EFFECT OF REPLACING MAIZE WITH DIFFERENT FIBRE SOURCES IN THE DIET OF BROILER CHICKENS

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Abstract
A feeding trial was conducted using eighty (80) day-old broiler chicks (Marshal Breed) and they were assigned to four treatments of two replicates each in a completely randomized design. The study which lasted for eight weeks was undertaken to investigate the comparative advantages of cereal offal [maize offal (MO), sorghum offal (SO), and sorghum brewer dried grains (SBDG)] as a replacement for maize grain (MG) in the diet of broiler chickens. There were no significant differences (P>0.05) among the body weights. Birds fed sorghum offal (SO) attained the highest weight gain (2.4kg), followed by maize offal (2.3kg) and maize grain (2.15kg). The lowest weight gain was recorded on birds fed the diet containing SBDG. The birds gained weights indicate that the intake of energy and proteins were well above maintenance requirements. The best (1.10) feed conversion ratio was recorded in birds fed sorghum offal based diet followed by those on maize offal based diet (1.13). The financial analysis revealed that total feed cost was low with higher gross profits for birds on sorghum offal and maize offal based diets. It was concluded that sorghum offal and maize offal have potential in effectively replacing maize as a source of energy without any adverse effects on the performance broiler chickens

Key words: broiler chickens, performance, carcass characteristics, fibre sources

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1. INTRODUCTION

It is no more gainsay that maize is the major source of energy in poultry diets especially in developing countries. In fact, it makes up approximately 65 to 70% of the poultry diet (Mutetwa, 1996). The use of maize in poultry feeding is however, limited because of the competition for it by man, the beverage industries and livestock industry (Iji, 2010). This is a serious problem in Nigeria because of poor yield of maize. FMA&WR (2008) reported the potential yield of maize as 8 tons/hectare, while the average yield is 3.8 tons/ha. This has resulted in shortage of the grains resulting in the present increase in price. This problem, if not addressed, may result in lower income to poultry farmers and reduced animal protein intake of Nigerians. This situation has compelled animal nutritionists to intensify research on alternative feedstuffs which are cheaper and readily available. Presently, there is no doubt that agricultural extraction industries turn out large quantity of by-products annually which may have nutritive potentials as animal feedstuffs. A large proportion of cereals (maize, sorghum grains) are processed by breweries and flour industry with a resultant increase in the output of their by-products. These by-products are not directly utilizable by humans; therefore, the possibility of converting them into cheap and wholesome animal products could be exploited. Cheeke (1999) then recommended that further research into the nutritive content of feed and by-products is needed to develop efficient feeding system for poultry birds.

However, while there is documentary evidence for the utilization or possibility of utilizing maize and sorghum grains as feedstuffs for monogastric animals (Luis, 2000 and Uko *et al*., 1999), there is little of similar report on the use of their by-products. It is on the above that this research is tailored towards comparing the effects of different fibre sources (maize offal, sorghum offal and sorghum brewers dried grain) on the performance of broiler chickens.

2. MATERIALS AND METHODS

Experimental Location

This experiment was conducted at the Poultry Unit of the Ibrahim Badamasi Babangida University Teaching and Research Farm, Lapai, Niger State. Lapai is very close to Minna (State capital), which lies between Latitude 9.31^0 and 9.45^0, east of the equator (Usman, 2013). The area falls within the Southern Guinea Savannah Vegetation Zone of Nigeria with mean annual rainfall between 1100 – 1600mm and a mean temperature between 21^0C and 36.5^0C (Usman, 2013).

Source and Processing of Feed Ingredients

Fish meal, blood meal, bone meal, limestone, salt, premix, lysine, methionine and groundnut cake were purchased from Minna, Niger State. Maize was obtained from Lapai market. Test ingredients (Maize offal, sorghum offal and sorghum brewer dried grains were obtained from Lapai and its environs.

Proximate Analyses

Nutrient contents of the test ingredients were analyzed on dry matter basis (DM), and these are moisture, crude protein, crude fibre, ash, ether extract and nitrogen free extract (NFE).

Determination of moisture

2 grams of each test ingredient was weighed in duplicates into different Petri dishes and dried in an oven overnight for 12 hours at 105^{o}C using the method described by Osborne and Voogt (1978). The samples were cooled in desiccators, weighed and the average dry matter content was calculated and expressed in percentages.

