Egg quality of Muscovy ducks reared under different management systems in the humid tropics

Calidad de los huevos de los patos Muscovy criados bajo diferentes sistemas de manejo en los trópicos húmedos

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ABSTRACT

External and internal qualities of Muscovy duck eggs were examined in three management systems; semi intensive (SI), intensive system with wallow (IW) and intensive system without wallow (IO) in the humid tropical region using a completely randomized design. Twenty ducks were used per treatment with two replicates of 10 ducks each to give sixty ducks, all raised in deep litter. Feeding was uniform from duck starter mash, duck grower mash and duck layer mash given on restricted regime (twice daily) basis for ducks in SI treatment or *ad libitum* for those on IW and IO. Average egg weight were higher (76.35g and 76.27g) in intensive systems than in semi intensive system (70.80g). Egg volume, specific gravity and shape indices were also higher in intensive system than in semi intensive. Albumen height, length, width, and index; yolk height and diameter, as well as albumen-yolk ratio were higher in IO than SI too. However, there were no significant differences ($p>0.05$) in management system with respect to egg length, width, shell thickness, shell weight and shell percentages, yolk index and Haugh unit of Muscovy duck eggs produced in different rearing systems. Feeding ducks *ad libitum* in intensive management system tends to encourage better egg quality than restricted feeding on semi intensive system.

Key words: Egg quality, Muscovy ducks, management systems.

RESUMEN

Las cualidades externas e internas de los huevos de patos Muscovy se examinaron en tres sistemas de manejo; semi-intensivo (SSI), sistema intensivo con revolcarse (SICR) y el sistema intensivo sin revolcarse (SISR) en la región tropical húmeda utilizando un diseño completamente al azar. Se utilizaron 20 patos por tratamiento con dos repeticiones de 10 patos cada una para dar 60 patos, todos criados en hojarasca profunda. La alimentación fue uniforme desde una mezcla de inicio para patos, mezcla de crecimiento para patos y mezcla de capas para pato en base a un régimen restringido (dos veces al día) para los patos en el tratamiento SSI o *ad libitum* para aquellos en SICR y SISR. El peso promedio del huevo fue mayor (76,35 y 76,27 g) en los sistemas intensivos que en el sistema SSI (70,80 g). El volumen del huevo, la gravedad específica y los índices de forma también fueron mayores en el sistema intensivo que en el SSI. La altura, longitud, ancho e índice de la albúmina, la altura y el diámetro de la yema, así como la relación albúmina:yema siguieron la misma tendencia. Sin embargo, estos no fueron significativamente diferentes ($P > 0,05$) en el sistema de manejo con respecto a la longitud y ancho del huevo, grosor de la cáscara, peso de la cáscara y porcentaje de cáscara. Similarmente, no hubo efecto significativo de los sistemas de manejo ($P > 0,05$) en el índice de la yema y la unidad Haugh de los huevos de patos Muscovy.

Palabras clave: Calidad del huevo, patos Muscovy, sistemas de manejo.

INTRODUCTION

Ducks produce eggs of larger sizes and more nutrients than chicken, containing higher proportions of protein and dry matter comparatively (Bird, 1986). Egg quality can also be rated in terms of interior and exterior characteristics in addition to nutrients derivable from eggs. For instance, the thickness of egg shell indicates if the egg would easily break. The traditional Japanese customers prefer eating their eggs very fresh thus Haugh unit value is measured at each stage of the distribution route (Egg Tester, 2005). Duck eggs weigh about 64g (Ola, 2000); 63g-85g (Harun *et al*, 2001) or between 65g-100g (Nickolova, 2004).

Earlier study (Etuk, 2006) revealed that smallest duck egg weighed 68.87g while the heaviest

was 74.67g in the semi intensive management system, while eggs from intensive management systems, weighed up to 78.65g. Specific gravity of egg, a function of egg weight and volume, is another parameter of importance. External parameters like egg length, breath, shape as well as interior egg parameters including albumen and yolk measures are also of great importance in determining hatchability and for consumption purpose (Etuk, 2006).

This study, therefore, aimed at determining the internal and external egg quality of Muscovy ducks raised under intensive management system with or without wallow, and semi intensive management system in the humid tropics.

