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Preface

We would like to present, with great pleasure, the inaugural volume-9, Issue-9, September 2023, of a scholarly journal, *International Journal of Environmental & Agriculture Research*. This journal is part of the AD Publications series *in the field of Environmental & Agriculture Research Development*, and is devoted to the gamut of Environmental & Agriculture issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

This journal was envisioned and founded to represent the growing needs of Environmental & Agriculture as an emerging and increasingly vital field, now widely recognized as an integral part of scientific and technical investigations. Its mission is to become a voice of the Environmental & Agriculture community, addressing researchers and practitioners in below areas.

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Environmental science and regulation, Ecotoxicology, Environmental health issues, Atmosphere and climate, Terrestric ecosystems, Aquatic ecosystems, Energy and environment, Marine research, Biodiversity, Pharmaceuticals in the environment, Genetically modified organisms, Biotechnology, Risk assessment, Environment society, Agricultural engineering, Animal science, Agronomy, including plant science, theoretical production ecology, horticulture, plant, breeding, plant fertilization, soil science and all field related to Environmental Research.

Agriculture Research:

Agriculture, Biological engineering, including genetic engineering, microbiology, Environmental impacts of agriculture, forestry, Food science, Husbandry, Irrigation and water management, Land use, Waste management and all fields related to Agriculture.

Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within that community who supported the idea of creating a new Research with *IJOEAR*. We are certain that this issue will be followed by many others, reporting new developments in the Environment and Agriculture Research Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IJOEAR* readers and will stimulate further research into the vibrant area of Environmental & Agriculture Research.

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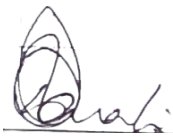
(Managing Editor)



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The Haematological and Serum Biochemistry of four Breeds of Cattle fed Palm Kernel Cake based diet

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Abstract— *The objective was to investigate haematological and serum biochemical parameters of four Nigerian breeds of cattle grazed and supplemented with palm kernel cake. Twenty four yearlings were used for this study. Experiment was a 2×4 factorial laid in a completely randomized design. Animals were divided into two groups, one group fed experimental diet and also grazed while the other only grazed. At the end of eight weeks feeding trial, four animals of different breeds were from each group making a total of eight animals selected. Blood samples were collected from these animals via jugular vein puncture using sterilized disposable syringe. Parameters determined were red blood cell, white blood cell, pack cell volume, haemoglobulin, mean corpuscular haemoglobulin, mean corpuscular haemoglobulin concentration, mean corpuscular valve, total protein, globulin, creatinine, albumin, cholesterol, urea, amino transferase and alanine transferase. The data collected were analyzed using IBM SPSS (2011). Results revealed that concentrate and grazing and grazing alone had effect ($p<0.05$) with the following values respectively on Hb (9.29,7.05), WBC (9.29,5.20), RBC (6.40,5.03), PCV (25.91,18.01), MCH (13.81,14.15), MCHC (35.00,34.84) and PLT (590.25,501.25) of breeds but had no effect on MCV (40.10,22.56) of breeds ($p>0.05$) though parameters were within normal range for cattle. Similarly, concentrate and grazing, and grazing alone had effect ($p<0.05$) on serum biochemical profile with the following values respectively total protein (7.85,7.43), albumin (4.54,2.81) total cholesterol (145.00,145.38), urea (38.75,3919) and alanine transferase (69.55,61.83) but had no effect ($p>0.05$) on creatinine (0.96,1.04), globulin (2.91,3.62) and aspartate aminotransferase (68.43,75.88) although all values were still within normal range for cattle. It is therefore concluded that blood biochemical parameters and haematology were within range in all treatments indicating that diet did not exert any deleterious effect. Animals that fed on concentrate however recorded higher values for most parameters. Therefore, the supplementation of Cattle diet with PKC is advisable*.

Keywords— Haematological, Serum biochemical parameters, Palm kernel cake, Nigerian breeds of cattle, Concentrate supplementation.

I. INTRODUCTION

Cattle are the most common type of large domesticated animals *(www.agriculturwnigeria.com)*. They command a prominent position in our meat and livestock industry. Cattle are also utilized for milk, hides and skin which is processed into leather, it's by products such as dung is utilized as manure and fuel.

