JOURNAL FOR UNDERGRADUATE RESEARCH

Centre For Undergraduate Research
University of Abuja
Vol 1, No. 1 June, 2023
ISSN: 1115-7534
Published by Undergraduate Research

Performance of Noiler Chickens Fed Graded Levels of Maize Cob and Groundnut Shell Marsh in Abuja, Nigeria.

Babalola Matthew[1], Chukwu Blessing[1] & Rufus Adebisi Oluwafemi[1*]
Department of Animal Science, Faculty of Agriculture, University of Abuja, FCT Abuja, Nigeria.

Correspondence: Babalola Matthew, Department of Animal Science, Faculty of Agriculture, University of Abuja, Abuja, Nigeria. matthew.babalola2017@uniabuja.edu.ng

***Mentor:** Rufus Adebisi Oluwafemi Department of Animal Science, Faculty of Agriculture, University of Abuja, Abuja, Nigeria.

Abstracts

A study was conducted for 84 days to evaluate performance of noiler chicken fed maize cob and groundnut shell marsh (1:1) at different inclusion levels. A total of one hundred and fifty unsexed noiler chicks were randomly allotted into five dietary treatments in a completely randomized design. Each treatment was replicated thrice with ten birds per replicate. Birds on treatments1, 2, 3,4 and 5 were fed the basal diet at inclusion level of 0%, 5%, 10%, 15% and 20%, with maize cob and groundnut shell marsh in partial replacement of maize grain, respectively. Feed and water were provided ad libitum. Data were collected on feed intake, weight gain and feed conversion ratio. 5ml of blood sample were collected for haematology and serum biochemistry analysis from 3 birds per replicate via the wing vein. All data generated were subjected to analysis of variance (ANOVA). Result of the growth performance showed no significant ($p>0.05$) difference in all the parameters measured except for the feed intake (FI) feed conversion ratio (FCR) and mortality (%). The result of the hematological parameter shows significant differences ($P<0.05$), in the values of white blood cell (WBC) and lymphocytes (LYM) only. The serum biochemistry shows significant differences in the value of Creatinine. (Mg/dl), Triglycerides (Try Mg/dL), Total bilirubin (Mmol/L) and Alanine aminotransferase (ALTiu/L) ($P<0.05$).The carcass characteristics showed no significant difference. Hence result obtained from this research can be recommended for inclusion of maize cob and groundnut shell marsh up to 20% as partial replacement of maize grain in the diet of Noiler birds.

INTRODUCTION

The utilization of non-conventional feed material has become very important as it helps reduces the competition between human and animals when it comes to conventional feed materials thereby reducing cost of feeding and also reduces nuisance caused by the agricultural by-product in the society (Olafadehan *et al.,* 2020). Noiler chicken production is becoming more acceptable due to their resistivity to diseases and ability live on kitchen and agricultural waste and they are dual purpose birds (Animashahun *et al.,*2022). The ability of these birds to convert agricultural, natural and household waste into edible product such as meat and egg of high protein, for human consumption, growth and healthy living makes noiler birds a vital part of poultry production (Livestock, 2020).

Poultry production generally rely on the use of conventional feed ingredients. However, the prices of conventional feeds are becoming unaffordable to most smallholder farmers involved in poultry production. According to (Chandrasekaran, 2014), Poultry plays an important economic, nutritional and socio-cultural role in the livelihood of rural households in developing countries, including Nigeria as the major source of animal protein and income. Poultry sector is in competition with human on the meager feed ingredients leading to an increase in cost of production. WorldoMeter (2020), stated that Nigeria population was about 206,139,589 with an annual growth rate of 2.58%, in the year 2020.Hence, there is a need for low-cost feed input for sustainable and profitable production and breeds with high meat and egg production (Animashahun *et al.,*2022). Groundnut shells contain diverse bioactive and functional components which are important for human and animals (Pham *et al.,* 2019). Basically, it is used as a feedstock, filler in fertilizer and bio-filter carriers. Nutritional level is one of the vital factors which affect the physiology and performance of animals (Ajao, 2013).

The utilization of crop residue in livestock production will minimize cost of production and environmental impacts cause by the indiscriminate disposal of the residues. Without limiting the performance characteristics of the animal if given at the right quantity (Yanti and Yayota, 2017).

Therefore, evaluation of the Noiler chicken performance fed graded level of the maize cob and groundnut shell diets will help to determine the effect of synergistic use of the two ingredients for poultry production and its economic implication**.**

Materials and methods

Experimental site

The experiment was carried out at the Teaching and Research Farm in the University of Abuja, located in Gwagwalada Area Council of the Federal Capital Territory Abuja, Nigeria. The University lies between latitude 08°51° and 09°37°N and longitude of 7° 20° and 7°51° E. The area is characterized by two distinct seasons which are the rainy seasons from May to October and the dry season from November to April

Source of ingredients used for the experiment

100kg bag each of maize cob and groundnut shell were collected around Gwagwalada community at Gwagwalada Area Council, Abuja, was thoroughly dried and grinded into marsh.

Experimental design

The experimental design was completely randomized design (CRD). One hundred and fifty (150) day old Noiler chicks was purchased from reputable hatchery from Ibadan. The animals were grouped into 5 treatments, with thirty (30) birds per treatment (T1, T2, T3, T4 and T5) and three replicate with ten (10) birds per replicate (R1, R2, and R3) respectively. Groundnut shell and maize cob was thoroughly grinded into marsh at proportion of 0%, 5%,10%,15% and 20% respectively.

Experimental birds and management

Amo noiler chicks obtained from Amo Farm Sieberer commercial hatchery in Ibadan was used for this experiment. The birds were reared in a brooding cage with pen dimension of 0.94 square meter for 28days, then transferred into a battery cage and the experiment lasted for 84 days. Heat and light were provided throughout the brooding period using lanterns, electricity and routine vaccination (Gumboro and lasota) were administered as shown below. Feed and fresh water were provided *ad-libitum.*

EXPERIMENTAL DIETS

Table 2.3.1 and 2.3.2 Composition of Experimental Starter and Finisher diet Containing Graded level of Maize cob and Groundnut shell Marsh at different inclusion level.

