EFFECT OF AGE AND SEASON ON EGG QUALITY TRAITS OF ISA BROWN LAYER STRAIN REARED IN DERIVED SAVANNA ZONE OF NIGERIA.

Ojedapo, L.O.

Department of Animal Nutrition and Biotechnology, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State. Nigeria.

Abstract:

The study was carried out to determine the effect of age and season on the egg quality traits of Isa brown layer. A total of 100 point of laying birds of Isa brown was used for the study. Data was collected on Egg weight (EW), egg length (EL), egg breath (EB), shell thickness (ST), shell weight (SW), yolk weight (YW), yolk length (YL), yolk height (YH), albumen weight (AW), albumen height (AH) and yolk index (YI) were analysed for fixed effect of age and fixed effect of season. Significant ($P < 0.05$) differences were observed between the season and external quality traits of Isa brown layers at different ages. At considered age, early met season had higher values for Egg weight (52.53g vs 49.37g), (56.95g vs 48.10g), (62.00 vs 47.85g), (60.5lg vs 52.64g), (59.75g vs 49.97g), (60.07 vs 50.63g), (59.58 vs 51.32g), (58.67, vs 51.67g), (56.90g vs 51.90g), (60.25g vs 50.73), (60.25 vs 51.22), (63.18 vs 52.03) and shell weight values 68.43g, 4.88g, 7.57g, 6.92g, 7.23g, 7.32g, 7.63g, 7.07g, 7.55g, 7.53g, respectively for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 respectively than the late dry season. Internal assessment on egg quality traits reveals higher values of AH for late dry season of 8.22cm, 8.44cm and 8.71cm at age 10, 11 and 12 respectively while early wet season were higher for AH of 40.42cm, 39.65cm, 39.85cm, 39.48cm, 40.08cm, 40.40cm, 36.18cm, 38.83cm and 40.27cm for age 3, 4, 5, 6, 7, 8, 9, 10 and 12 respectively. YW values were favoured for early wet season of 12.52g, 13.98g, 13.86g, 13.28g, 12.92g, 12.65g and 12.60g at age 1, 3, 4, 5, 6, 7 and 8 respectively. Consequently, it was concluded from the various results obtained in this present study that Isa brown egg quality traits were better monitored during the early wet season which favoured the measured variables.

Keywords: Season, age, egg quality variables, Isa brown layers, derived savanna

Introduction

Production of eggs and its quality may also be influenced by many other factors such as breed, mortality rate, culling age and season (North and Bell, 1990). The effect of season differed significantly for the traits; egg shell weight, shell thickness and egg shell membrane, but not differed for egg weight. However, egg weight, egg shell weight, shell thickness and egg shell membrane were higher in wet season than the dry season (Islam *et al*., 2001). Egg external and internal qualities are of major importance to egg industry worldwide. These qualities traits of the eggs are significant in the poultry breeding for their influence on the yield features of the future generation, breeding performance and quality growth chicks (Altinel *et al*., 1996). Therefore, the internal and external characteristics of egg changes significantly with age, while egg shell quality deteriorates, egg weight, yolk weight and albumen weight increase as the age increase in chickens (Hurnik *et al*., 1997). Yannakopoulos and Tservenigousi (1986) reported that the egg weight and shell weight increased with age but egg shell thickness decreased in Japanese quail. It has also been that yolk proportion increased, where as albumen and egg shell proportion decreased (Fletcher *et al*., 1983).

During summer or hot season, laying birds are exposed to a number of stresses like growth decrease, reduced production and imbalance nutrition (Ahmed *et al*., 1993). However, management of heat stress during the dry season might requires a system of conductive cooling of the birds body either by sprinkling water and which have been reported useful and influences the quality of egg produce by layers during the hot season. The climatic conditions have also been known to affect the production of laying hens (Oluyemi and Roberts, 2000). In area of hot and humid climate, commercial hybrids produce an average of 180-200eggs per year while in more temperate climate; birds can produce between 250-300eggs per year (Smith and Leckeq, 1990). Egg quality obviously affects the reproductive fitness of the parent. Reduction in egg shell quality affect the depression of hatchability and weakening of the embryo were noted (Peebles and Brake, 1987). Egg quality is influenced by genetic and non-genetic factors such as season, environment and feed intake. Exotic strain produced improved egg weight as well as egg mass, albumen and yolk weight and height, shell thickness in wet season and old age in comparison with hot season and young age of the birds (Salahuddin and Howlider, 1991).