Determination of crude protein using Micro-Kjeldhal Method

A gram of maize offal was placed into a 100cm^3 Kjeldhal digestion flask. A selenium catalyst tablet and 10cm^3 of H_2SO_4 were added into the flask, and the mixture was boiled until frothing ceased and the digested sample became clear. The content in the flask was cooled to room temperature. Then, 10ml aliquot solution, 20ml of 40% NaOH solution and distilled water (filled to mark) were added into a distillation flask (50cm^2) containing the digested sample and steamed distilled. The ammonia liberated was collected over 50ml 4% Boric acid-mixed indicator solution, cooled and titrated with standard 0.01N H_2SO_4 solution to obtain nitrogen content. Crude protein was then calculated by multiplying the percentage nitrogen obtained by a factor (6.25) according to A.O.A.C. (1995). That is: %CP = %Nitrogen x 6.25. The procedure was carried out for the remaining test ingredients (sorghum offal and sorghum brewer dried grains).

Determination of total ash

Total ash was determined by incineration of 2 grams of each test material in a crucible placed in a Muffle furnace at 550^{o}C for 4 hours according to Pearson (1976). The residue was weighed and expressed as percentage total ash content.

Determination of crude fibre

2 grams of each test ingredient was put in a conical flask of 1 litre capacity as W_0, and 200ml of 1.25% H_2SO_4 was added to each sample and boiled for 30 minutes. Each mixture was filtered through a muslin cloth stretched over a 9cm Buchner funnel and rinsed well with hot distilled water. Each filtered material (residue) was scraped (using spatula) into a 50cm^3 round bottom flask, and was added 200ml of 1.25% NaOH, allowed to boil gently for 30 minutes, filtered and the residue washed with hot distilled water. Then each residue was rinsed once with 10% HCL, twice with industrial methylated spirit, and thrice with petroleum ether (boiling point of 40-60^{o}C). After each residue was allowed to drain dry, it was then scraped into a crucible and later dried overnight in a hot air oven at 105^{o}C. It was cooled in desiccators and weighed as W_1, ashed at 550^{o}C for 90 minutes in a Muffle furnace, and finally cooled in desiccators and weighed as W_2. Percentage crude fibre was calculated as:

$$\%\ Crude\ fibre = \frac{100(W1 - W2)}{W0}$$

Determination of lipid by Soxhlet extraction method

2 grams of each test ingredient in duplicates were weighed into porous thimble blocked clean white cotton wool free of fat. This was

placed in an extraction chamber, which was weighed receiving flask containing 200ml petroleum ether and below is a condenser. Extraction was done for six hours, the thimble was carefully removed, and the petroleum ether was collected in the top container. After the extraction, the receiving flask was disconnected from water bath when it was almost free of the reagent, oven dried at 105^{o}C for 30 minutes, cooled in desiccators and weighed.

Experimental Birds and Management

Eighty (80) day-old broiler (Marshal) chicks, obtained from Bachelor Chicks, Ibadan, were used for the experiment. They were assigned to four treatments of two replicates each in a completely randomized design (CRD). Prior to the arrival of the chicks, all necessary scrubbing, cleaning and disinfecting of the pen with Dettol solution were carried out. The floor of the pen was well littered with fresh wood shavings. The Chicks were brooded in deep litter using charcoal and chargeable lamps as source of heat and light respectively. The birds were housed in an open-sided, dwarf walled pen for a period of eight weeks. Normal routine and management practices as outlined for the tropics by Oluyemi and Roberts (2000) were put to use during the study. Anti-stress (glucose) was given on arrival. The birds were allowed access to experimental diets, and fresh and clean water which were supplied *ad libitum*. Embazin Forte® and antibiotics were administered in water and all the vaccines (Lasota and Gumboro) were administered as and when due. Vitalyte® (anti-stress) was administered to the birds after every vaccination and weighing. Feed intake and the body weight gain of the birds were recorded on weekly basis throughout the period of trial. Feed conversion ratio and feed cost per kg gain weight gain were calculated.