Table 2.3.1 Composition of experimental Starter diet Containing Graded level of Maize coband Groundnut shell Marsh at different inclusion levels

	Level of MCGS INCLUSION				
INGREDIENTS (KG)	0%	5%	10%	15%	20%
MAIZE	48	45.6	43.2	40.8	38.4
MCGS	0	2.4	4.8	7.2	9.6
SOYA BEAN MEAL	22	22	22	22	22
DEOILRICE	10	10	10	10	10
PKC	4.5	4.5	4.5	4.5	4.5
FISH MEAL	4	4	4	4	4
BLOOD MEAL	3	3	3	3	3
WHEAT OFFAL	4	4	4	4	4
BONE MEAL	2	2	2	2	2
OYSTER SHELL	1.5	1.5	1.5	1.5	1.5
LYSINE	0.25	0.25	0.25	0.25	0.25
METHIONINE	0.25	0.25	0.25	0.25	0.25
VITAMIN PREMIX	0.25	0.25	0.25	0.25	0.25
SALT	0.25	0.25	0.25	0.25	0.25
TOTAL	100	100	100	100	100
CALCULATED ANALYSIS					
M.E (KCAL/KG)	2880	2877	2872	2869	2865
CP %	23.40	23.30	23.20	23.10	22.90
FEED COST/PER KG (#)	347	341	336	331	325

Table 2.3.2 Composition of Experimental Finisher diet Containing Graded level of Maize cob and Groundnut shell Marsh at different inclusion levels.

	% LEVEL OF MCGS INCLUSION				
INGREDIENTS(KG)	**0%**	**5%**	**10%**	**15%**	**20%**
MAIZE	60	57	54	51	48
MCGS	0	3	6	9	12
SOYA BEAN MEAL	20	20	20	20	20
DEOILRICE	5	5	5	5	5
PKC	4	4	4	4	4
FISH MEAL	4	4	4	4	4
WHEAT OFFAL	2.5	2.5	2.5	2.5	2.5
BONE MEAL	2.5	2.5	2.5	2.5	2.5
OYSTER SHELL	1	1	1	1	1
LYSINE	0.25	0.25	0.25	0.25	0.25
METHIONINE	0.25	0.25	0.25	0.25	0.25
VITAMIN PREMIX	0.25	0.25	0.25	0.25	0.25
SALT	0.25	0.25	0.25	0.25	0.25
TOTAL	100	100	100	100	100
CALCULATED ANALYSIS					
M.E (KCAL/KG)	3000.98	2996.40	2991.89	2987.35	2982.40
CP %	18.72	18.87	19.03	19.18	19.33
FEED COST/PER KG (#)	167	161	156	151	150

MCGS: Maize cob and Groundnut shell Marsh; PKC: Palm kernel cake; M.E: Metabolizable energy; CP: Crude Protein

Vitamin Premix: 2.5kg of premix contains: *Retinol acetate (10000000iu), Vit. D3 (2000000iu), Vit. E (15000iu), Vit. B (3000mg), Niacin (15000mg), Vit. B6 (3000mg), Vit. B12 (10mg), Vit. K3 (2000mg), Biotin (20mg), Folic Acid (500mg), Calcium pantothenate (800mg), Chlorine Chloride (250000mg), Manganese (75000mg), Iron (25000mg), Copper (5000mg), Zinc (70000mg), Selenium (150mg), Iodine (1300mg), Magnesium (100mg), Ethoxyquin (500g), BHT (700g)*

Table 2.3.3 Cost of feed per kilogram of ingredient used

Ingredients	Cost (#/kg)	Cost (USD/) #640/$1
MAIZE	230	147,200
MCGS	5	3,200
SOYA BEAN MEAL	340	217,600
DEOILRICE	210	134,400
PKC	140	89,600
FISH MEAL	2200	1,408,000
WHEAT OFFAL	200	128,000
BONE MEAL	130	83,200
OYSTER SHELL	40	25,600
LYSINE	2500	1,600,000
METHIONINE	2500	1,600,000
Vitamin premix	1660	1,062,400
Salt	650	416,000

Source sustainable feed mill Gwagwalada 2023

2.4 DATA COLLECTION

Parameters measured

The following parameters were measured; Initial weight (IW), Final weight (FW), Weight gain (WG); (FW - IW) ……. Figure 1

Average Daily Weight Gain (ADWG); (WG÷84) …….. Figure 2

Daily feed intake; (left over feed - feed given) ……Figure 3

Average Daily Feed Intake (ADFI); (Feed intake ÷ 84). ….Figure 4

Feed intake (FI): Sum of (ADFI) for 84 days. …….Figure 5

Feed conversion ratio; (FI) ÷ WG……Figure 6

Economy of production: The feed cost was calculated per treatment diet. Other expenses on drugs, vaccines and litter were common for all the treatments. Cost per kg gain was calculated by multiplying cost per kg by the Feed conversion ratio.

2.4.1 HEMATOLOGICAL AND SERUM BIOCHEMICAL PARAMETERS

2.4.2. Hematological parameters

Blood sample were collected from the wing vein of three birds per replicate into a 2ml sterile syringe and transferred onto an ethylene diamine tetra-acetic (EDTA) bottle to determine the packed cell volume (PCV), red blood cell (RBC) count, hemoglobin (Hb) concentration, white blood cell (WBC) counts and differential counts. The packed cell volume (PCV), erythrocyte concentration (RBC), hemoglobin (Hb), and leucocytes concentration (WBC) counts were calculated using an automated cell counter. While mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) Were calculated using the formula below as described by (Jain, 1986).

$$\text{MCHC (g/dL)} = \frac{HB}{PCv} \times 100 \quad \text{……..figure 7}$$

$$\text{MCV (fL)} = \frac{PCV}{RBC} \times 100 \text{……..figure 8}$$

$$\text{MCH (pg)} = \frac{HB}{RBC} \times 100 \text{…….figure 9}$$

The mean corpuscular volume (MCV) is used to calculate the erythrocyte size, the mean corpuscular hemoglobin (MCH) to measure hemoglobin amount per blood cell and the mean corpuscular hemoglobin concentration (MCHC) to know the amount of hemoglobin relative to size of the cell per red blood cell.