Rangelands for animals to graze only blossom in the rainy season while in the dry season, they become standing hay (*Bamigboye et al.,2013*).Feed accounts for about two- third of the cost of meat production (*Vecchiettin and Giardini, 2000*) which is about 70-90% of total cost of fattening cattle (*Lamidi, 2005*).High cost of conventional feedstuffs have made research efforts to be directed towards harnessing and enhancing the utilization of agricultural by products and crop residues for livestock feeding.

Palm kernel cake is highly fibrous and has a medium grade protein content which is more suitable in feeding of ruminants and rabbits (*Pichard, 2005*). Protein content of palm kernel cake is between 18-25% (*Onwuka et al.,2014*). Palm kernel cake is deficient in lysine, methionine, histidine and threonine. Palm kernel is gritty and high in fibre content.

The health status of animals maintained under different feeding conditions is one of the criteria for welfare assessment. The assessment is through the haematology and serum biochemistry of the animal. The need to observe the changes taking place in the animal's body in response to external factors such as nutrition as it affects haematological and biochemical parameters cannot be over emphasized (*Scamell, 2006*). When haematological and serum biochemical values fall within the normal range established for the animal, it is an indication that the diet does not show adverse effect on the animal. Haematological and serum biochemical components are valuable in monitoring feed toxicity especially with feed constituents that affect the blood as well as health status of farm animal. Haematology and serum biochemistry assay of livestock determine the physiological disposition of the animals to their nutrition (*Menon et al, 2013*). Haematological traits especially PCV and Hb are correlated with the nutritional status of animals PCV and other haematological parameters are useful aids to prognosis and may reveal adverse condition even when the animal does not display obvious clinical signs of ill health. Thus biochemical determination of serum constituents and blood examination can provide valuable information regarding nutrition, and other environmental factors that influence the performance and wellbeing of animals (*Ate et al., 2009; Al-Fartosiet al., 2010; Diostanzo and Gill, 2012*). Serum vitamin, protein and lipid concentrations are affected by diet/nutrition (*Swanson et al, 2004*). Diet is therefore an important factor influencing rumen environment and blood metabolite. This study was carried out to evaluate the effect of palm kernel cake on haematology and serum biochemistry of four breeds of cattle.

II. MATERIALS AND METHODS

2.1 Experimental Site

This experiment was carried out at the ruminant section of the department of animal science and technology research farm, Nnamdi Azikiwe University Awka, Anambra state. The location is situated on lat 6.24◦N, 6.28◦N and a longitude of 7.00◦E, 7.04◦E of the equator on the southern part of Nigeria. The climate is the tropical wet and dry with clear season. The mean daily temperature is usually about 27◦c-34◦c in March and lowest during harmattan month of December and January (*Ezenwaj 2013*). The annual temperature and rainfall are 26.8◦c and 1589mm respectively.

2.2 Experimental Animal and Management

A total of twenty four yearlings of four different breeds of cattle was used for this experiment. The breeds include; White Fulani, Red bororo, Adamawa gudali and Sokoto gudali. They were purchased from cattle markets in Adamawa state.

2.3 Experimental Diet

Palm kernel cake used for experiment was purchased from a known palm kernel cake processing factory at Amansea Awka.

2.4 Management of Experimental Animals

On arrival, the animals were weighed, tagged and kept in pens for proper routine maintenance. All animals were given antibiotics injection (oxytetracycline) while Ivomec injection was administered to control both endo and ecto-parasites. Animals were acclimatized for two weeks before commencement of feeding trial. The feed given was a PKC and salt was provided free choice for the animals. The diet was given to the animals in the morning before they go to graze. Water was also supplied ad-libitium. Feeding trial lasted for eight weeks excluding two weeks of adjustment period.

2.5 Experimental Treatment

Yearlings were divided into two groups, twelve animals per breed. A group was fed experimental diet while the other did not. Each animal in each group constituted a replicate.