Determination of Nitrogen Free Extract (NFE)

This was determined by subtracting the sum of crude protein, crude lipid, crude fibre and ash from 100% (A.O.A.C., 1995).

That is:

% NFE = 100 – (%crude protein + %crude lipid + %crude fibre + %ash)

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Experimental Diets

Four diets were compounded using different fibre sources to replace maize as source of energy at 100% level of replacement. Palm oil was added to the diets containing the offals to improve their energy level. Diet 1 contained maize grain (MG) and served as control, Diet 2 contained maize offal (MO), Diet 3 contained sorghum offal (SO) and Diet 4 contained sorghum brewer dried grain (SBDG). These were formulated in such a way to contain 24.52% CP and 3004.54 kcal/kg ME, for the starter diets (Table 1), and 20.62% CP and 2917.04 kcal/kg ME for finisher diets (Table 2).

Data Collection

Feed intake was carried out on weekly basis. It was the total amount of feed consumed by the birds within the week and it is given as; Feed offered (kg) – left over (kg)

Body weight gain: The birds were weighed on weekly basis. The initial weight was subtracted from the final weight to get the body weight gain.

Feed conversion ratio was calculated at the end of each week as:

$$\text{Feed conversion ratio} = \frac{\text{feed consumed (g)}}{\text{weight gained by birds (g)}}$$

Carcass evaluation:

This was carried out at the end of the experiment. Two birds per replicate were randomly selected, starved (of water) overnight and slaughtered by severing the jugular vein with a knife. The dead birds were immersed in warm water to pluck the feathers manually. Each bird was cut into parts and the visceral removed carefully. The visceral organs (Liver, spleen, kidney, heart, gizzard, abdominal fat, and pancreas) and cut up parts (breast, back, drum sticks, thighs and wings) were weighed.

Economic Analysis

Veterinary care and miscellaneous (variable cost): This was calculated as the total amount of money spent on vaccines, drugs, day old chick and other expenses divided by the number of the birds. Average body weight (kg): This was the final body weight of the birds before slaughtering.

TABLE 1: Composition of experimental broiler starter diets

Ingredient (%)	MG	MO	SO	SBDG
Maize grain	51.51	-	-	-
Maize offal	-	51.51	-	-
Sorghum offal	-	-	51.51	-
Sorghum brewer dried grain	-	-	-	51.51
Groundnut cake	37.29	37.29	37.29	37.29
Fish meal	5.00	5.00	5.00	5.00
Bone meal	2.50	2.50	2.50	2.50
Palm oil	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
***Premix**	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated values:				
Crude protein (%)	24.52	24.50	24.60	24.40
ME (kcal/kg)	3004.54	3003.60	3002.70	3002.10

*Flomix Mineral-Vitamin premixes of 0.25kg contains vitamin A 10,00mg, Vitamin D3, 2,000mg, Vitamin B1 500mg, Vitamin B2 5,000mg, Vitamin B6 300mg, Vitamin B12 10,000mg, Pantothenic Acid 10,000mg, Niacin 25,000mg, Folic Acid 1,000mg, Biotin 100,000mcg, Choline 150,000mg, Antioxidant 125,000mg and minerals such as Manganese 10,000mg, Zinc 50,000mg, Cobalt 250mg, Iron 40,000mg, Copper 6,000mg, Iodine 500mg and Selenium 100mg.
MG: Maize grain, MO: Maize offal, SO: Sorghum offal, SBDG: Sorghum brewer dried grain, ME: Metabolizable energy

TABLE 2: Composition of experimental broiler finisher diets

Ingredient (%)	MG	MO	SO	SBDG
Maize grain	54.40	-	-	-
Maize offal	-	54.40	-	-
Sorghum offal	-	-	54.40	-
Sorghum brewer dried grain	-	-	-	54.40
Wheat offal	10.50	10.50	10.50	10.50
Groundnut cake	26.40	26.40	26.40	26.40
Fish meal	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00
Palm oil	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
***Premix**	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated values:				
Crude protein (%)	20.62	20.65	20.06	20.11
ME (kcal/kg)	2977.50	2900.00	2980.00	2870.00