2.4.3. Biochemical parameters

Blood samples of 2ml were collected from 3 birds per replicate and transferred into a vacuum test bottle without ethylene diamine tetra-acetic acid. The blood samples were used to analyses the Albumin (Ab), Total protein (TP), Uric Acid (U), Glucose (G), Blood cholesterol, Globulin (GL), alanine transaminase, alanine phosphate as described by (Reitman and Frankel 1957; Tietz *et al.,* 1983)

2.4.4 Carcass characteristics

A bird per replicate was used for the purpose of evaluating the carcass characteristics. The feet were separated from each carcass in the tibio-tarsal joint. Weights of the carcass parts, abdominal fat, internal organs (liver, thymus, heart, lungs, kidneys, pancreas, testes), and gastrointestinal tract characteristics (crop, proventriculus, gizzard, right and left cecum) were all measured as described by Ahmadi *et al.,* (2018). The width, length, wall thickness of left and right cecum was also recorded respectively. Total weight of all dissected parts and the weights of various segments of the digestive tract were expressed as a percentage of carcass, as described by Ahmadi *et al*., (2018).

2.5 Data analysis

2.5 .1 Proximate analysis

Proximate analysis of the test ingredient and each treatment diet was carried out at faculty of agriculture, Animal Science laboratory using standard method as described by (AOAC, 2002).

2.5.2 Statistical Analysis

All data were subjected to one-way analysis of variance (ANOVA) using SPSS (25) and significant means was separated using Duncan Multiple Range tests (Duncan, 1955).

3.0. Result and discussion

3.1 Proximate analysis of test ingredient

The proximate composition, mineral and anti-nutritive value of groundnut shell marsh and maize cob are presented in Table 3.1. The two samples contain moisture content, crude protein, dry matter, crude fibre, ether extract, total ash and metabolizable energy at 14.85%, 14.11%, 85.15%, 20.71%, 1.86% ,4.22% and 3280.6 kcal/kg respectively.

Table 3.1 Proximate Composition of Groundnut shell marsh

PARAMETER	% COMPOSITION
MOISTURE CONTENT	10.72
DRY MATTER	89.28
CRUDE PROTEIN	11.65
CRUDE FIBRE	7.22
ETHER EXTRACT	1.20
M.ENERGY (Kcal/Kg)	1892.8

Table 3.1.3 Anti-nutritive value of groundnut shell marsh

Anti-nutritive factors (Mg/100g)	% Composition
Phytate	204.6
Oxalate	371.2
Saponin	156.9
Tannin	100.3
Cyanide	10.6
Trypsin	73.4

3.1. 4 Proximate analysis of maize cob marsh

The proximate composition, and anti-nutritive value of maize cob marsh are presented below.

3.1.5. Proximate Composition of Maize cob marsh

PARAMETER	% COMPOSITION
MOISTURE CONTENT	7.11
DRY MATTER	92.89
CRUDE PROTEIN	5.08
CRUDE FIBRE	31.56
ETHER EXTRACT	2.18
M.ENERGY (Kcal/Kg)	2008.7

Table 3.1.6 Anti-nutritive value of Maize cob marsh

Anti-nutritive factors (Mg/100g)	% Composition
Phytate	403.1
Oxalate	300.2
Saponin	120.9
Tannin	205.7
Cyanide	75.71
Trypsin	21.80

Table 3.1.7 Proximate analysis of the mixture of Maize cob and Groundnut shell marsh

PARAMETER	% COMPOSITION
MOISTURE CONTENT	14.85
DRY MATTER	85.15
CRUDE PROTEIN	14.11
CRUDE FIBRE	20.71
ETHER EXTRACT	1.86
TOTAL ASH	4.22
M.ENERGY (Kcal/Kg)	3280.6

3.2 Growth performance of Noiler chicken fed graded level of maize cob and groundnut shell marsh

The result of Noiler chicken fed graded levels of maize cob and groundnut shell marsh at different proportion presented on Table 3.2, shows no significant effect (P>0.05) on the initial body weight (IBW) final body weight (FBW) and weight gain (WG). However, there was significant (P<0.05) difference in the value of feed intake (FI), average daily feed intake (ADFI), feed conversion ratio (FCR) and mortality (%) respectively. P>0.05) on the initial body weight (IBW) final body weight (FBW) and weight gain (WG). However, there was significant (P<0.05) difference in the value of feed intake (FI), average daily feed intake (ADFI), feed conversion ratio (FCR) and mortality (%) respectively.

Table 3.2

	% LEVEL OF MCGS INCLUSION						
Parameters	**0**	**5**	**10**	**15**	**20**	**SEM**	**SIG**
IBW (g)	46.53	47.20	47.00	46.66	46.43	0.20	NS
FBW (g)	1,250.66	1,313.16	1,242.60	1,176.66	1,150.33	45.50	NS
WG (g)	1,204.13	1,265.96	1,195.66	1,130.00	1,103.90	45.55	NS
ADWG (g)	14.33	15.07	14.23	13.45	13.14	0.54	NS
FI (g)	6,703.04^{ab}	5,749.23^{b}	6,631.57^{ab}	7,148.28^{a}	7,174.42^{a}	179.85	*
ADFI (g)	79.79^{ab}	68.44^{b}	78.94^{ab}	85.09^{a}	85.40^{a}	2.14	*
FCR	5.57^{ab}	4.58^{b}	5.58^{ab}	6.32^{a}	6.77^{a}	0.11	*
Mortality (%)	0.23^{ab}	0.40^{a}	0.33^{a}	0.10^{b}	0.23^{ab}	0.335	*

$^{a-c}$Means in the same row with different superscript differ significantly (P<0.5); IBW: initial body weight; FBW: final body weight; WG: weight gain; ADWG: average daily weight gain; FI: feed intake; ADFI: average daily feed intake; SEM: standard error of means; SIGN: significant (P<0.5) difference; FCR: feed conversion ratio.