The Isa brown is a hybrid type of sex link chicken, which is the result of crossing Rhode Island Reds and White Leghorns. The Isa brown is a hybrid, not a true breed. It is known for its high egg production of approximately 300 eggs per hen in the first year of

laying (ISA, 2006). Egg weight is a parameter which can be determined without breaking the eggs (Wilson and Suarez, 1993). It is also an established fact that weight of an egg is a direct proportion of albumen, yolk and shell that it contains and this varies significantly between strains of hen (Pandey *et al.*, 1986). The relationship between weight, length and width of eggs has been reported by (Daviloo, 2000) who also noted the proportion of yolk, albumen and shell that contribute to the egg weight increase with the hen's age, reaching a plateau by the end of the laying cycle. Thus, egg weight is one of the important phenotypic traits which influence egg quality and reproduction fitness of the chicken parent's (Islam *et al*., 2001; Farooq *et al*., 2001). The aim of the study therefore was determine the effect of age and season on the egg quality traits of Isa brown layer in derived savanna area of Nigeria.

MATERIALS AND METHODS

Experimental site

The research was carried out at the Poultry unit of Teaching and Research Farm Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria. Ogbomoso is a derived savanna zone of Nigeria that that lies within the latitude 8^0 15^1 North and longitude 4 ^{0} 15^1 East. The area has an annual rainfall of 1247mm with altitude between 300 – 600 meter above the sea level while the mean annual temperature is about 27^0 C (Amao *et al*., 2011).

Experimental Animals and management

100 point of laying birds of Isa brown were purchased from reputable farm and reared in cages. The birds were fed with commercially prepared layer mash containing 16% crude protein with 2724kcal/kgME. The feed and water were given *ad-libitum* throughout the experimental period. The birds were 26weeks of age at the beginning of experiment. The Nigeria season has been divided into four by many animal breeders as; January – March as Late Dry season, April – June as Early Wet season, July – September as Late Wet season, October – December as Early Dry season (Adedeji *et al*., 2006).

DATA COLLECTION

The eggs were taken to the laboratory for analysis to determine the following egg quality traits; Egg weight, egg length, egg breath, shell thickness, shell weight, yolk weight, yolk length, yolk height, yolk index, albumen weight and albumen height. Egg quality traits were measured following standard procedure (Monira, 2003).

Statistical Analysis

Data collected were subjected to analysis of variance using the general linear model of SAS (2003), the following model.

$Y_{ijk} = \mu + A_i + S_j + (AS)_{ij} + e_{ijk}$

Where; Y_{ijk}= the individual measurement of the birds.

μ = the overall means

A_i = fixed effect of i^{th} age (26, 27, 28, 29, 30, 31, 32, 33,34, 35, 36, 37weeks are late dry season while 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 weeks are early wet)

S_j = fixed effect of j^{th} season (1, 2)

$(AS)_{ij}$= Interactive effect of i^{th} age and j^{th} season

e_{ijk} = Random error

Results

Table 1 shows the influence of late dry and early wet season on the external quality trait of Isa brown layer at 1, 2, 3, 4, 5 and 6 weeks of age. There were significant ($p < 0.05$) different between late dry and early wet season on the external quality trait of Isa brown layer at 1, 2, 3, 4, 5 and 6 weeks of age. The significant difference were only exist in egg weight and shell weight where early wet was higher than the late dry season but there was no significant ($p > 0.05$) differences in egg length, egg breath and shell thickness.

Table 2 shows the influence of late dry and early wet season on the internal quality trait of Isa brown layer at 1, 2 ,3, 4, 5 and 6 weeks of age. The season at different age were found to be significantly ($p<0.05$) differed on the albumen height, albumen weight, yolk weight and yolk height where early wet is higher than late dry and the reverse was found in age 2 and 3. While significant different was only observed for yolk length at age 2.

The effect of late dry and early wet season on the external quality trait of Isa brown layer at 7, 8, 9, 10, 11 and 12 weeks of age shown in table 3. There were significant ($p<0.05$) differences between late dry and early wet season on the external quality trait of Isa brown layers at 7, 8, 9, 10, 11 and 12 weeks of age. The significant difference exist in egg weight and shell weight where early wet was higher than the late dry season and also significant different was observed only in 10week age for both the egg length and egg breath.