2.6 Data Collection

At the end of eight weeks feeding phase, blood samples were collected from four animals from each group making a total of eight animals. 5ml of blood was collected from each animal via jugular vein puncture using sterilized disposal syringe and needle. Blood samples were drawn into vials containing Ethylene-Diamine-Tetra-Acetic acid (EDTA) as anticoagulant. This was used to determine the following haematological and serum parameters Red blood count (RBC), pack cell volume (PCV), white blood cell (WBC), platelets, haemoglobin concentration (HC), mean corpuscular valve (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC), total protein globulin, glucose, albumin, cholesterol, creatinine, urea, amino transferase and alaninetransferase. Haematological parameters were analysed using rinse, diluents and M-30Cfl lyse reagents in a haematology auto analyser. Serum was analysed using a serum auto analyzer.

2.7 Experimental Design and Statistical Analysis

The experiment was a 2 by 4 factorial arrangement involving two treatments which are the patterns of feeding (concentrate/ grazing and only grazing) and four breeds (white Fulani, red bororo, sokoto gudali, adamawa gudali) were shared into two groups in a completely randomized design. Statistical package used was IBM (2011).

III. RESULTS AND DISCUSSION

TABLE 1
HAEMATOLOGICAL INDICES OF INDIGENOUS CATTLE GRAZED AND SUPPLEMENTED WITH PALM KERNEL CAKE

Factors		**Parameter**							
Breed	Feeding Pattern	Hb	PCV	RBC	WBC	MCV	MCH	MCHC	PLT
AG	Concentrate feeding combined with grazing	8.25	22.30	5.61	9.45	37.70	13.80	36.10	623.50
	Grazing	6.90	17.25	5.13	4.40	22.10	14.20	35.35	472.50
WF	Concentrate feeding combined with grazing	9.15	26.65	6.59	9.85	38.90	13.25	34.50	731.50
	Grazing	7.45	22.10	5.02	7.55	25.90	14.60	33.70	603.50
SG	Concentrate feeding combined with grazing	10.15	31.10	7.08	9.60	44.40	14.40	32.50	403.00
	Grazing	6.75	17.20	4.78	3.85	21.10	14.10	35.95	504.00
RB	Concentrate feeding combined with grazing	9.60	23.60	6.30	8.25	39.40	13.80	36.90	603.00
	Grazing	7.10	15.50	5.21	5.02	21.15	13.70	34.35	425.00
	SEM	0.16	0.48	0.15	0.22	12.44	0.14	0.15	2.35
	p-value	0.001	0	0.001	0	0.978	0.001	0	0

Where: AG = Adamawa gudali

WF = White fulani

SG = Sokoto gudali

RB = Red bororo

PCV=Packed cell volume

RBC= Red blood cell

WBC= White blood cell

MCV= Mean corpuscular haemoglobin

MCH= Mean corpuscular haemoglobin

MCHC= Mean corpuscular haemoglobinconcentration

PLT= Platelets

TABLE 2
SERUM BIOCHEMICAL INDICES OF INDIGENOUS CATTLE GRAZED AND SUPPLEMENTED WITH PALM KERNEL CAKE

Factors		Parameter							
Breed	Feeding Pattern	TP	Globulin	Albumin	TC	Creatinine	AST	ALT	Urea
AG	Concentrate feeding with grazing	8.06	2.53	5.53	151.5	0.95	65.4	73.3	40.00 40.00
	Grazing	7.07	3.65	2.52	149	1.03	73.25	62.2	39.04 39.04
WF	Concentrate feeding with grazing	6.53	3.03	3.53	153	0.9	67.4	70.4	37.04 37.04
	Grazing	7.04	4.06	2.98	138	1.04	80.4	60.25	38.06 38.06
SG	Concentrate feeding with grazing	8.52	3.04	5.48	136	1.25	71.5	66.2	39.07 39.76
	Grazing	8.29	3.55	3.02	148	1.03	75.45	63.25	40.65 40.65
RB	Concentrate feeding with grazing	8.27	3.03	3.63	139.5	0.75	69.4	68.3	38.20 38.20
	Grazing	7.32	3.23	2.73	146.5	1.06	74.4	61.6	39.02 39.02
	SEM	0.1	0.17	0.02	1.49	0.05	1.61	0.2	0.13 0.13
	P-value	0	0.077	0	0	0.003	0.087	0	0.0

3.1 Haematological profile of four breeds of cattle (Adamawa gudali, White Fulani, sokoto gudali and Red bororo)

The hematological status of cattle grazed and also fed supplement (pkc) and those grazed alone were similar but significantly different ($p<0.05$) as shown in all tables.