***Flomix Mineral-Vitamin premixes of 0.25kg contains vitamin A 10,00mg, Vitamin D3, 2,000mg, Vitamin B1 500mg, Vitamin B2 5,000mg, Vitamin B6 300mg, Vitamin B12 10,000mg, Pantothenic Acid 10,000mg, Niacin 25,000mg, Folic Acid 1,000mg, Biotin 100,000mcg, Choline 150,000mg, Antioxidant 125,000mg and minerals such as Manganese 10,000mg, Zinc 50,000mg, Cobalt 250mg, Iron 40,000mg, Copper 6,000mg, Iodine 500mg and Selenium
MG: Maize grain, MO: Maize offal, SO: Sorghum offal, SBDG: Sorghum brewer dried grain, ME: Metabolizable energy

Price per feed: This was calculated by taking into consideration the individual ingredients used in compounding the diet. This is calculated by:
Price per (kg) feed = cost per (kg) of the diet

Total investment: was the total amount of money spent during the cause of production.
Gross returns: this was the live weight gain multiply by the price of chicken per kg.

Gross profit: this was the profit realized after the sales of the bird. It is given as gross return - to tal investment.
Benefit cost ratio: was the ratio of the gross profit and total investment.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA), according to the procedures of Steel and Torrie (1980). Differences in treatment means were compared using Duncan Multiple Range Test (Duncan, 1955).

3. RESULTS AND DISCUSSION

Proximate composition of the test ingredients

The proximate compositions of the test ingredients were shown in Table 3. The crude protein of sorghum brewer dried grain (7.25%) was lower than those of sorghum offal (12.88%) and maize offal (13.70%). Sorghum brewer dried grains was higher in crude fibre (12.80%), than sorghum offal (8.70%) and maize offal (7.80%). The crude fibre content of sorghum brewer dried grains (12.80%) is higher than the value (9.45%) reported by Olupona *et al*. (2002), but approximately similar to the value (13%) reported by Uchegbu and Udedibie (1998). Maize offal had the highest NFE value (61.80%), followed by sorghum offal (56.02%), then sorghum brewer dried grain having the least (40.37%). This conforms to the report of Olomu (2011), who stated that maize and sorghum are good energy sources.

Performance characteristics of broiler chickens fed test ingredient.

Growth performance of the broiler chickens was presented in Table 4. Birds fed sorghum offal (SO) recorded the highest body weight gain (2.40kg), followed by those fed maize offal (2.30kg) and birds on the control diet (2.15kg), while the least (1.85kg) was recorded in those fed sorghum brewery dried grain (SBDG). The least live weight recorded in Treatment 4 (SBDG) is in agreement with the report of Ajaja *et al*. (2002) who stated that birds fed sorghum brewer dried grains had decreased weight gain. However, there were no significant (P>0.05) differences among the treatment means. This is in line with the reports of Verma *et al.* (2001) and Edwin *et al.* (2002) who reported no significant (P>0.05) differences among treatment means of the experimental birds. There were significant (P<0.05) differences in the dressed weight (2.00kg) and the eviscerated weight (1.89kg) of birds fed Diet 3 while those fed Diet 4 recorded the lowest (1.6kg and 1.54kg respectively). This agreed with the concept that broiler chickens eat more to satisfy their energy needs (Smith, 2001). There was no significant difference (P>0.05) in the feed intake of the broiler birds. The weekly weight gain of the broilers was better in Diet 3 compared to other treatments. The feed conversion ratio of the broiler chicken was at the best (1.10) in those fed sorghum offal, followed by those fed maize offal (1.13) and control (1.17), while the least (1.50) was recorded in SBDG. FCR also showed no significant (P>0.05) differences. These findings were in close agreement with the reports of Edwin *et al.* (2002), Tornekar *et al.* (2009) and Ravinder *et al.* (2011), but in contrast to the report by Ironkwe *et al*. (2012) that there were significant differences in the FCR of broiler chickens fed cereal offals.

TABLE 3: Proximate composition of the test ingredients

Parameter (%)	Maize offal (MO)	Sorghum offal (SO)	Sorghum brewer dried grain (SBDG)
Dry matter	93.60	92.40	93.50
Ash	6.30	6.50	16.00
Crude protein	13.70	12.88	7.25
Crude fibre	7.80	8.70	12.80
Fat	5.10	8.30	13.73
NFE	67.10	63.62	50.22

TABLE 4: Growth performance of broiler chickens fed test ingredient.