MATERIALS AND METHODS

The study was carried out at College Farm, Akwa Ibom College of Agriculture, Nigeria, where average temperature ranged between 18 – 27^0C on minimum and 24-26 ºC maximum and relative humidity range between 55 – 86%. Annual rainfall in the region is between 1770 – 2400mm. One hundred and fifty ducklings aged 1-7 days were collected from local farmers and brooded under intensive management system for four weeks. They were fed with duck starter mash containing 19.5% crude protein, 5.35% crude fiber and 2,881.18 Kcal/kg metabolizable energy for eight weeks. After the eighth week, 60 females were selected and randomly assigned to three treatments in a completely randomized design. The treatments were semi intensive management system (SI), intensive system with wallow (IW) and intensive system without wallow (IO). Each treatment had two replicates and each replicate contained 10 ducks. Duck grower mash containing 6.11% crude fiber, 16% crude protein and 2,607.98 Kcal/ kg metabolizable energy was fed from week 9 until the first eggs were picked (at about 30-32 weeks of age), before duck layer mash (Table 1) was introduced thereafter. Ducks in the intensive management systems (IO and IW) were fed *ad libitum*, while same quantity of feed for each treatment was given to ducks in semi intensive management system on twice- daily regime. In addition, ducks in semi intensive management were allowed access to limited range behind the pen where they fed on forages.

Nest boxes were provided in all replicate pens, and egg collection was done three times daily. Eggs were selected from three clutches for quality analysis and averages of the three clutches were used for all computations. Egg quality parameters were measured in all cases within 48 hours of collection. The interior parameters considered were egg weight, egg length and width, albumen height, length and width, yolk height and diameter. Albumen index (AI) was computed using the method of Kul and Seker (2004) as follows:

$$AI\ (\%) = \frac{\text{Albumen height}}{\frac{\text{Albumen length+Albumen width}}{2}} \times 100$$

Haugh unit was calculated by the method of Haugh (1937) as follows:

$$\text{Haugh unit (HU)} = 100 \log (H + 7.57 - 1.7\ W^{0.37})$$

Where H = albumen height and W = weight of egg.

Table 1. Composition of complete diet for reproductive Muscovy ducks.

Composition	Percentage
Maize	22.00
Soya bean meal	13.00
Wheat offal	12.00
Palm kernel cake	16.00
Brewer dried grain	21.00
Fish-meal	9.00
Oyster shell	5.00
Bone meal	1.32
Salt	0.25
DL-methionine	0.08
Lysine	0.10
Vitamin/Mineral premix	0.25
Total	100.00
Chemical composition (% dry matter)	
Crude protein	16.00
Crude fiber	8.98
Ether extracts	4.80
Calcium	2.98
Phosphorus	0.42
ME (Kcal/kg)	2713.44
Dry Matter (DM)	82.46

* Each 2.5kg contains: Vit.A, 10,000,000 IU; Vit.D3, 2,000,000 IU; Vit. E, 10,000 IU. K, 2,000mg; Thiamine (B1), 1,500mg; Riboflavin (B2), 4,000 mg; Pyridoxine (B6) 1,500 mg; Niacin, 15,000mg; Vit. B12, 10mg; Pantothenic Acid, 5,000 mg; Folic Acid, 500 mg; Biotin 20mg; Antioxidant, 125g; Manganese, 800g; Zinc, 50g; Iron,20g Copper, 5g;1.2g; Selenium, 200mg; Cobalt, 200mg

Ten eggs were sampled from each replicate and 3 samplings were carried out during three clutches. Averages of the three samplings in all replicates/treatments were obtained for data analysis. Means of data obtained were analyzed with one-way analysis of variance, ANOVA (Steel and Torrie, 1980) and significantly different means were separated using least significant difference, LSD (Obi, 1990).

RESULTS AND DISCUSSION

Weight of Muscovy eggs obtained in all treatment groups were within the range reported earlier (Etuk *et al*, 2006). Duck eggs from intensive management systems (IW and IO) were significantly, heavier ($p<0.05$) than those from semi intensive management system. There was no significant difference ($p>0.05$) in the specific gravity of eggs raised under the intensive systems (IW and IO). However, eggs from IW and IO showed significant ($p<0.05$) advantage in specific gravity over those from SI. Egg length in the three treatment groups did not differ significantly ($p>0.05$), indicating that hatchability of such eggs will be less affected by the management system. It has been reported that egg length is a major prediction variable for hatchability due to its influence on egg shape index (Harun *et al*, 2001). Egg width in the three treatment groups showed no significant difference ($p>0.05$), though ducks in SI and IW recorded higher values. Moreover, Bauer (1983) reported that eggs weighing about 72g would readily hatch if the diameter were more than 45mm. Shape index of eggs from SI was 0.76mm, which was significantly ($p<0.05$) higher than the 0.74mm recorded for ducks in IW and IO (Table 2).

