^1 North of the equator. The altitude is between 300 and 600m above sea level while the mean temperature and annual rainfall are 27^0 c and 1247mm respectively (Amao *et al*., 2010).

Experimental animals and management

Three hundred and twenty pullets of point of lay of a commercial strain (Nera Brown) were purchased at a reputable farm. On the farm at arrival, half of the birds were reared in standard battery rearing cages and the other half were reared in floor pens with litter. The management of both treatments (cage vs deep litter) was otherwise similar and birds were managed according to standard commercial practices. The birds were fed with commercially prepared feed in two phases: 18% of crude protein, 2864kcalMEkg grower diet till 18-20 weeks of age and 17% crude protein, 2892kcalMEkg layer diet from 20 weeks upward. The hens had *ad libitum* access to water and normal layer crumbled ration throughout the period of the experiment.

Data Collection

Weekly measurement were made on the various egg parameters that were randomly selected at end of each week on egg number, egg size, egg length, egg width, shell weight, shell thickness, egg shape index (external traits) and internal egg quality on egg mass, yolk weight, yolk height, albumen weight and albumen height in respect to cage and deep litters with the procedures described by Monira (2003).

Statistical Analysis

Data collected was subjected to analysis of variance using the general linear model of SAS (2003), with the below model;

$$Y_{ij} = \mu + H_i + e_{ij}$$

Where;

Y_{ij}= Measurement of individual birds for egg qualities

μ = Overall means

H_i= Effect of housing systems i^{th}(i = 1, 2)

e_{ij}= Random error

Results

The least square means of external egg quality traits as affected by housing types is presented in Table 1. There was significant (P <0.05) effect on the housing types and the external egg quality traits measured. Egg weight, egg length, egg breadth, shell weight and shell thickness shows superior or higher values of 59.51 ± 2.35, 6.00 ± 0.25, 3.59 ± 0.10, 7.36 ± 0.28 and 0.36 ± 0.01 respectively for deep litter housing type over its counterpart in cage housing system.

Table 2 shows the least square means of internal egg quality traits as affected by housing types. There was significant (P < 0.05) difference that exists between the internal egg quality variables and the housing types. Deep litter housing type reveals higher values for yolk weight (14.84 ± 1.26), yolk colour (2.14 ± 0.11), albumen weight (36.98 ± 3.45) and albumen height (8.76 ± 0.86) than cage housing type while yolk weight (1.40 ± 0.02) was higher in cage system than the deep litter.

Discussion

The observed overall result shows a significant effect on the egg quality trait and the housing system, which is consistent with findings reported by Leyendecker *et al*., (2001a). These authors pointed out that white and brown layer lines differed in their ability to perform in alternative housing systems. Egg weight in the deep litter system were higher than that of the cage system were similar with the work of Singh *et al*.,(2009) that eggs from hens on litter were heavier and this could have correlated with live weight and egg production. The results of this present study obtained that egg shell quality traits were more affected by housing system which is consistent with the work of Tumora *et al*., (2007). Egg shell thickness, shell weight, egg length and egg breadth that were reported to be favoured in deep litter housing were disagreed with the findings of Tumora *et al*., (2011) that reported no significant differences between these housing systems. The present results for eggshell thickness were in agreement with the finding reported by Van den Brand *et al*., (2004) who observed greater eggshell thickness and strength in eggs from deep litter layers. However,

Lichovnikova and Zeman (2008) reported higher egg shell strength in eggs from cages. Also Hidalgo *et al*., (2008) showed the effect of housing on egg shell thickness and strength. They stated that shell thickness was the lowest in eggs produced in cages while deep litter presented the highest values.

The internal egg quality traits in their present study were in line with the findings of Wang *et al*., (2009). The increase in yolk colour, yolk weight and yolk height that better in the deep litter housing system had been reported by Hussein *et al*., (1993) and Silversides and Scott (2001). These authors reported a clear defect of housing system on yolk traits, and a darker yolk colour in deep litter system is expected. However, it was reported that yolk trait was mainly determined by xanthophylls (Karunajeewa, 1978) because feedstuffs play an important role in the pigment deposition in yolk. Contradictory results were obtained in yolk colour reported by Tumowa *et al*., (2011) who obtained reports that favoured caged layer chickens.

The housing system affected albumen quality which was higher in deep litter housing were in agreement with previous studies of Williams, (1992) who reported that deep litter layer showed more variable albumen quality with layer age than the caged layers. However, Pavlouski *et al*., (1981) found that albumen quality of deep litter eggs was higher than cage eggs. Meanwhile, contradictory results was reported by Wang *et al*., (2009) who reported no difference was found in albumen quality between the two housing systems. The results documented for albumen quality were not also in agreement with the finding of Benton and Brake (2000) that obtained lower albumen quality in eggs from litter system and contributed their finding on the fact that eggs from a litter system are more exposed to ammonia from litter, which would reduce the albumen quality.

Conclusion

The results on egg quality traits in relations to the housing system reveals the egg weight, egg length, egg breadth, shell weight and shell thickness (external egg quality traits) and yolk weight, yolk colour, albumen weight and albumen height (internal egg quality traits) were better in deep litter system than the caged eggs. Thus this shows the ability Nera layer in both housing systems.

Recommendation

The results of this study have demonstrated that there exist differences in egg quality and the housing type. Therefore it is important to select an appropriate housing system for a particular strain of layer in order to produces eggs in with the highest quality variables.

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TABLE 1:Least square means of external egg quality traits as affected by housing types

		HOUSING TYPES	
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Parameters	**N**	**Deep litter**	**Cage system**
Egg weight (g)	125	59.51 ± 2.35[a]	56.35 ± 3.47[b]
Egg length (cm)	125	6.00 ± 0.25[a]	5.84 ± 0.29[b]
Egg breadth (cm)	125	3.59 ± 0.10[a]	3.25 ± 0.11[b]
Shell weight (g)	125	7.36 ± 0.28[a]	6.83 ± 0.21[b]
Shell thickness (mm)	125	0.36 ± 0.01[a]	0.28 ± 0.03[b]

[ab]Means along the same row having different superscripts are significantly (P <0.05) different.

N = Number of observation

TABLE 2:Least square means of internal egg quality traits as affected by housing types

		HOUSING TYPES	
Parameters	**N**	**Deep litter**	**Cage system**
Yolk weight (g)	125	14.84 ± 1.26[a]	14.36± 0.89[b]
Yolk colour	125	2.14 ± 0.11[a]	1.65± 0.01[b]
Yolk height (mm)	125	1.05 ± 0.10[b]	1.40± 0.02[a]
Albumen weight (g)	125	36.98 ± 3.45[a]	35.17± 4.88[b]
Albumen height (mm)	125	8.76 ± 0.86[a]	8.41± 0.39[b]

1.

2. [ab]Means along the same row having different superscripts are significantly ($P < 0.05$) different
3. N = Number of observation
4.