The Hb for the animals grazed and also supplemented with concentrate fell within the range of (8.25-10.15 g/dl) and those that grazed alone ranged between (6.75-7.45g/dl). Though the values for supplemented animals were higher, they all fell with the normal range for healthy cattle as reported by (RAR, 2009).

PCV for animals grazed and fed supplement were within the ranges of 22.30-31,10g/dl while animals that only grazed were between 15.50-22.10 g/dl. Theses' values obtained all fell within the range for healthy cattle as reported by (RAR, 2009). This suggests that PKC in cattle ration does not induce reduction in PCV.

RBC for grazed and supplemented cattle and those grazed alone were similar but significantly different. The RBC values obtained for grazed and supplemented cattle were between the ranges of ($5.61\text{-}7.08\times10^6\times\mu/l$) and ($5.02\text{-}5.21\times10^6\mu/l$) respectively but still fell within the range for cattle as reported by (MVM, 2012).

WBC count were similar among breeds and agrees with the normal value of WBC that ranged between $4\text{-}12\times10^3\mu/l$ as stated by (RAR,2009) but higher WBC values was observed in breeds grazed and fed supplement. This indicates that animals were capable of generating antibodies in the process of phagocytosis and have high resistance to diseases (Soetan et al, 2013).

MCV however was not significantly different ($p>0.05$). Breeds grazed and fed supplement ranged between (37.7-44.40 fl) which fell within range for healthy cattle according to (RAR, 2009) but animals that only grazed had values between (21.15-25.90fl) these values were below the established range for healthy animals. This could be as a result of anemic condition and on deficiency in diet.

MCHC were similar but significantly different among breeds of grazed and supplemented and only grazed cattle. The range however was normal for healthy cattle reported by (RAR, 2009). This shows that blood level condition of animals was stable and was not affected by feeding pattern.

Platelet count of animals both grazed alone and supplemented with concentrate (pkc) were all similar and within range for healthy cattle as reported by (RAR, 2009). Platelets were unaffected by feeding pattern

3.2 Serum biochemistry of four breeds of cattle (Adamawa gudali, Sokoto gudali, White fulani and Red bororo) grazed and supplemented with palm kernel cake.

The results showed that there was significant difference ($p<0.05$) among parameters measured for different breeds except globulin and AST which were not significantly different ($p>0.05$).

The total protein of experimental animals fell within range normal range of 6.7- 8.8 g/dl (Gleghorn et.al, 2004). Although SG, AG, WF and RB grazed and also supplemented with pkc had highest values of 8.25, 8.06, 6.53 and 8.27g/dl respectively compared to animals grazed alone but were within range for healthy cattle as reported (msdvet manual.com). This could mean that those animals received adequate levels of protein from the diet and this translated into adequate production of microbial protein by the microbes to the animal.

Total cholesterol and albumin values for different breeds were significant ($p>0.05$) and fell within range for healthy cattle as reported by (msdvet manual.com) though values carried with some breeds fed supplement with AG having highest values (15.50mg/dl) for cholesterol and (5.53g/dl) and albumin. WF also recorded 153.00 for cholesterol and 3.53 for albumin, SG and RB also recorded highest for cholesterol (5.48mg/dl) and (3.63g/dl) for albumin compared to the animals grazed alone. Total cholesterol however, were high in some breeds only grazed this included SG which recorded (148.00mg/dl) and RB (146.50 mg/dl). All values gotten did not exceed the range for healthy cattle. Thus, PKC has no adverse effect on cholesterol and albumin of animals. Values of grazed animals which recorded high vales for total cholesterol could be due to influence of selectivity preference of forage by animals when they go on grazing.

It was observed that AST was not significantly different ($p>0.05$) among breeds but fell within normal range for healthy cattle as reported by (msdvetmanual.com). Result showed that AST values were highest in breeds grazed and supplemented with pkc. AST activities increased above normal range in pathological situations that cause cell necrosis such as liver damage to liver cells (Klinkon and Jezek, 2012) but AST in this study was within range.

