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Nutrient Quality Characteristics of Eggs from Seven-chicken Strains in South-Western Nigeria

A.J. Atansuyi, U.C. Ihendu, O.A. Falade, C.O. Joachim and C.A. Chineke
Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria
Corresponding author: A.J. Atansuyi; E-mail: ajatansuyi@futa.edu.ng; Telephone: +2348034832175

Abstract
This study was carried out to determine the nutrient quality of eggs from seven-chicken strains in South-Western Nigeria using a total of 195 hens. Theseven strains are normal feather, fulani ecotype, frizzle feather, naked neck and transylvania indigenous strains while hubbard and marshall were meat-type exotic chickens. Each strain was replicated three times at 10 birds per replicate making a total of 30 hens per strain except the frizzle feather that were 15 in number. Completely randomized design (CRD) was used for the trial that lasted for 24 weeks. Forty-two eggs of 6 eggs per strain were collected at first and last day of the 32nd week of age from the hens for nutrient composition studies on the basis of yolk, albumen and whole egg. The birds were fed experimental diet at 125g/bird/day. Results showed that the fat content of the yolk in exotic birds were higher compared to their indigenous counterparts. Significant differences ($p<0.05$) observed in crude protein and nitrogen free extract in the eggs albumin of frizzle feather indicated that it was superior to other strains. It can be concluded that indigenous strains had better nutritional properties in their whole egg due to high level of ash, fat, protein and nitrogen free extract than their exotic counterparts. The yolk of frizzled feather is recommended based on its high protein content while naked neck yolk is recommended because of its low fat contents especially for people living with obesity and heart related diseases and children under five.

Keywords: Nutrient composition, egg quality, improvement, Indigenous and exotic chickens

Introduction

Some indigenous chickens, such as naked neck, frizzle feather, Fulani ecotype and normal feather, constitute about 80% of the 120 million poultry birds found in Nigeria (RIM, 2002). Among these species, naked neck possesses good egg laying characteristics (Udoh *et al.,* 2012). This breed of chicken contains genes and alleles pertinent to their adaptation to a particular environment and breeding goals (Romanov *et al*., 1996). Indigenous chickens are self-reliant and hardy birds with the capacity to withstand harsh weather conditions and adapt to adverse environment (Chin, 2003). They are known to possess qualities such as the ability to hatch their own eggs, brood, scavenge for major parts of their food and possess appreciated immunity from endemic diseases (Duguma, 2006). Their products are preferred by the majority of Nigerians because of the pigmentation, taste, leanness and suitability for special dishes (Horst, 1989). These products (egg and meat) are readily available to villagers and people in the urban and semi-urban areas at relatively cheaper rates, thus, serves as a good source of income and protein in their diets (Ibe, 1992).

Therefore, the objectives of the study are to determine the nutrient quality characteristics of eggs from seven-chicken strains in South-western Nigeria. This will also help to generate baseline data on the nutrient composition of some Nigerian indigenous chickens and make appropriate recommendations for the consumption of these eggs as food.

Materials and Methods

The study was carried out between June – December, 2016 at the Teaching and Research Farm, Livestock Section (Poultry Unit) of the Federal University of Technology, Akure Ondo State, Nigeria with Latitude 07° 16¹ and 07° 18¹N and Longitude 05° 09¹ and 05° 11¹ E. There is a unimodal rainfall pattern which starts from April to October with an average of 1556mm per annum. The average ambient temperature was about 30 - 32°C and relative humidity was 80%.A total of 195 hens of different strains were obtained from the Research Farm hatchery in Oyo state, Nigeria. There were seven strains of chickens used for the experiment which were: Normal feather, Fulani ecotype, Frizzle feather, Transylvania and naked neck indigenous strains while Hubbard and Marshall were meat-type exotic chickens. Each strain was replicated three times at 10 birds per replicate making a total of 30 hens per

strain except for the Frizzle feather that were 15 in number. The study which lasted 24 weeks had the birds distributed into seven treatments according to their genotypes in a completely randomized design (CRD) arrangement. The diet used for the experiment was formulated at the Federal University of Technology, Akure Teaching and Research Farm Feed mill. The diet was fed to the birds at 125g/bird/day for the period of the experiment. The calculated analysis of the diet is 16.70% crude protein and 10.50Kcal/kg metabolizable energy.Forty-two eggs of six eggs per strain were collected at first and last day of the 32nd week of age from the experimental hens for nutrient compositional studies on the basis of yolk, albumen and whole egg. Proximate analysis of yolk, albumen and whole egg was carried out to determine the percentage of moisture content (MC), ash, fat contents and crude protein (CP) while dry matter (DM), nitrogen free extract (NFE) and gross energy (GEE) were evaluated as described by AOAC (2000).