3.3 Haematological parameters of Noiler Chicken fed graded level of maize cob and groundnut shell marsh.

Table 3.3 present haematological parameters of Noiler chicken fed graded level of groundnut shell and maize cob marsh. The haematolohogical values ranged of Pack cell volume (PCV) (29.06-30.63%,), Haemoglobin (Hb) (6.78- 9.52g/dl), Red blood cell (RBC) (2.83-3.37×10^6/uL), Mean corpuscular haemoglobin (MCH) (70.01-75.83pg), Mean corpuscular volume (MCV) (39.28-42.55fL,) and mean corpuscular haemoglobin concentration (MCHC) (80.21-84.80%).

Hb (g/dl) and MCH concentration were significantly (P <0.05) different in treatment 1 with treatments 2, 3, 4 and 5. The white blood cell (WBC), lymphocyte (LYM), Monocyte (MON) Hematocrit (HET) and Eosinophil (EOS) values ranges between 5.41-7.56 (×10^6/uL), 7.34-8.86(×10^6/uL), 0.64-1.48(×10^6/uL) ,2.18-2.54(×10^6/uL) and 0.59-0.84(×10^6/uL) respectively**.** Likely the values of LYM and WBC were significantly (P <0.05) different with WBC treatment 1 having a value of (5.14×10^3uL) that is lower than (6.11×10^3uL) value in treatment 2, whereas, treatment 3,4 and 5 were statistically similar (p>0.05).

Table 3.3.

	% LEVEL OF MCGS INCLUSION							
Parameters	0	5	10	15	20	MEAN	SEM	SIG.
PCV (%)	29.84	29.06	30.07	30.01	30.63	29.92	0.32	NS
Hb(g/dL)	6.78 ^{b}	8.76^a	9.24^a	9.52^a	9.24^a	8.71	0.28	*
RBC(×10^6uL)	3.22	2.83	2.95	3.37	3.31	3.13	0.11	NS
MCV (fl)	42.09	39.28	40.03	42.31	42.55	41.25	0.67	NS
MCH (pg)	70.11^b	70.01^b	73.03^{ab}	75.83^a	72.74^{ab}	72.84	0.76	NS
MCHC (%)	84.10	81.86	80.21	81.78	84.80	82.55	1.04	NS
WBC(×10^3uL)	5.41^c	6.11^b	7.42^a	7.08^a	7.56 ^{a}	6.71	0.23	*
LYM(×10^3uL)	7.34^b	8.02^{ab}	8.19^{ab}	8.37^a	8.86^a	8.15	0.16	*
MON(×10^3uL)	0.82	0.64	1.34	1.48	1.35	1.12	0.12	NS
HET (×10^3uL)	2.18	2.26	2.23	2.36	2.54	2.31	0.05	NS
EOS (×10^3uL)	0.62	0.78	0.66	0.84	0.59	0.70	0.05	NS

3.4. Serum biochemical indices of Noiler chicken fed graded level of Maize cob and Groundnut shell marsh.

Table 3.4 presented Serum biochemical indices of Noiler chicken fed graded level of Maize cob and Groundnut shell marsh. The values ranged between Albumin (ALB) 1.68-2.13 g/dl, Globulin (GLO) 1.81-2.02g/dl, Try (Mg/dL)38.81-42.96mg/dl, T.bil (Mmol/L)0.98-1.76Mmol/dl, Urea (URE) 31.66-34.25mg/dl, Creatinine (Creat) 1.14 -1.55mg/dl, Alkaline phosphate (ALP) 36.39-44.52iu/L, Asparte aminotransferase (AST) 92.90-99.21iu/L and Alanine aminotransferase (ALT) 63.62-76.11 iu/L, respectively. There were no significant difference in the value of Alb (g/dL), Glo (g/dL), Ure (Mg/dL), AST (iu/L) and ALP (iu/L) (P>0.05). But there were significant differences in the value of Creat. (Mg/dl), Try (Mg/dL),T.bil (Mmol/L) and ALT (iu/L) (P<0.05) .

Table 3.4

	% LEVEL OF MCGS INCLUSION							
Parameters	**0**	**5**	**10**	**15**	**20**	**MEAN**	**SEM**	**SIG.**
Alb (g/dL)	1.68^{b}	1.95^{ab}	1.99^{ab}	1.90^{ab}	2.13^{a}	1.93	0.06	NS
Glo (g/dL)	1.81	1.86	1.93	1.98	2.02	1.92	0.03	NS
Creat. (Mg/dl)	1.14^{c}	1.37^{bc}	1.82^{a}	1.61^{ab}	1.55^{b}	1.49	0.06	*
Try (Mg/dL)	38.81^{b}	39.98^{ab}	41.80^{ab}	42.96^{a}	42.75^{a}	41.26	0.56	*
T.bil(Mmol/L)	0.98^{b}	1.44^{a}	1.40^{a}	1.56^{a}	1.76^{a}	1.43	0.08	*
Ure (Mg/dL)	31.66	34.32	32.79	32.80	34.25	33.16	0.40	NS
ALT (iu/L)	63.62^{b}	64.21^{b}	75.51^{a}	74.98^{a}	76.11^{a}	70.88	1.89	*
AST (iu/L)	92.90	94.65	96.89	97.04	99.21	96.14	1.20	NS
ALP (iu/L)	36.39^{d}	41.04^{c}	42.16^{bc}	43.32^{ab}	44.52^{a}	41.48	0.78	NS

3.5 Carcass Characteristics and Relative Organ Weights Noiler chicken fed graded level of Maize cob and Groundnut shell marsh

