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Research Article

Assessment of Egg Quality of the Nigerian Local Pigeon (Columba Livia Domestica) in Gombe, Nigeria

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Abstract

The research was conducted to assess the egg quality of the Nigerian indigenous pigeons in three agro- ecological zone of Gombe state, namely; Gombe Central, South and North. 90 fresh eggs were randomly collected from these zones comprising of 30 eggs per zone to assess the external and internal egg quality of the domestic pigeon. Data were collected on egg weight, Egg length Egg width, Egg shell weight, Shell thickness and the Internal egg characteristics were albumen height, yolk height, albumen weight, yolk weight and Haugh unit. Results indicated that egg weight value were 14.052 ± 0.173, 14.385 ± 0.229 and 13.758 ± 0.99g in Gombe Central, South and Gombe North. The mean average of egg weight in the study area was 14.273 ± 0.1045g. However, egg weight was significantly (P<0.05) affected by location. Gombe South seems to have a heavier egg weight compared to Central and Gombe North. Albumen height value was 5.6100 ± 0.0044, 5.6933 ± 0.032, and 5.4333 ± 0.063mm in Gombe Central, South and Gombe North. The mean average of the albumen height in the study area was 5.6401 ± 0.03082mm. There was a significant difference (P<0.001) in albumen height across location. Yolk height value were 12.880 ± 0.12048, 13.206 ± 0.0475, 12.753 ± 0.12127g in Gombe Central, South and North, respectively. Overall yolk height was 13.0696 ± 0.06187mm, which was highly significant at (P<0.001) for location. Haugh unit values were 93.897 ± 0.02318, 94.120 ± 0.2493 and 93.158 ± 0.3237 in Gombe Central, South and North, respectively. However, there was a significant difference (P <0.01) in Haugh unit for location effect. Most correlation values were significant at 1%. However, a few were correlated at 5%. Egg weight is correlated with egg length (0.499; P<0.01), shell weight (0.28; P<0.01) and Haugh unit (-0.278; P<0.05). Albumen height was correlated with yolk length (0.23; P<0.05) and Haugh unit (0.0928; P<0.01). Conclusively, the high egg qualities are indication of good reproductive performance in the pigeons. Since most correlated responses were positive, selection for a particular egg characteristic could lead to positive responses in others and such correlated responses could be used to hasten selection processes to improve the pigeons.

Introduction

The pigeon is one of the valuable species of poultry, reared conventionally by the poor farmers in rural areas for maintaining their livelihood. It is also reared by the people in urban areas as a symbol of recreation. The contribution of pigeons has not yet been considered in relation to the contribution of livestock sub-sector and whole poultry production, though the pigeons provide an alternative source of animal protein [1]. Nowadays, Pigeon rearing has become very popular. Pigeon meat is very lean, having high nutritional value, easily digestible, low fat content and rich in proteins, minerals and vitamins [2].

Pigeon belong to members of the large family Columbidae, land birds, characterized by stout bodies, short necks, small heads, and thick, heavy plumage [3]. Pigeons are incredibly complex and intelligent animals. They are ubiquitous birds and can be found in virtually every town and city around the globe [4]. They are highly dependent on humans to provide them with food and sites for roosting, loafing, and nesting. They live side by side with human as a source of food, hobby and experimental purposes [5]. Although pigeons are one of the most intelligent of all the bird species man has found limited uses for the birds other than for the purposes of sport, food and as a message carrier.

Pigeons are mainly monogamous birds [6]. Courtship display of pigeon is usually performed by the male, and shown by the fluffing of the breast feathers, dragging of the tail, cooing, and treading of the feet on the floor. If the female is receptive she will nod her head, after which billing follows. The male presents an open beak into which the female inserts hers. There is evidence that the male regurgitates into the beak of the female. Subsequently the female will crouch, elevate her wings and receive the male, and the pair-bond is formed [3]. Columba livia domestica are typical altricial birds. Both parents care for the young and produce crop milk to feed them [7]. There are numerous breeds of domestic pigeons that differ in size, shape, structure, color and beak length. The Nigerian pigeons are short-beaked and are highly valued, but they are also considered difficult to breed due to problems with feeding the newly-hatched squabs.