The effect of late dry and early wet season on the internal quality trait of Isa brown layer at 7, 8, 9, 10, 11 and 12 weeks of age shown table 4. There were significant ($p<0.05$) differences between late dry and early wet season on the external quality trait of Isa brown

layer at 7, 8, 9, 10, 11 and 12 weeks of age. The significant differences were observed in albumen height and yolk weight where late dry was higher than early wet for considered age and also significant in albumen weight where early wet is higher than the late dry.

Discussions

The season and age in the related studies on egg characteristics in this present study were earlier reported by Adedeji *et al*., (2006) who reported a significant influence of season on internal and external quality traits for pure and cross breeding chicken progeny. Thus, the results reported in this present study regarding the external quality trait were in lines with the findings of Abdel Galil *et al*., (2004) and Enaint *et al*., (2009). These authors reveal similar result on egg weight and shell weight which were the same for this presents study.

The age related studies on egg weight in this study were also similar to the finding of Suk and Park (2001) who reported egg similar result for Isa brown and Korean native chicken. The results shows the affected by the environmental factors, season along with evidence of genetic involvement which including breeding breed effect were reported earlier by Shaler and Pasternak (1993). While other parameters of external egg quality such as egg length, egg breath and shell thickness decreased as the hen age increased. In support of this result, different authors mentioned that shell thickness and shell percentage decreased through advanced flock age. Brake *et al*., (1997) reported that eggs from early production breed flock tended to have thicker egg shells and it affect other egg quality traits. Bare and Striem (1998) and Suk and Park (2001) also observed that egg shell thickness decreased during the second production cycle than in the first. The egg shell weight at early age was lower than older age, indicating that egg shell of the pullets was lighter than egg shell of spent layers. Suk and Park (2001) also observed that the egg shell was heavier in older birds. A number of studies have shown that egg shell weight increases as the birds grow older. So, the reason for heavier egg shells of old age might be the production of heavier eggs by the birds than those been produce during the early age.

Information regards to the influence of early wet and late dry season on the internal quality trait of Isa brown at various age. As hen age increased, albumen weights, albumen height and yolk weight percentage were significantly increased compared to those from eggs produced during the younger age. O'Sullivan *et al*., (1991) reported that yolk and albumen weights percentage increased as the hen age increased. The albumen of the late dry season and young age's egg was lighter than the eggs of early wet season and older ages. Similarly, Izat *et al.* (1985) and Suk and Park (2001) observed that the albumen weight increased with

the increase in age of birds. More albumen weight of the eggs produced by the early wet season and older ages in this study may be attributed to their heavier eggs produced with the advancement of age. Eggs produced by late dry season and young age have had a lighter yolks than those of early wet season and older age layers. Suk and Park (2001) also found that the yolk weight increased with increase in age of the birds. Applegate *et al.,* (1999) observed that the eggs of older hens contained proportionately more yolk. The results also depicted that weight of the eggs greatly influenced the yolk weight. A probable explanation for more yolk weight in early wet season and older age's layers might be heavier eggs produced by the birds during the aged production cycle. Rossi and Pompei (1995), Suk and Park (2001), Van den Brand *et al*., (2004), Ojedapo *et al*., (2008) confirmed that the yolk weight and yolk percentage increased with the hens' age, which is in agreement with this present study.

Moreover, highly significant interactions were also seen in all albumen quality characteristics: as egg weight increased with the age of hens, so did the albumen weight, which is in agreement with Rossi and Pompei (1995); Suk and Park (2001).

Conclusion

It was found that the age has a significant effect on the egg quality traits and weight in various season of the year, specifically late dry and early wet season. It was revealed that egg weight, shell weight, yolk weight, albumen weight, yolk index increased with age at the experimental season while shell thickness and other parameters measured decreased with age. It would be concluded that keeping Isa brown at increased age and at early wet season of the year favoured the birds with increase in the quality trait of the eggs.

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Table 1: Influence of late dry and early wet season on external egg quality traits of Isa brown layers at different ages.