Creatinine and urea were significant ($p<0.05$) among breeds. Klinkon and Jezek stated that increased urea concentration in serum of values is indicative of increased protein catabolism. On the other hand, creatinine is synthesized during endogenous metabolism in muscles and do not depend on nutrition (Klinkon and Jezek, 2012) the values reported for the various variables fell within ranges reported for apparently healthy subjects by other studies. For instance, Mahima et al. (2013) reported reference values for urea as 34.26 ± 0.90g/dl, creatinine (0.93 ± 0.03g/dl), total protein (5.34 ± 0.10g/dl), globulin (1.94 ± 0.31g/dl), ALT (29.58 ± 1.08iu/l), and AST (66.63 ± 2.38 iu/l) in healthy Hariana cattle. Omer *et al.* (2009) reported values of 26.78 ± 1.77mg/100ml, 1.33 ± 0.20mg/100ml, 7.24 ± 0.20g/100ml, 9.74 ± 1.98iu/l, and 25.24 ± 2.27iu/l for urea, creatinine, total protein, ALT and AST, respectively in suckling and yearling Sudanese carmels (Camelusdromedarius). In cattle breeds of Saudi Arabia, Al-Shami (2003) reported values of serum urea as 24.1 ± 2.1mg/dl, 1.3 ± 0.01mg/dl for creatinine, 7.4 ± 0.62g/dl for total serum protein, 270 ± 20.1iu/l for AST and 0.1 ± 1.4 for ALT. These values substantially agree with the values reported in the present study and this showed that both natural forages and the formulated rations were well tolerated by the animals and that supplementation of diet with palm kernel cake has no adverse effect on pathology of animals.

IV. CONCLUSION AND RECOMMENDATION

From the results obtained in this study, it is concluded that the use of palm kernel cake as supplement to cattle did not have any adverse effect on haematology and serum biochemistry of the different breeds of cattle rather all parameters were within the normal range for healthy cattle.

I recommend that farmers use palm kernel cake in fattening their cattle as it no negative effects on health of animals but rather promotes growth and meet up the dietary requirements of the animals.

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Effect of Chicken Strain on the Nutrient Composition of Eggs

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Abstract— *The study examined the effect of chicken strain (Isa brown, Lohmann brown, Isa white and Noiler) on the proximate composition of eggs laid by 22-weeks old hens. Completely Randomized Design (CRD) was used to carry out the study. The Gravimetric method, Furnace Incineration Gravimetric method, Bligh Dryer method, Kjeldahl method, AOAC 2019 method and Arithmetic Difference method were used to determine the Moisture content, Ash content, Fat content, Protein content, Crude fiber and Carbohydrate content of the egg samples, respectively. The mean values of the proximate composition of the four strains (Isa brown, Lohmann brown, Isa white and Noiler) of chicken studied are: Crude fiber- 0.47%, 0.41%, 0.41%, 0.44%; Moisture content- 75.08%, 75.14%, 76.06%, 76.40%; Ash content- 0.16%, 0.40%, 0.49%, 0.42%; Protein content- 12.56%, 12.51%, 11.74%, 11.03%; Carbohydrate content- 1.72%, 0.94%, 0.57%, 1.51% and Fat content- 10.01%, 10.61%, 10.74%, 10.20% respectively. The study invariably revealed that the eggs of Isa brown hens have more protein, carbohydrate and crude fiber contents. Eggs of Isa white hens contain significantly more fat and ash contents compared to those of Isa brown, Lohmann brown and Noiler hens. Noiler eggs have the highest moisture content. In conclusion, from a nutritional point of view, eggs of Isa brown strain are healthier because they contain less amount of fat and higher percentage of protein.*

Keywords— breeds, nutrient composition.