Poultry eggs, as the whole nutrition reservoir for embryo development, have long been recognized as one of the major nutrient sources for humans [8]. Undergoing the divergent evolution processes, eggs from different poultry species formed their unique properties from egg size to nutritional composition [9]. Egg albumen as the major part of egg (taking up about 60%), consists of water (88%), proteins (11%), minerals, and carbohydrates (1%). The existence of various proteins in egg albumen gave it the characters of foaming, emulsifying, and gelling [10].

However, the information on egg characteristics has been limited mostly to chicken eggs. Other usual poultry species, such as duck, goose, turkey, quail, and pigeon should also be paid attention to their egg properties, which would be helpful in technological and functional application of egg from different poultry origins. This study assesses the egg qualities of

the Nigerian indigenous pigeon for external and internal attributes and correlates the various attributes for pigeon's egg improvement.

Materials and Methods

Location of the study area

The study was conducted in Gombe. Gombe state is located in the Sudan Savannah zone in the North Eastern part of the country. It falls on longitude 11°10'E and latitude 10°17'N. It has annual rainfall of between 850-1500 mm that falls between mid - May and terminating in October. The annual maximum temperature is 41°C obtained mostly in April and minimum annual temperature of 13°C obtained mostly in January (Mohammed, 2011). The state covers a total area of about 20,265 sq. km. The approximate altitude of Gombe ranges from 400-500m above mean sea level.

Climate and vegetation of the study area

The climate is described as tropical continental climate. The temperature is high all year round with a mean annual temperature of 30°C. The highest temperature is recorded during the dry hot months of March, April and May with maximum temperature above 37°C. During the rainy season, the temperature drops considerably due to the cloud cover between July and August as well as during the Harmattan periods of November to February. The area records about three to four months of rainfall and is concentrated in the months of July, August and September with the average annual rainfall of 951mm per annum. The soil is very fertile, sandy loam of varying colours from dark, brownish, grey and red. The vegetation cover of Gombe comprises of sparsely-dense trees with shrubs and sparse grasses to a more open grass of less height and stunted trees. The most common trees found this area includes; Mango, Guava, Cashew, locust-bean, tamarind among others.

Data collection

Gombe state was divided into three agro-ecological zones namely: Gombe North, South and Central. A total of 30 quail eggs were collected per zone making up a total of Ninety eggs in the zone. 15 per LGAs per zones in a nested (Hierarchical balanced) design to assess the external and internal egg quality of the domestic quail.

Data were generated on external and internal characteristics of the pigeon eggs as follows;

a) **External egg parameters**

i. **Egg weight:** the eggs were collected, numbered, labelled and weighed using a digital electronic scale to the nearest 0.01g.

ii. **Egg length:** was measured using a Vernier calliper to the nearest 0.01mm.

iii. **Shell weight:** eggs were carefully broken and poured inside a clean glass surface for the shell to be weighed with a digital electronic scale to the nearest 0.01g.

iv. **Shell thickness:** the eggs were oven dried for 24 hours after which a micrometer screw gauge was used to measure the thickness of the shells to the nearest 0.01mm.

b) **Internal egg parameters measurement**

i. **Yolk height, Yolk diameter, Albumen height:** were measured using a Vernier calliper to the nearest 0.01mm.

ii. **Yolk weight:** the yolk was carefully separated from the albumen by spoon-scooping it to a plate and then weighed using a digital electronic scale to the nearest 0.01mm.

iii. **Albumen weight:** were obtained by subtracting the shell value from the yolk weight.

iv. **Haugh unit:** is a measure of egg protein quality based on the height of its egg and it is measured based on the height of the albumen. The higher the number, the better the quality of the egg. It was measured using the formula

$$HU = 100 * Log(h + 7.57) - (1.7 * W\,0.37)$$

Where
HU= Haugh unit
h = observed height of the albumen in millimetres
w = weight of egg in grams

Statistical analysis

Data obtained were analysed by ANOVA using Statistical Package for Social Science SPSS version 23 (2015). Significantly different means in a subset were separated using Ryan Einot Gabriel Welsh F- Test. Person's Correlation co-efficient were computed to test the relationship between the egg traits.