Age	Season	EW	EL	EB	SW	ST
1	Late dry	49.37±0.87[b]	5.29±0.02	4.13±0.01	5.97±0.10[b]	0.17±0.00
	Early wet	52.53±0.22[a]	5.70±0.04	4.54±0.00	8.43±0.07[a]	0.32±0.00
2	Late dry	48.10±0.39[b]	5.00±0.07	4.73±0.13	4.21±0.34[b]	1.92±0.35[b]
	Early wet	56.95±0.52[a]	5.34±0.08	4.99±0.13	4.88±0.38[a]	2.10±0.43[a]
3	Late dry	47.85±0.26[b]	5.35±0.02	4.11±0.00	5.82±0.81[b]	0.16±0.00
	Early wet	62.00±0.65[a]	5.77±0.01	4.54±0.02	7.57±0.09[a]	0.22±0.00
4	Late dry	52.64±0.47[b]	5.35±0.19	4.22±0.01	6.04±0.10[b]	0.21±0.01
	Early wet	60.51±0.81[a]	5.55±0.02	4.39±0.02	6.92±0.11[a]	0.21±0.00
5	Late dry	49.97±0.28[b]	5.36±0.02	4.18±0.01	6.12±0.09[b]	0.16±0.00
	Early wet	59.75±0.76[a]	5.57±0.03	4.45±0.02	7.23±0.09[a]	0.21±0.00
6	Late dry	50.63±0.27[b]	5.37±0.23	4.24±0.01	5.85±0.10[b]	0.16±0.00
	Early wet	60.07±0.71[a]	4.85±0.74	4.99±0.08	7.32±0.09[a]	0.21±0.00

[ab]Means along the same column with different superscripts at each season are significantly different ($p<0.05$).

EW= Egg weight (g), EL= Egg length (mm), EB= Egg breath (mm), SW= Shell weight (g), ST= Shell thickness (mm)

Table 2: Influence of late dry and early wet season on internal egg quality traits of Isa brown layers at different ages.

Age	Season	AH	AW	YW	YL	YH	YI
1	Late dry	16.53±0.16[b]	32.72±0.39[a]	10.52±0.05[b]	3.84±0.03	1.60±0.03	0.39±0.01[b]
	Early wet	19.13±1.85[a]	30.95±1.35[b]	12.52±0.81[a]	3.35±0.14	1.42±0.09	3.38±0.51[a]
2	Late dry	18.17±1.61[a]	31.79±1.28	7.72±0.51	2.69±0.13[b]	4.06±0.08[b]	1.46±0.28[a]
	Early wet	14.98±1.74[b]	31.91±1.56	7.19±0.12	3.10±0.12[a]	9.57±0.73[a]	0.44±0.00[b]
3	Late	6.17±0.11	30.02±0.49[b]	10.33±0.61[b]	3.60±0.02	5.53±0.59[a]	0.44±0.00

	dry						
	Early wet	6.78±0.17	40.42±0.56 [a]	13.98±0.14 [a]	3.63±0.02	3.62±0.02 [b]	0.46±0.00
4	Late dry	6.57±0.11[b]	35.71±1.49 [b]	11.61±0.16 [b]	3.61±0.01	1.59±0.01	0.43±0.01
	Early wet	7.28±0.13[a]	39.65±0.74 [a]	13.86±0.14 [a]	3.62±0.02	1.70±0.01	0.46±0.00
5	Late dry	6.95±0.11	32.18±0.28 [b]	11.83±0.09 [b]	3.58±0.01	1.63±0.01	0.45±0.00
	Early wet	6.72±0.11	39.85±0.73 [a]	13.28±0.14 [a]	3.62±0.01	1.61±0.01	0.44±0.02
6	Late dry	6.46±0.13	32.87±0.21 [b]	11.28±0.09 [b]	3.60±0.01	1.61±0.01	0.44±0.00
	Early wet	6.26±0.11	39.48±0.64 [a]	12.92±0.13 [a]	3.61±0.01	1.61±0.01	0.44±0.00

[ab]Means along the same column with different superscripts at each season are significantly different ($p<0.05$).

AH= albumen height (cm), AW= albumen weight (g), YW= yolk weight (g), YL= yolk length (cm), YH= yolk height (cm), YI= yolk index.

Table 3: Effect of late dry and early wet season on external egg quality traits of Isa brown layers at different ages.