The carcass characteristics of Noiler chicken fed graded level of Maize cob and Groundnut shell marsh is presented in Table 3.5. The live weight (757.00 - 815.00g), Dressed weight (685.00 - 722.66g), Dressing percentage (65.16 -74.32g) and Eviscerated weight (495.16 - 617.33 g) while, weight of Head (32.33-52.66 g), , Wing (73.66-79.33 g) ,Leg (53.66 - 60.00 g),Drumstick (68.66 - 76.66),Neck (g)(36.00-46.66), Breast (g) (101.00 -131.00) Back (g) (91.33 - 105.33) Thigh (g)(75.33 - 89.66), Liver(g) (16.00 -16.66),Heart (g) (0.83 -0.79), Intestine length(cm) (127.33 - 149.33),Gizzard (g)(32.66-44.00) respectively

Table 3.5

	% LEVEL OF MCGS INCLUSION					
Parameters	**0**	**5**	**10**	**15**	**20**	**SEM**
Live weight(g)	757.00	824.00	681.00	889.00	815.00	71.11
Dressed weight(g)	685.00	758.66	632.00	716.00	722.66	60.75
Eviscerated weight (g)	495.16	673.00	510.50	638.66	617.33	56.57
Dressing percentage (%)	65.16^{b}	82.16^{a}	75.07^{ab}	71.76a^{b}	74.32^{ab}	1.88
Head (g)	32.33	34.00	36.00	38.00	52.66	3.32
Wing (g)	73.66	79.00	67.50	75.66	79.33	6.90
Legs (g)	53.66	56.00	43.50	48.00	60.00	4.33
Drumstick (g)	68.66	89.33	58.00	81.33	76.66	8.08
Neck (g)	36.00	47.66	40.00	58.16	46.66	5.08
Breast (g)	101.00	51.33	105.50	137.50	131.00	14.24
Back (g)	91.33	128.33	92.00	102.66	105.33	9.22
Thigh (g)	75.33	83.66	70.00	79.66	89.66	7.82
Liver(g)	16.00	19.00	22.00	16.66	16.66	1.67
Heart (g)	0.83	0.72	0.79	0.80	0.79	0.02
Intestine length(cm)	127.33	127.33	151.50	138.66	149.33	6.09
Gizzard (g)	32.66	49.66	44.00	50.66	44.00	4.43

3.6.0 Economy of production

The cost per #/kg of feed reduces across the treatment due to the lesser cost of the test ingredient maize cob and groundnut shell marsh. Treatment 4 and 5 has higher cost per kg gain due to it high feed conversion ratio.

Table 3.8

	% LEVEL OF MCGS INCLUSION				
Parameters	**0%**	**5%**	**10%**	**15%**	**20%**
Initial weight (g)	46.53	47.20	47.00	46.66	46.43
Final weight(kg)	1.25	1.31	1.242	1.17	1.15
Cost per kg feed(#/kg)	167	161	156	151	150
Total feed intake(g)	6.70^{ab}	5.74^{b}	6.63^{ab}	7.14^{a}	7.17^{a}
Daily feed intake(g)	79.79^{ab}	68.44^{b}	78.94^{ab}	85.09^{a}	85.40^{a}
Feed conversion ratio	5.57^{ab}	4.58^{b}	5.58^{ab}	6.32^{a}	6.77^{a}
Total feed cost (#)	13,326.29	11,019.37	12,315.77	12,849.89	12,811.47
Total Weight gain(kg)	1.20	1.26	1.19	1.13	1.10
Cost per kg gain (#)	930.18	738.04	871.24	955.07	1,016.73

4.0. Discussion

The maize cob and groudnut shell marsh contain crude protein (14.11%), dry matter(85.15%), crude fibre(20.71%), ether extract(1.86%), total ash (4.22%)and metabolizable energy of 3280.6 kcal/kg. According numerous studies crude fibre was considered as an anti-nutritional factor due to it adverse effect on feed intake and nutrient digestibility also it was noted to have vital effect on the gastro intestinal tract development, digestive physiology and nutrient absorption in poultry birds nutrition. Noiler chicken are known to be efficient converted of feed into meat and egg, due to their ability to utilize low quality feed ingredient. Hence high crude fibre content didn't hinder their performance. According to Mokolopi, 2022 groundnut shell contains 0.50% crude protein, 59.0% crude fiber, 2.50% ash While, Irabor *et al.,* 2022 reported crude protein (5.29%) crude fibre (34.77%). The results obtained for the performance were in agreement with Donkoh *et al.,* 2003, whose, inclusion of maize cob marsh in the diets of broiler has no significant effect on the weight gained Animasahun *et al*., 2021 reported no significant (P>0.05) differences in the growth performance of noiler chicken fed *Parkia biglobosa* leave meal (PBLM).According to Attia *et al*., (2018) haematological analysis is important in assessing the suitability and quality of the non-conventional feed ingredients for the animal. These parameters are influenced by age, sex, toxic compounds and feed content.

Polat *et al.* (2011) reported values of 1.12-1.22mg/dl creatinine in Arbor acre. Which is in agreement with the creatine values obtained across the treatment for serum biochemistry. Furthermore, Yakubu *et al.* (2009) reported that Albumin value of Arbor acre and Titan Anak were 2.77g/dl and 2.48g/dl respectively which also is similar with the result obtained. Donkoh *et al.,* (2003) reported that were no effect on the carcass characteristics of broiler chickens fed maize cob at various inclusion level in their diet which is also in agreement with the result obtained. The cost of feed was also minimal across the treatment.

5.0 Conclusion

The experiment investigated the effect of feeding graded level of maize cob and groundnut shell marsh in partial replacement of maize on the performance characteristics of Noiler chicken. The utilization of non-conventional feed material has become very important as it helps reduces the competition between human and animals, thereby reducing cost of production. Based on the result obtained and physical examination of the experiment for a period of 12 weeks, it is recommended to include maize cob and groundnut shell marsh up to 20% as partial replacement of maize grain in the diet of Noiler birds. Since it doesn't have negative effect on the performance, blood profile and carcass quality of the chicken.