I. INTRODUCTION

A Strain is a certain family of birds that are usually bred with a certain emphasis on specific traits (Daniels, 2015). A strain, also called a bloodline or simply a line, is a family of related chickens. They are distinctive in having been selectively bred by a single person or organization long enough for all the chickens to be uniquely uniform in some way. Commercial strains of birds (that can be hybrid birds, not just pure bred birds) are usually given specific names after the producer, or after the cross, example, the Black Rock hybrid (Daniels, 2015). However, poultry farming is fast becoming an attractive business in Nigeria due to its short gestation and generation interval, prolificacy and lack of taboos to its production coupled with an increasing demand for its products by large segment of the populace especially during religious, local and national festivals. In order to meet this increasing demand, there is an urgent task of developing or procuring the fastest growing strains for new entrants and long-time poultry farmers who have resources to invest in this sub-sector which generates employment opportunities for both skilled and unskilled labour. The improvement in this sub-sector will no doubt lead to increase in protein consumption and enhance the well-being of the people in addition to promoting national growth and development. There is strong evidence that there are genetic differences in growth rate between strains or breeds of chickens (Deeb and Lamont, 2002; Olawumi, 2011)

Nutrient composition according to Wikipedia is a detailed set of information on the nutritionally important components of foods and provides values for energy and nutrients including protein, carbohydrates, fat, vitamins and minerals and for other important food components such as fiber. The nutritional value of an egg is divided between the egg white and the egg yolk. The egg white contains more than half the egg's total protein, while the egg yolk contains all the fat in the egg and a little less than half of the protein (The Gourmet Egg recipe book, 2021). The nutrient composition of various foods depends on several factors which include species, breeds, cultivars, ecological factors, post-harvest handling, preservation and storage techniques (FAO, 2013; Onyenweaku *et al*., 2018). Some foods are considered healthy depending on their nutrient content, while others

are considered to be unhealthy (FAO, 2007; Onyenweaku *et al*., 2018). Therefore, this study is aimed at determining the effect of chicken strain on the nutrient composition of eggs and comparing them for the benefit of farmers and consumers.

II. MATERIALS AND METHODS

2.1 Location of Study

The study was carried out at Maeve Research Laboratory, Awka. It is located at temporary site of Nnamdi Azikiwe University, Awka. Awka town is located in South-Eastern part of Nigeria and in the eastern part of Anambra State. It is bound by Latitudes 6°11'N and 6°17'N and Longitude 7°02'E and 7°08'E.

2.2 Experimental Design

The experiment was conducted using Completely Randomized Design (CRD) to test the effect of chicken strain on the nutrient composition of eggs. There were four treatment groups comprising Isa Brown, Isa White, Lohmann Brown and Noiler and five replicates.

The model of the design is as follows:

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

Where,

Y_{ij}= Single Observation

μ = Overall Mean

T_i = Effect of Treatment (chicken strain)

e_{ij}= Random Error

2.3 Sample Collection

The eggs used for this experiment were procured from Maeve Farm, Okpuno, Awka South Local Government Area, Anambra State. The eggs were collected from 22 weeks and transported to Maeve Laboratory for nutrient composition analysis.

2.4 Equipment

The equipment used include, 250ml beaker, 250ml conical flask, sterile magnetic stirrer, burette, moisture meter, digital weighing balance, centrifuge and kjeldahl apparatus.

2.5 Reagent

The reagents used include, methanol, chloroform, selenium catalyst, NaOH, sulphuric acid, indicator-bromocressol green and methyl red.

2.6 Sample Preparation

The egg samples were thoroughly washed with distilled water in Maeve Laboratory, Awka, Anambra State, Nigeria. The egg samples were cracked, opened and emptied into 250ml beaker. The sample was then mixed properly till it became homogenous and ready for use.

2.7 Proximate Determination

2.7.1 Moisture Content Determination

The moisture content of the samples was determined by gravimetric method as described by Pearson (1976), James (1995) and Bradley (2003). A measured weight of the fresh sample (5g) was put in a previously weighed moisture can and dried in the oven at 95-100°C under pressure not exceeding 100mgHg for 30 minutes in the first instance. It was cooled on the desiccator and reweighed. The weight was recorded and the sample returned to the oven for further drying. The drying, cooling and weighing was done at intervals and repeatedly until a constant weight was obtained. By weight difference, the weight of moisture lost was determined and expressed as a percentage of the sampled weight analyzed.