All data generated were used to analyze the chicken egg for nutrient composition characteristics. The data were subjected to one way analysis of variance (ANOVA) using SAS, 2008 Version 13 statistical software. Duncan Multiple Range Test (DMRT) was used to separate the means where significant differences existed using the same statistical package.

Results and Discussions

The nutrient composition of the chicken eggs yolk on dry basis presented in Table 1 below showed that there were significant differences ($p<0.05$) in the percentage moisture and dry matter contents of the chicken strains. Fulani ecotype (FE) chicken eggs had the lowest MC of 7.00% in their yolk while Transylvania eggs had the highest of 9.00%. Also, there were significant differences ($p<0.05$) in fat, CP, NFE and GEE of the chicken eggs yolks in which normal feather and Naked neck recorded the highest (55.00%) and lowest (50.00%) values of crude fat contents respectively. Transylvania and FE recorded highest (23.50%) and lowest (18.50%) values of CP while highest and lowest values of NFE were recorded for NN (27.50%) and NF (22.50%) respectively. Similarly, strains also had significant difference ($p<0.05$) effect on gross energy where highest energy value (2788.00 KJ/kg) was recorded for Normal Feather and least energy value (2681.50 KJ/kg) was recorded for Naked Neck. The significant differences observed in these parameters (DM, ash, NFE, fat CP and GEE) indicated that indigenous strains were superior to exotic in DM content which makes their yolks richer in minerals and probably vitamins than exotic strain. The fat contents of yolk in Hubbard broiler was found to be the highest which would normally contribute to the survival of embryo because yolk lipids has been predicted to supply 90% of the energy requirements of late term embryo (Turro*et al*., 1994). This may largely be responsible for the poor survival of indigenous chicken embryos and hatchability of their eggs. The naked neck indigenous strain had more mineral contents in its yolk than their exotic counterparts due to high level of ash and NFE. Higher yolk energy level observed in indigenous suggests that they would have higher livability of chicks.

Table 1: Effect of strain on nutrient composition of chicken's egg yolk

Parameter	NF	NN	FF	FE	TB	MB	HB	SEM
MC (%)	8.00^{c}	8.00^{c}	8.50^{b}	7.00^{e}	9.00^{a}	7.50^{d}	8.00^{c}	0.08
ASH (%)	2.0^{ab}	2.50^{a}	2.00^{ab}	2.50^{a}	1.50^{b}	2.00^{ab}	2.00^{ab}	0.12
FAT (%)	55.00^{a}	50.00^{d}	53.00^{b}	52.50^{b}	51.00^{c}	50.50^{cd}	54.50^{a}	0.12
CP (%)	20.00^{c}	20.00^{c}	22.00^{b}	18.50^{e}	23.50^{a}	20.00^{c}	19.50^{d}	0.12
NFE (%)	22.50^{d}	27.50^{a}	23.00^{d}	26.50^{b}	24.50^{c}	27.00^{ab}	24.00^{c}	0.04
DM (%)	92.00^{b}	92.00^{b}	91.50^{bc}	93.00^{a}	91.00^{c}	92.50^{ab}	92.00^{b}	0.04
GEE kJ/kg	2788.00^{a}	2681.50^{g}	2747.50^{c}	2727.50^{d}	2717.50^{e}	2690.00^{f}	2772.00^{b}	2.88

a,b,c,d,e,f,g = means on the same row but with different superscripts are statistically ($p<0.05$) significant, NF = Normal feather, NN = Naked neck, FF = Frizzled feather, FE = Fulani ecotype; TB = Transylvanian bird, MB = Marshal broiler, HB = Hubbard broiler, SEM = Standard error of the mean

The nutrient composition of the albumen in Table 2 showed that there were significant differences ($p<0.05$) in percentage moisture and dry matter contents of chicken strains. Among the Nigerian indigenous chickens, frizzled feather (FF) had lowest MC (6.50%) and highest DM (93.50%) while normal feather (NN) and Fulani ecotype (FE) had highest MC of 8.00% and lowest DM of 92.00% contents. There were significant differences ($p<0.05$) in Fat, CP,

NFE and GEE in which Hubbard (HB) and normal feather recorded the highest (10.00%) while FE had lowest (6.00%) values of Fat. This indicated that indigenous chicken egg albumin would be nutritionally wholesome for children and people living with obesity. Albumin dry matter, ash and fat were affected by breeder strain. This report disagrees with the findings of Hajkhodadadi (2014) who reported that albumin dry matter, ash and fat was not affected by breeder strain. The differences observed in this research might be due to age factor. Significant differences ($p<0.05$) observed in crude protein and nitrogen free extract indicated that frizzle feather was nutritionally superior to other strains. This is in agreement to the report of Ahn *et al.* (1997) in their study on the effect of egg size, strain and age of hens on the solids content of chicken eggs.