6.0 Acknowledgment

The authors are grateful to the University of Abuja through the Centre for Undergraduate Research, University of Abuja, Federal Capital Territory, Nigeria, for fully funding the study

Funding:

This work was supported by Undergraduate Student Research Grant from University of Abuja to Okonkwo Heritage. Grant Number 2021/CUR/1/008

References

Abdi-Hachesoo, B., Talebi, A and Asri-Rezaei, S. (2011). Comparative study on blood profile of indigenous and Ross-308 broiler breeders. *Global Veterinary Journal, 7;238*-241

Addass, P.A., Midau, A. and Babale, D.M. (2010). Haemato-biochemical findings of indigenous goats in Mubi, Adamawa State. *Nigeria Journal of Agricultural Sciences*, 6: 14-16.

Adeniji, A.A and Balogun, O.O. 2002. Utilization of flavour treated blood-rumen content mixture in the diets of laying hens. *Nigerian Journal of Anim. Production*. 29 (1): 34-39.

Ahmadi M, Ahmadian A and Seidavi AR. Effect of Different Levels of Nano-selenium on Performance, Blood Parameters, Immunity and Carcass Characteristics of Broiler Chickens Poultry Science Journal 2018. ISSN: 2345-6604 (Print), 2345-6566 http://psj.gau.ac.irDOI:10.22069/psj.2018.13815.1276

Akinbobola A.(2022) Noiler Chicken Breed: History, Features & Other Facts https://www.livestocking.net/kuroiler-chicken-breed-key-facts-features#:~:text=Noiler%20chicken%20breed%20was%20developed,pure%2Dline%20breeding%20program%20began.

Aksit M, Yalcin S, Ozkan S, Metin K, Ozdemir D.(2006) Effects of temperature during rearing and crating on stress parameters and meat quality of broilers. *Poultry Science* ; 85:1867-1874.

Alemede, I.C., Adama, J.Y., Ogunbajo, S.A. and Abdullahi, J. (2010). Haematological Parameters of Savanna Brown Does Fed Varying Dietary Levels of Flamboyant Tree Seed Meal. *Pakistan Journal of Nutrition*, 9 (2): 167-170.

Animashahun, R.A., Alabi, O.O., Okeniyi, F.A., Olawoye, S.O., Shoyombo, J.A. and Falana, B.M (2022). Performance and blood profile of Noiler chickens fed diets containing graded levels of Parkia biglobosa leaf meal Food Research 6 (5): 256 - 265

AOAC (1999). Official methods of Analysis, 7th Edition. *Association of Analytical Chemists, Washington DC.*

Aya, V. E., Ayanwale, B. A., Ijaiya, A. T. and Aremu, A. (2013). Haematological and serum biochemistry indices of broiler chickens fed rumen filtrate fermented palm kernel meal-based diet. Proceedings of the 18th *Annual Conference of Animal Science Association of Nigeria*, 329.

Bal Bhandari, 2019. Crop residue as animal feed DOI: 10.13140/RG.2.2.20372.04486.

Bello, A.W. and Tsado, D.N. (2013). Haematological and biochemical profile of growing Yankasa rams fed sorghum stover supplemented with graded levels of dried poultry droppings-based diets. *Pakistan Journal of Biological Science*, 15, 16 (24):1922- 1928.

Bishnu et al. Antioxidant activities, polyphenol, flavonoid, and amino acid contents in peanut shell J. *Saudi Soc. Agric. Sci*. (2018).

Blair, R., (2008). Nutrition and feeding of organic poultry. Cabi Series, CABI, Wallingford, UK

Clifford, G.R. and Briggs, H. (2007). Hematologic and Biochemical *Reference Intervals for Mountain Goats (Oreamnos americanus): Effects of Capture Conditions. North West Science,* 81 (3): 206 – 214.

degradation parameters (2013).

Domesticus, G and Rajshahi, L. F. (2013). Haematological and Biochemical Profiles of Gallus Indenous, Exotic and Hybrid Chicken Breeds (*Gallus Domesticus*) Bangladesh. *Bangladesh Journal of Zoology*, *41*(2), 135–144.

Donkoh, A.; Nyannor, E. K. D.; Asafu-Adjaye, A.; Duah, J., 2003. Ground maize cob as a dietary ingredient for broiler chickens in the *tropics. J. Anim. Feed Sci*., 12 (1): 153-161.

Duwa, H., Saleh, B., Lamido, M and Saidu, A. (2014). Growth Haematological and Serum Biochemical Indices of Broiler Chickens Fed Banana Peel Meal as Replacement for Maize in the Semi-Arid Zone of Nigeria, *Nigerian Journal of Animal Production*, *4*(5), 121–126.

Etim, N. N., Williams, M. E., Enyenihi, G. E., Udo, M. D. and Offiong, E. E. A. (2013). Haematological parameters: indicators of the physiological status of farm animals. *British Journal of Science,* 10(1): 33-45

Etuk, E. B., Opara, M. N., Okeudo, N. J., Esonu, B. O. and Udedibie, A. B. I. (2012). Haematological

and Serum Biochemical Parameters of Local Turkey Poults Fed Diets Containing Two Varieties of Sorghum. *Journal of Poultry Science*, *2*(4), 81–89.

Ewuola, E. O.; Gbore, F. A.; Ogunlade, J. T.; Bandyopadhyay, R.; Niezen, J.; Egbunike, G. F., 2008. Physiological response of rabbit bucks to dietary fumonisin: performance, haematology and serum biochemistry. Mycopathologia, 165 (2): 99-104

FAO. 2013. State of food insecurity in the world: The multiple dimensions of food security. Rom

FAO. 2022. Handbook on the integrated crop management of groundnut and sesame for farmer field schools in central dry zone of Myanmar. Nay Pyi Taw.

Food and Agricultural Organization of the United Nations (FAO). 1984. Structure and Characteristics of the World White Maize Economy.

Food and Agricultural Organization of the United Nations [FAO], (2006). *Poultry review – Ghana*: The structure and importance of the commercial and village-based poultry in Ghana, by K.G. Aning. Final review report. Rome.

Garacyk, S., Pliszozackrol, A., Kotonski, B., Wilczek, J. and Chimelak, Z. (2003). Examination of haematological and metabolic changes mechanism of acute stress in turkeys.