It was calculated using the formula:

$$\text{Moisture (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where

W_1= initial weight of empty crucible

W_2= weight of empty crucible+ sample

W_3= final weight of empty crucible + sample after drying to constant weight

2.7.2 Ash Content Determination

The furnace incineration gravimetric method (AOAC, 2000) was used. A measured weight **(**5g) of each sample was put in a previously weighed porcelain crucible. The sample in the crucible was put in a muffle furnace at 550^{o}C for 2 hours, the sample was allowed to burn until it became white ash. The crucible was carefully removed from the furnace (taking care not to allow air blow the ash away), cooled in the desiccator and reweighed. The difference in weight of ash was obtained and expressed as percentage of the sample weight analyzed. The ash content of the sample was then calculated using the formula:

$$\text{Ash (\%)} = \frac{W_2 - W_1}{W} \times 100$$

Where:

W = weight of sample

W1 = weight of empty crucible

W2 = weight of crucible + ash

2.7.3 Fat Content Determination

Bligh dryer method of (2010) was used. 5ml of the solvent was measured into centrifuged tube. 3ml of methanol and chloroform was poured into the sample. The mixture was centrifuged for 30mins and the fat content separated. The fat content was weighted and the percentage content calculated as follow:

$$\text{Fat (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where;

W1 = weight of empty filter paper

W2 = weight of paper + sample before defatting

W3 = weight of paper + sample after defatting and drying.

2.7.4 Crude Protein Determination

The protein content of the samples was determined by the kjeldahl method as described by James (1995). The total nitrogen was determined and multiplied by the factor 6.25 to obtain the protein content; 0.5g of each sample was mixed with 10ml of concentrated sulphuric acid (H_2SO_4) in a kjeldahl digestion flask. A tablet of a selenium catalyst was added to it and the mixture was digested by heating in a fume cupboard until a clear solution was obtained. Each of the digest was carefully transferred into a 100ml volumetric flask and made up to the mark by distilled water. A 10ml portion of each digest was mixed with an equal volume of 45% NaOH solution in a kjeldahl distilling unit. The mixture was distilled and the distillate collected into 10ml of 4% boric acid solution containing three (3) drops of mixed indicator-bromocressol green and methyl red. A total of 50ml distillate was collected and titrated against 0.02N H_2SO_4 solution from green to a deep red point. A reagent blank was also digested, distilled and then titrated, just as the sample. The nitrogen and protein content was calculated thus:

$$\text{Nitrogen (\%)} = \frac{\text{T} \times 0.02\text{N} \times 14}{W \times 1000} \times 100$$

Where;

W = weight of sample analyzed

N = Normality of titrant (0.02N)

T= Titre value

14= Molar mass of Nitrogen

The percentage of protein was calculated as % protein = %nitrogen × 6.25**.**

2.8 Crude Fiber (AOAC 2019 Method)

2ml of petroleum ether and 10ml of H_2SO_4 were added to 5ml of the sample. The mixture was refluxed for 15minsand washed with warm water to remove excess acid. 5ml of $CaCO_3$ was added and boiled for another 15mins. The mixture was filtered and the residue collected. The residue was oven fried, weighed and cooled. The sample residual was then incinerated and weighed. Percentage crude fiber was then calculated as

%Crude fiber = loss in weight after incineration x 100

2.9 Carbohydrate Content Determination:

The carbohydrate content of the test samples was determined by estimation using the arithmetic difference method described by Bemiller (2003). The carbohydrate was calculated and expressed as the Nitrogen Free Extract (NFE) as shown below:

%CHO (Nitrogen Free Extract) = 100 - % [MC + P + Fat+ Ash + CF].

2.10 Statistical Analysis

The data collected were all subjected to One Way Analysis of Variance (ANOVA) using SPSS version 21. The differences between treatment means were separated using $P<0.05$.

III. RESULTS

The effect of chicken strain on the proximate composition of chicken eggs are shown in Table 1. Significant differences ($P<0.05$) exist between the crude fiber contents of the eggs studied. Isa brown and Noiler breeds had the highest crude fiber contents, though Noiler, Isa white and Lohmann brown are statistically similar ($p>0.05$). The moisture contents of the eggs are uniform ($p>0.05$), irrespective of the strain. On the other hand, ash contents of the chicken eggs are significant ($P<0.05$). Isa white outscored ($p>0.05$) Lohmann brown and Isa brown in ash content. The ash contents of Isa white and Noiler are similar ($p>0.05$) and those of Lohmann brown and Noiler are the same statistically ($p>0.05$).