Table 2: Effect of strain on nutrient composition of egg albumen

Parameter	NF	NN	FF	FE	TB	MB	HB	SEM
MC (%)	7.00^{c}	8.00^{b}	6.50^{d}	8.00^{b}	9.00^{a}	7.00^{c}	7.00^{c}	0.14
Ash (%)	3.0^{a}	2.00^{c}	2.50^{b}	3.00^{a}	3.00^{a}	3.00^{a}	1.00^{d}	0.16
Fat (%)	10.00^{a}	8.00^{c}	7.00^{d}	6.00^{e}	9.00^{b}	8.00^{c}	10.00^{a}	0.16
CP (%)	45.00^{b}	44.00^{c}	49.00^{a}	41.00^{d}	44.50^{bc}	44.50^{bc}	40.00^{c}	3.16
NFE (%)	42.00^{e}	46.00^{c}	41.50^{f}	49.50^{a}	42.50^{de}	44.50^{d}	48.50^{b}	3.32
DM (%)	93.00^{a}	92.00^{b}	93.50^{a}	92.00^{b}	91.00^{c}	93.00^{a}	93.00^{a}	0.14
GEE kJ/kg	1831.50^{b}	1802.00^{c}	1780.00^{d}	1749.00^{e}	1807.00^{c}	1787.00^{d}	1852.00^{a}	2.88

a,b,c,d,e Means on the same row but with different superscripts are statistically ($p<0.05$) significant.

Table 3 below showed that the nutrient composition of whole eggs from the experimental birds were significantly different ($p<0.05$) in NFE and GEE with Hubbard (HB) recorded the highest NFE value (26.50%) while FF and FE recorded the lowest (14.00%) values of NFE. Gross energy was also affected by different strains where indigenous (FE) recorded highest (2899.50KJ/kg) while exotic (HB) had the least (2695.50 KJ/kg). Moisture content favoured frizzled feather showing the highest mean of the strains which contradicts the report of Isidahomen *et al.* (2014). The reason for this difference could probably be due to the age or feed consumed or genetic make-up of the hens. The significant differences ($p<0.05$) observed in ash contents revealed that exotic (Marshall) breed had highest ash content among the chicken strains. This agrees with the work of Babangida *et al*. (2006). The ash content gives a measure of total amount of inorganic compounds such as minerals present in an egg. The significant variation ($p<0.05$) observed in percentage fat, CP, NFE and gross energy among the strains agrees with the finding of Isidahomen *et al.* (2009) who observed that the chicken genotype significantly affected the nutrient quality of the eggs irrespective of the size. Low fat content observed in Fulani ecotype agrees with the report of Babangida *et al.* (2006). The low fat content of egg is an important for people who suffer from heart related diseases and obesity. Crude protein was also found to be higher in normal feather which could be as a result of age or feed consumed or their genetic make-up. However, the values recorded were similar to those reported by Olomu (2003).

Table 3: Effect of strain on nutrient composition of whole egg

Parameter	NF	NN	FF	FE	TB	MB	HB	SEM
MC (%)	7.50^{b}	7.00^{c}	8.50^{a}	8.00^{ab}	8.00^{ab}	8.00^{ab}	8.00^{ab}	0.14
ASH (%)	1.0^{d}	2.00^{b}	2.00^{b}	1.50^{c}	2.00^{b}	2.50^{a}	2.00^{b}	0.16
FAT (%)	51.00^{d}	55.50^{b}	58.50^{ab}	59.50^{a}	53.00^{c}	51.00^{d}	50.50^{e}	3.16
CP (%)	31.00^{a}	23.00^{d}	26.00^{b}	24.50^{c}	20.00^{f}	23.00^{d}	21.00^{e}	2.16
NFE (%)	17.50^{e}	19.50^{d}	14.00^{f}	14.00^{f}	24.50^{b}	23.50^{c}	26.50^{a}	2.32
DM (%)	92.50^{ab}	93.00^{a}	91.50^{c}	92.00^{b}	92.00^{b}	92.00^{b}	92.00^{b}	3.14
GEE kJ/kg	2722.00^{e}	2810.00^{c}	2864.50^{b}	2899.50^{a}	2741.50^{d}	2702.00^{f}	2695.50^{g}	3.00

a,b,c,d,e,f,g Means on the same row but with different superscripts are statistically ($p<0.05$) significant.

Conclusions and Recommendation

The findings of this study showed that strain had significant effect on the nutritional composition of albumen, yolk and whole egg. It can be concluded that indigenous strains (naked neck and frizzle feather) had better nutritional properties in the whole egg due to high level of protein, fat, ash and nitrogen free extract than their exotic

counterparts. The yolk of naked neck is recommended because of its low fat contents while frizzled feather yolk is recommended based on its high protein content especially for people living with heart related diseases and obesity and children respectively. Based on this, government support in carrying out genetic improvement researches on these chickens is advocated because of the nutritional advantages in their eggs.

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