Results and Discussion

External egg characteristics

Table 1 showed the external egg characteristics of the pigeon in the study area. Results revealed that that egg weight value was 14.05 ± 0.17in Gombe Central, 14.38 ± 0.22 in Gombe South and 13.75 ± 0.99g Gombe North. The mean average egg weight in the study area was 14.27 ± 0.10g. Egg weight was significantly (P< 0.05) affected by study location. Egg length, shell weight, egg width, shell surface area and thickness were not affected. However, the results for mean average egg length, shell weight, egg width, shell surface area and shell thickness were 4.01 ± 0.03mm, 1.50 ± 0.02g, 26.93 ± 0.07mm, 28.06 ± 0.05 and 0.04± 0.00mm, respectively.

Table 1: External egg quality of pigeons.

	Location				
Parameters	Gombe Central	Gombe South	Gombe North	Mean	LSD
Egg weight(g)	14.05 ± 0.17ab	14.38 ± 0.22a	13.75 ± 0.99 b	14.27 ± 0.10	*
Egg length (mm)	3.97 ± 0.06	4.00 ± 0.06	3.85 ± 0.06	4.01 ± 0.03	NS
Shell weight(g)	1.50 ± 0.05	1.50 ± 0.04	1.50 ± 0.03	1.50 ± 0.02	NS
Egg width(mm)	26.69 ± 0.14	26.92 ± 0.08	26.72 ± 0.07	26.93 ± 0.07	NS
Shell surface area	27.79 ± 0.11	27.99 ± 0.05	28.05 ± 0.12	28.06 ± 0.05	NS
Shell thickness(mm)	0.04 ± 0.003	0.04± 0.004	0.04 ± 0.002	0.04± 0.001	NS

Note: NS = Not significant, Significant at * = P < 0.05. Means in row with different superscripts are significantly different.

Internal egg quality characteristics

Results on internal egg characteristics are presented in table 2. The results indicated that albumen height and yolk height were affected significantly (P< 0.001) by study location. Haugh unit was also affected (P< 0.01). With the exception of albumen and yolk weight which were not affected. The mean average value of 5.64 ± 0.03mm albumen height, 7.15 ± 0.03g albumen weight, 4.48 ± 0.02 g yolk weight, 13.06 ± 0.06mm yolk height, 94.04 ± 0.16 Haugh unit were recorded, respectively.

Table 2: Internal egg quality of pigeon.

	Location				
Parameters	Gombe Central	Gombe South	Gombe North	Mean	LSD
Albumen height (mm)	5.61 ± 0.04a	5.69 ± 0.03a	5.43 ± 0.06b	5.64 ± 0.03	***
Albumen weight(g)	7.08 ± 0.06	7.06 ± 0.02	7.11 ± 0.08	7.15 ± 0.03	NS
Yolk weight(g)	4.45 ± 0.03	4.43 ± 0.04	4.43± 0.04	4.48 ± 0.02	NS
Yolk height(mm)	12.88 ± 0.12b	13.20 ± 0.04a	12.75 ± .01b	13.06 ± .06	***
Haugh unit	93.89 ± 0.23ab	94.12 ± 0.24a	93.15± 0.32b	94.04 ± .16	**

Note: NS = Not significant, Significant at ** = P < 0.01; *** = P < 0. 001. Means in row with different superscripts are significantly different.

Correlation of egg characteristics

Correlation coefficients between egg measurements are presented in Table 3. Most correlation values were significant at 1%. Egg weight is correlated positively with egg length (0.49; P<0.01), shell weight (0.28; P<0.01) but correlated negatively with Haugh unit (0.27; P<0.05). Most egg characteristic measured was lowly correlated. Albumen height is correlated with yolk height (0.23; P<0.05) and Haugh unit (0.09; P<0.01). There was no significant correlation between egg weight and shell surface area (0.16), shell thickness (0.14) and albumen weight (0.05). Albumen height (0.09), yolk weight (-0.11) and yolk width (0.18).