Gernsten, T. (2009). Medline Plus Medical Encyclopedia: RBC Indices. *Available at: en.wikipedia.org/wiki/red blood cell indices.*

Gramb, M., Uchechi, I.J., Kehinde, A.N., Bala, A.S. and Onimisi, R.A. (2011). Haematological and serum biochemical indices of growing rabbits fed camel blood rumen content mixture. *Journal of Research Opinions in Animal and Veterinary Sciences*,1 (1):44-47.

Havenstein GB, Ferket PR, Scheideler SE, Larson BT. Growth, livability, and feed conversion of 1957 vs 1991 broilers when fed "Typical" 1957 and 1991 broiler diets. *Poultry Science* 1994a; 73:1785-1794.

Heise *et.al.* 2015. The poultry market in Nigeria: Market structures and potential for investment in the market. *International Food and Agribusiness Management Review* 18: 197-222.

Heuzé V., Tran G., Lebas F., 2017. Maize grain. Feedipedia, a programme by INRAE, CIRAD, AFZ and FAO. https://www.feedipedia.org/node/556 Last updated on September 7, 2017, 14:29.

Huff G., Huff N., Ruth N., Anthony N., Nestork. Effects of Escherichia coli challenge and transport stress

Ibrahim, A., Thnaian, A. and Elbahr, S. M. (2012). Investigation of Selected Biochemical Parameters of Local Chicken with Different Age and Sex in Ala-Ahasa, Saudi Arabia. *Pakistan Journal of Biological Sciences*, *15*(7), 827–832.

Iji, P.A., Toghyani, M., Ahiwe, E.U. and Omede, A.A. (Eds.) (2017). Alternative sources of protein for poultry nutrition. Cambridge, *United Kingdom: Burleigh Dodds Science Publishing Limited.* https:// doi.org/10.19103/as.2016.0011.13

In Vivo. Journal Farmasi Galenika (Galenika Journal of Pharmacy). 5(1):12-19.

Irabor, A. E., Ekelemu, J. K., Ekokotu, P. A., Obakanurhe, O. and Adeleke, M. L. (2022). Groundnut shell meal as a partial replacement for maize in diets of Clarias gariepinus juveniles. *International Journal of Agricultural Technology* 18(5):1995-2008.

Isaac, L. J., Abah, G., Akpan, B. and Ekaette, I. U. (2013). Haematological properties of different breeds and sexes of rabbits. *Proc. of the 18th Annual Conf. of Anim. Sci. Assoc*.

Jain, N.C. (1986): Schalm's Veterinary Haematology, 4th ed., Lee and Febiger, Phladeliphia.

Liu, Y., Lyon, B., G., Windham, W. R., Lyon., C. E., Savage, E. M. 2004. Prediction of physical, color, and sensory. characteristics of broiler breasts by visible/near infrared reflectance spectroscopy. *Poultry Science*, vol. 83, no. 8, p. 1467-1474. PMid: 153390271.

Longe, O. G.; Ogedegbe, N. E.E., 1989. Influence of fibre on metabolisable energy of diet and performance of growing pullets in the tropics. Br. *Poult. Sci.,* 30 (1): 193-196.

Meluzzi, A., Primiceri, G., Giordani, R. A., and Fabris, G. (1992). Determination of Blood Constituents Reference Values in Broilers. *Poultry Science*. *71*(34), 337–345

Merck Manual (2012). Haematologic reference ranges. Mareck Veterinary Manual. Retrieved from http://www.merckmanuals.com.

Mézes, M.; Balogh, K., 2009. Mycotoxins in rabbit feed: A review. World Rabbit Science, 17 (2): 53-62
Minka, N.S. and Ayo, J.O. (2007). Physiological responses of transported goats treated with ascorbic acid during the hot-dry season. *Animal Science Journal*, 78:164-172.
Mmereole, F. U. C. (2008). The Effects of Replacing Groundnut Cake with Rubber Seed Mealon the Haematological and Serological Indices of Broilers. *International Journal of Poultry Science,* 7(6), 622-624.
Mokolopi B.G. Groundnut Shells as a Potential Feed Supplement for Ruminants on Pastures: A *Review.Indian Journal of Animal Research.*2022. (56):521-524
National Centre for Energy Research and Developmen [NCERD]. (2000). Raising healthier: Nigeria. National Centre for Energy Research and Development, University of Nigeria, Nsukka, Nigeria. Reports of UNISPAR/UNESCO sponsored projects 9: 70-76.
Nguyen, Q.C. and Tran, P. T. T. (2003). Study on Some Biological Characteristics of Local Chicken Breeds. *Special Scientific Papers, Vietnam, Nien Vietnam. 2*(1), 24–34.
NseAbasi N. Etim, Mary E. Williams, Uduak Akpabio, & Edem E. A. Offiong. (2014), Haematological Parameters and Factors Affecting Their Values. Volume 2.
Nwosu C. I and Igugo R.U. (2019). Serum Biochemistry of Broiler Chickens Fed Varying Levels of Cassava Peel Meal Supplemented with Exogenous Enzyme (Natuzyme) as Replacement for Maize. *International Journal of Science and Research* (IJSR) Volume 9 Issue 7.
Obikaonu, H. O., Okoli, I. C., Opara, M. N., Okoro, V. M. O., Ogbuewu, I. P., Etuk, E. B and Udedibie, B. I. (2011). Haematological and Serum Biochemical Indices of Starter Broilers Fed Neem (*Azadirachta Indica)* Leaf Meal. *Journal of Agriculture and Environmental Science 1(4), 150-54.*
OECD/FAO (2016), "Agriculture in Sub-Saharan Africa: Prospects and challenges for the next decade", in OECD-FAO Agricultural Outlook 2016-2025, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/agr_outlook-2016-5-en.
Ogunbajo, S. O., Alemede, I. C., Adama, J. Y., & Abdullahi, J. (2009). Haematological parameters of Savannah brown do feed varying dietary levels of flamboyant tree seed meal (p. 88-91). *Proceedings of 34th Annual Conference of Nigerian Society for Animal* Production.
Oke, U. K., Herbert, U., Ebuzoeme, C. O. and Nwachukwu, E. N. (2007). Effect of genotype on the haematology of of Nigerian local chickens in a humid tropical environment. *Proc. of 32nd Annual Conf. Nigeria. Soc. for Animal production.*
Olabanji, R. O., Farinu, G. O., Akinlade, J. A. and Ojebiyi, O. O. (2007). Growth performance and haematological characteristics of weaner rabbits fed cyanide in processed cassava peels meals haematology and biochemical indices of growing rabbits. *Proc. of 35th annual conf.*
Olafadehan, O. A., Oluwafemi, R. A., & Alagbe, J. O. (2020). Carcass quality, nutrient retention and caeca microbial population of broiler chicks administered Rolfe (Daniellia oliveri) leaf extract as an antibiotic alternative. *Journal of Drug Discovery,* 14(33), 146-154.
Olafedehan, C. O., Obun, A. M., Yusuf, M. K., Adewumi, O. O., Oladefedehan, A. O., Awofolaji, A. O., & Adeniji, A. A. (2010). Effects of residual cyanide in processed cassava peal meals on haematological and biochemical indices of growing rabbits (p.212). *Proceedings of 35th Annual Conference of Nigerian Society for Animal Production.*
Olajide R, Akinsoyinu AO, Afolabi KD, Owosibo AO, Fakolade PO and SB Akinleye (2009) Digestibility of nutrients by hybro broilers as affected by contents of anti-nutritional factors in wild cocoyam corm-based diets. *Proceedings of 14th Annual Conference of Animal Science Association of Nigeria, Ogbomoso, Nigeria*.
Onyeyili, P. A., Egwu, G. O., Jibike, G. I., Pepple, D. J., & Ohaegbulam, J. O. (1992). Seasonal variation in haematological indices in the grey-breasted guinea fowl (Numidamealagris Gallata pallas). *Nigerian Journal of Animal Production,* 18(2), 108-110.
Ovuru, S. S., & Ekweozor, I. K. E. (2004). Haematological changes associated with crude oilingestion in experimental rabbits. *African Journal of Biotechnology,* 3(6), 346-348
Owosibo, A. O., Odetola, O. M., Odunsi, O. O., Lawrence-Azua, O. O. (2013). Growth, Haematology and Serum Biochemistry of Broilers fed Probiotics Based Diets. *African*