Age	Season	EW	EL	EB	SW	ST
7	Late dry	51.32±0.32[b]	5.41±0.02	4.21±0.01	6.33±0.09 [b]	0.21±0.00
	Early wet	59.58±0.84[a]	5.57±0.03	4.38±0.02	7.63±0.08 [a]	0.21±0.00
8	Late dry	51.67±0.26[b]	5.43±0.02	4.21±0.01	6.58±0.06 [b]	0.20±0.00
	Early wet	58.67±0.89[a]	5.46±0.03	4.41±0.02	7.07±0.01 [a]	0.22±0.00
9	Late dry	51.90±0.28[b]	5.43±0.02	4.21±0.04	6.50±0.06 [b]	0.22±0.00
	Early wet	56.90±0.54[a]	5.51±0.02	4.33±0.02	7.55±0.13 [a]	0.51±0.29
10	Late dry	50.73±0.28[b]	4.88±0.08 [b]	5.00±0.09 [a]	6.53±0.06 [b]	0.23±0.00
	Early wet	60.25±0.49[a]	5.65±0.02 [a]	4.40±0.01 [b]	7.53±0.07 [a]	0.23±0.00
11	Late dry	51.22±0.24[b]	5.70±0.00	4.55±0.02	7.50±0.07 [b]	0.28±0.00

	Early wet	60.25±0.49[a]	5.51±0.02	4.44±0.02	7.42±0.12 [a]	0.23±0.00
12	Late dry	52.03±0.19[b]	5.71±0.00	4.53±0.00	8.00±0.00 [a]	0.30±0.00
	Early wet	63.18±0.59[a]	5.71±0.01	4.49±0.02	7.75±0.09 [b]	0.24±0.00

[ab]Means along the same column with different superscripts at each season are significantly different ($p<0.05$).

EW= Egg weight (g), EL= Egg length (mm), EB= Egg breath (mm), SW= Shell weight (g), ST= Shell thickness (mm).

Table 4: Effect of late dry and early wet season on internal egg quality traits of Isa brown layers at different ages.

Age	Season	AH	AW	YW	YL	YH	YI
7	Late dry	6.27±0.12	32.82±0.19 [b]	11.87±0.14 [b]	3.59±0.01	1.59±0.01	0.44±0.00
	Early wet	6.43±0.13	40.08±0.78 [a]	12.65±0.09 [a]	3.30±0.09	1.61±0.01	0.44±0.00
8	Late dry	6.14±0.11	33.08±0.17 [b]	11.90±0.10 [b]	3.30±0.09 [a]	1.42±0.05	0.44±0.00
	Early wet	6.24±0.14	40.40±0.79 [a]	12.60±0.11 [a]	2.91±0.13 [b]	1.20±0.08	0.45±0.00
9	Late dry	6.24±0.13	32.03±0.29 [b]	12.43±0.11	3.63±0.01	1.62±0.01	0.46±0.00
	Early wet	6.20±0.09	36.18±0.43 [a]	12.57±0.12	3.73±0.01	1.72±0.01	0.45±0.00
10	Late dry	8.22±0.04 [a]	35.553±0.24[b]	14.03±0.11 [a]	3.72±0.02	1.73±0.02	0.46±0.00
	Early wet	7.00±0.09 [b]	38.83±0.46 [a]	13.03±0.09 [b]	3.71±0.01	1.69±0.01	0.45±0.00
11	Late dry	8.44±0.03 [a]	38.55±0.07	15.35±0.17 [a]	3.95±0.01	1.84±0.01	0.50±0.00
	Early wet	6.72±0.12 [b]	38.92±0.58	13.38±0.15 [b]	3.66±0.02	1.72±0.01	0.46±0.00
12	Late dry	8.71±0.00 [a]	38.88±0.10 [b]	16.17±0.11 [a]	3.94±0.02	1.79±0.02	0.51±0.00

Early wet	7.40±0.14 [b]	40.27±0.43 [a]	14.42±0.23 [b]	3.81±0.02	1.78±0.02	0.46±0.00

[ab]Means along the same column with different superscripts at each season are significantly different ($p<0.05$).

AH= albumen height (cm), AW= albumen weight (g), YW= yolk weight (g), YL= yolk length (cm), YH= yolk height (cm), YI= yolk index.