Mean shell thickness, shell weight and shell percentage of eggs were not considerably different among eggs in the three treatment groups. No significant difference ($p>0.05$) were observed in these parameters that could be attributed to management systems adopted in the experiment. It is possible that the feed quality, which was uniform, was adequately utilized. According to Hasnath (2002) balance diet and proper utilization of feed improved egg shell which successfully prevented excessive breakage.

Data on interior egg quality of Muscovy ducks in the three management systems are presented in Table 3. Average albumen heights were 0.435mm (SI), 0.651mm (IW) and 0.64mm (IO). There was no significant difference ($p>0.05$) between IW and IO, but both groups recorded significantly ($p<0.05$) higher albumen indices than eggs from SI. Yolk height in IW and IO were significantly ($p<0.05$) higher than those eggs under SI. The yolk diameter of IW and IO were 4.85mm and 4.72mm, respectively, which did not differ from each other. Similarly, there were no significant differences ($p>0.05$) between the three groups in respect of Haugh unit. Haugh unit was on average about 70 which is a good indicator for freshness of eggs (Haugh, 1937).

CONCLUSION

Intensive system with *ad libitum* feeding produced better egg qualities than semi intensive system with restricted feeding regime. In contrast, wallowing by ducks did not bring additional quality improvement in intensive system compared with ducks that did not have access to wallow.

Table 2. External egg parameters of Muscovy ducks raised under three different management systems in Nigeria.

Parameters	SI	IW	IO
Egg weight (g)	$70.80^{b} \pm 0.35$	$76.27^{a} \pm 0.49$	$76.35^{a} \pm 0.34$
Egg volume (cm^3)	$59.81^{b} \pm 0.20$	$63.13^{a} \pm 0.21$	$62.84^{a} \pm 0.21$
Specific gravity(g/cm^3)	$1.19^{b} \pm 0.004$	$1.21^{a} \pm 0.005$	$1.22^{a} \pm 0.002$
Egg length (mm)	60.56 ± 0.44	61.10 ± 0.40	60.89 ± 0.41
Egg width (mm)	46.15 ± 0.26	46.15 ± 0.26	44.89 ± 0.20
Shape index (mm)	$0.76^{a} \pm 0.006$	$0.74^{b} \pm 0.006$	$0.74^{b} \pm 0.005$
Shell thick-ness (mm)	0.417 ± 0.002	0.419 ± 0.002	0.420 ± 0.002
Shell weight (g)	7.01 ± 0.04	7.02 ± 0.03	7.06 ± 0.03
Shell percentage (%)	$9.90^{a} \pm 0.06$	$9.21^{b} \pm 0.06$	$9.30^{b} \pm 0.06$

[ab] Mean values in rows marked with different letters differ significantly at $p < 0.05$

SI - Semi intensive management system, IW - Intensive system with wallow, IO - Intensive system without wallow

Table 3. Interior egg parameters of Muscovy ducks reared under different management systems in Nigeria.

Parameters	SI	IW	IO
Albumen height (mm)	0.435 [b] ± 0.10	0.651 [a] ± 0.17	0.646 [a] ± 0.013
Albumen length (mm)	8.95 [b] ± 0.07	9.76 [a] ± 0.12	10.01 [a] ± 0.10
Albumen width (mm)	6.92 [b] ± 0.22	7.64 [a] ± 0.11	7.87 [a] ± 0.10
Albumen index (%)	5.47 [b] ± 0.11	7.44 [a] ± 0.20	7.33 [a] ± 0.17
Yolk height (mm)	1.88 [b] ± 0.01	1.92 [a] ± 0.01	1.96 [a] ± 0.01
Yolk diameter (mm)	4.54 [b] ± 0.023	4.72 [a] ± 0.032	4.85 [a] ± 0.024
Yolk index (%)	41.40 ± 0.04	40.70 ± 0.04	40.60 ± 0.04
Albumen yolk ratio	0.133 [b] ± 0.003	0.185 [a] ± 0.005	0.181 [a] ± 0.004
Haugh Unit	69.97 ± 3.61	70.74 ± 1.73	70.70 ± 1.84

[ab] Mean values in rows marked with different letters differ significantly at $p < 0.05$

SI - Semi intensive management system, IW - Intensive system with wallow, IO - Intensive system without wallow

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