TABLE 1
THE EFFECT OF CHICKEN STRAIN ON THE NUTRIENT COMPOSITION OF EGGS

PARAMETERS %	ISA BROWN (T1)	LOHMANN BROWN (T2)	ISA WHITE (T3)	NOILER (T4)	P VALUE
Crude fiber	0.47b	0.41a	0.41a	0.44ab	0.01
Moisture content	75.08	75.14	76.06	76.4	0.95
Ash content	0.16a	0.40b	0.49c	0.42bc	0
Protein	12.56	12.51	11.74	11.03	0.12
Carbohydrate	1.72d	0.94b	0.57a	1.51c	0
Fat	10.01a	10.61c	10.74d	10.20b	0

Again, the protein contents are similar ($p>0.05$) across the strain. The discrepancies in strain were highest in carbohydrate and fat contents of the eggs. The carbohydrate contents of the Isa brown was highest ($P<0.05$) followed by the Noiler strain and the least being the Isa white ($P<0.05$). Contrariwise, Isa white had the highest fat content followed by Lohmann brown and the least being the Isa brown ($P<0.05$).

IV. DISCUSSION

The mean values for protein content of eggs from the four strains are slightly different from USDA (2018) recommended value of 12.6%, but those of Isa brown and Lohmann brown are similar to that reported by Mann (2007; 2008) who gave a mean value of 12.5% for whole raw fresh egg. The difference observed may be as a result of genotype, feeding or environment. Therefore, Isa brown and Lohmann brown eggs should be a preference to commercial egg producers and consumers whose interest is on improving the quantity of protein consumed or supplied to the body.

There is significant difference between the treatment means of carbohydrate with the mean values different from that reported by USDA (2018) who gave a value of 0.7%. This may be due to feeding and as such consumers should go for Isa brown and Noiler eggs with the highest carbohydrate content.

The values for fat obtained in this study across the treatments (10.01-10.73%) are similar to the reports by Seuss-Baum *et al.* (2011) and Jones *et al*. (2010) who gave the values of 8.7-11.2% and 9.93-11.71%, respectively. This implies that the consumption of eggs from the four strains is healthy for consumers especially in building up of energy in the body.

The moisture contents of the egg samples are similar to 76.1% which was reported by USDA (2018) and there is no significant difference between the treatment means ($P>0.05$). Comparing the mean values gotten from the experiment, it can be inferred that consumers whose major interest is on the moisture content of eggs should go for Noiler eggs.

Ash content which is a measure of the total amount of minerals present in a food was analyzed and it was found that the ash contents of the four strains are less than 0.86-0.89% for eggs of different shell colour (brown and white) according to Jones *et al*. (2010). The difference may be as a result of humidity, environment or feeding.

There is significant difference between the treatment means of crude fiber with Isa brown having the highest value. However, since crude fiber is of little food value it is advised that consumers should go for Lohmann brown eggs which have the lowest crude fiber content as this will help facilitate the utilization of valuable food nutrients embedded in these eggs.

V. CONCLUSION

The results obtained from the experiment show that the eggs of Isa brown strain have more protein, carbohydrate, and crude fiber contents while they are less in those of Isa white, Lohmann brown and Noiler breeds. Eggs of Isa white strain contain more fat and ash contents compared to those of Isa brown, Lohmann brown and Noiler breeds. Noiler eggs have the highest moisture content.

In conclusion, from a nutritional point of view, eggs of Isa brown strain are healthier because they contain less amount of fat and higher percentage of protein. This makes Isa brown eggs more acceptable by consumers as its consumption will help reduce the risk of high accumulation of fat in the body which when not properly burnt down can lead to obesity, heart burn and other health hazards. Again, due to its high protein content, when consumed will help in the repair of worn-out tissues in the body which will help promote good health as the immune system is strengthened in its fight against diseases.

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