Journal of Agriculture, *8*(41), 5076–5081. http://doi.org/10.5897/AJAR2013.7593.

Pan (2017). History of the poultry association of Nigeria. *Poultry Association of Nigeria*, Abuja.

Pham Anh Duc, P. Dharanipriya, Bharath Kumar Velmurugan, M. Shanmugavadivu, Groundnut shell -a beneficial bio-waste, Biocatalysis and Agricultural Biotechnology,Volume20,2019,101206,ISSN18788181.https://www.feedipedia.org/node/6374 https://doi.org/10.1016/j.bcab.2019.101206.

Polat, U., Yesilbag, D. and Eren, M. (2011). Serum Biochemical Profile of Broiler Chickens Fed Diets Containing Rosemary and Rosemary Volatile Oil. *International Journal of Poultry Science. 5*(13), 23–30.

Retiman, S. and Frankel, S. (1957): Determination of serum glutamic oxaloacetic and glutamic pyruvic transaminase. Am. J. Clin. Path.,28:56.

Santos Schmidt Em, Paulo AC, Martins GRV, Lapera IM, Test AIP, Junior LN, et al. Hematology of the bronze turkey (Meleagris gallopavo): variations with age and gender. *International journal of poultry science 2009*; 8(8): 752-754.science2008;87(11): 2234-224

Sauvant, D.; Perez, J. M.; Tran, G., (2004). Tables INRA-AFZ de composition et de valeur nutritive des matières premières destinées aux animaux d'élevage: 2ème édition. ISBN 2738011586, 306 p. INRA Editions Versailles.

Talebi A., Asri-Rezaei S., Rozeh-Chai, S. R. (2005). Comparatative Studies on Haematological Values of Broiler Strains (Ross, Cobb, Arbor-Acres and Arian). *International Journal of Poultry Science,4(2), 573-579.*

Tanimo, H.A.A., Oshibanjo, D.O., Adelowo, V.O., Akwashiki, M.A., Azi, I.W., James, O.C., Haruna, S. and Sunday, A.Y. (2020). Growth Performance, Carcass Characteristics and Heamatology Indices of Broiler Chicken Fed Graded Levels of Mango (Mangifera indica) Leaf Meal. Asian Journal of Research in Animal and Veterinary Sciences, 6(2), 20–27.

Togun, V. A., Oseni, B. S. A., Ogundipe, J. A., Arewa, T. R., Hammed, A. A., Ajonijebu, D.C. Mustapha, F. (2007). Effects of chronic lead administration on the haematologicalparameters of rabbits – a preliminary study (p. 341). *Proceedings of the 41st Conferences ofthe Agricultural Society of Nigeria.*

Wadhera D, Capaldi-Phillips ED(2014). A review of visual cues associated with food acceptance and consumption. Eat Beh.

WorldoMeter. (2020). Real Time World Statistics. Current World Population. Retrieved on December 24, 2022 from WorldoMeter website: https:// www.worldometers.info/world-population/ #:~:text=World%20Population%20Clock%3A%207.96%20Billion%20People%20(2022)%20%2D% 20Worldometer

Yakubu, A., Gwaska, J. A. and Salako, A. E. (2009). Strain and Placement Density Effects on Welfare, Haematological and Serum Biochemical Indices of Broilers in North Central Nigeria. *Acta Agiculturae Slovenica*, 94(2) 153-158.

Yanti and Yayota, (2017). *Reviews in Agricultural Science,* 5:65-76, 2017http://dx.doi.org/10.7831/ras.5.6

Zheng W. *et al.* Evaluation of a classification method for biodegradable solid waste using anaerobic