Table 3: Correlation of the egg measurement.

	Egg weight	Egg length	Shell weight	Egg width	Shell surface area	Shell thickness	Albumen height	Albumen weight	Yolk weight	Yolk length	Hu
EW	1	0.49**	0.28**	0.04	0.16	0.14	0.09	0.05	-0.11	0.18	-0.27*
EL		1	0.33**	0.34**	0.20*	0.12	0.06	0.08	0.12	0.18	-0.01
SW			1	0.15	0.34**	0.04	-0.04	-0.03	0.23*	-0.03	-0.14
EWi				1	0.08	-0.03	0.02*	0.08	0.16	0.16	0.21*
SSA					1	0.02	0.06	0.28*	0.05	-0.01	0.003
ST						1	-0.01	0.07	0.131	-0.001	-0.06
AH							1	0.18	-0.01	.23*	0.09**
AW								1	-0.05	0.12	0.16
YW									1	-0.08	0.02
YL										1	0.15
HU											1

* = Significant at P< 0.05 ** = Significant at P<0.01

Discussion

The result of this study indicated good egg quality as good shell weight and thickness assured the protection of the internal egg contents. The result of egg thickness reported in this study is lower than those reported by Sujan et. al. [11] for the three breeds in Bangladesh who gave thickness of eggshell to be 0.20±0.01 mm, 0.13±0.00 mm, 0.21±0.01 mm for Lakkha, Khaki and Shiraz breed respectively. Egg width and length in this study was within the range of those reported earlier by Sujan et. al. [11] which gave width and length of egg as 29.77±0.07 mm and 41.24±2.05 mm for Lakkha; 24.16±0.38 mm and 35.32±0.87 mm for Khaki, 29.78±0.11 mm and 40.45±1.11 mm for Shiraz breed respectively. A higher percent Haugh unit implied a better quality egg. Adeogun et. al. [12] Observed that the higher the Haugh unit, the more desirable the egg quality. In reference to the normal value, none of the parameters showed any deviation. The dimensions of eggs laid by the pigeon in the study area were comparable with those of the eggs of feral pigeons studied by Nam & Lee [13], and Nisianakis et al. [14]. The eggs of all breeds of pigeons had thinner shells than the eggs of feral pigeons [14,15].

The effect of location which is not significant in albumen and yolk weights showed that the pigeon may have been exposed to similar feeding stuff with similar nutritive values in the study area. However, location effect differ in albumen and yolk heights and haugh unit, this is an indication that the pigeons egg weights may have influence on the differences in these parameters. Gombe North zone having different egg quality may have been due primarily to management and availability of high quality cereals compared to other zones, that is, Gombe South and Central. Gombe North zone is well known for the cultivation of high quality cereals and this allow the pigeons to feed on these crops before harvesting on the farm and scavenged on leftover after harvest. This observation in weight differences in the study zone on other egg qualities is in conformity with Hoffmann, 2005 which opined that eggs from different poultry species formed their unique properties from egg size to nutritional composition.

The good correlations imply that increase in egg weight will lead to increase in the egg length and shell weight. Selection for better egg weight will invariably select eggs with better lengths. Shell weight were influenced by the weight of egg [16,17].

Conclusion

It can thus be concluded that:

a) The pigeon eggs have good external and internal qualities as the egg weight and Haugh unit characteristics are good

b) The correlation of egg characteristics showed that most traits which showed positive correlations can easily be selected for further improvement

c) The positive correlated responses can hasten selection for pigeon egg improvement.

d) The good egg qualities in favour of Gombe North zone is an indication that availability and quality cereal crops can improve egg quality, hence zones with adequate and quality cereal crops should be encouraged to keep pigeon as leftovers can be effectively utilised.

Recognizing the enormous potentiality of pigeon as an alternative to chickens, it is recommended that:

a) Farmers should be encouraged to keep pigeon for eggs and meat in providing supplementary income.

b) Pigeon farming should be encouraged and promoted in Nigeria to meet the protein deficient gap in animal protein intake

c) Further research be conducted on pigeon eggs attributes as strategies to make pigeon farming economically and commercially viable in the near future in Nigeria.

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