Parameter	MG	MO	SO	SBDG	±SEM
Initial weight (g)	50.00	50.00	50.00	50.00	-
Final weight (kg)	2.15	2.30	2.40	1.85	-
Dressed weight (kg)	1.90[a]	1.93[a]	2.00[a]	1.64[b]	0.04
Eviscerated weight (kg)	1.80[a]	1.81[a]	1.89[a]	1.54[b]	0.04
Weekly body weight gain (kg)	1.124	1.176	1.207	1.02	0.26
Weekly feed intake (kg)	0.625	0.625	0.623	0.608	0.12
FCR	1.17	1.13	1.10	1.50	0.22
Mortality (%)	-	5	-	10	-

MG: Maize grain, MO: Maize offal, SO: Sorghum offal, SBDG: Sorghum brewer dried grain, FCR: Feed conversion ratio

TABLE 5: Cut-up parts of broiler chickens fed test ingredients

Cutup part (%)	MG	MO	SO	SBDG	± SEM
Head	0.80	0.75	0.70	0.88	1.10
Neck	6.10	5.60	5.55	6.98	2.49
Wings	5.99	5.95	5.65	7.02	1.32
Drumsticks	8.64	10.82	10.70	6.95	47.30
Thigh	8.69	11.05	10.75	10.08	53.31
Back	16.64	13.65	15.70	13.15	39.03
Breast	17.97	16.41	18.25	16.17	32.38
Shank	0.66	0.65	0.61	0.83	0.88

MG: Maize grain, MO: Maize offal, SO: Sorghum offal, SBDG: Sorghum brewer dried grain

TABLE 6: Visceral organs of broiler chickens fed test ingredients

Visceral organ (%)	MG	MO	SO	SBDG	± SEM
Liver	0.74	0.81	0.73	0.95	0.78
Kidney	0.58	0.60	0.60	0.70	2.01
Heart	0.27	0.29	0.35	0.37	0.80
Spleen	0.27	0.26	0.15	0.31	0.58
Pancreas	0.17	0.26	0.25	0.28	0.58
Gizzard	0.6.5	0.64	0.65	0.73	1.00
Abdominal fat	0.80	0.72	0.74	0.72	1.37
Proventiculus	0.34	0.47	0.38	0.49	1.93
Intestine	6.15	5.88	5.70	6.86	1.59

MG: Maize grain, MO: Maize offal, SO: Sorghum offal, SBDG: Sorghum brewer dried grain

TABLE 7: Cost benefit for broiler chickens fed cereal offals as replacement for maize

Parameters	MG	MO	SO	SBDG
Cost of day old chick (₦)	200.00	200.00	200.00	200.00
Final weight gain (kg)	2.15	2.30	2.40	1.85
Cost of feed (₦/kg)	94.53	89.20	86.13	92.49
Total feed consumed (kg)	5.00	5.04	4.98	5.21
Total cost of feed consumed (₦)	472.65	449.57	428.93	481.87
Variable cost (₦)	252.50	252.50	252.50	252.50
Total investment (₦)	925.15	902.07	881.43	934.37
Cost of bird /kg (₦)	1000.00	1000.00	1000.00	1000.00
Gross return (₦)	2150.00	2300.00	2400.00	1850.00
Gross profit (₦)	1224.85	1397.93	1518.57	915.63

MG: Maize grain, MO: Maize offal, SO: Sorghum offal, SBDG: Sorghum brewer dried grain

Carcass characteristics of broiler chickens fed test ingredients.

Table 5 showed no significant (P>0.05) differences on all the cut-up parts (% dressed weight) examined. Proportions of the breast, drumsticks and thigh were higher for birds fed sorghum offal than those fed control diet while reverse is the case of the back and wings. The highest proportions for shank and wings were recorded in Diet 4. Proportions of the visceral organs which were presented in Table 6, showed no significant (P>0.05) differences also. The proportions of all the visceral organs were at the highest in birds fed SBDG except in the abdominal fat where birds fed control diet had the highest (0.80%).

Cost benefit for broiler chickens fed test ingredients.

The cost of feed per kg was lower in sorghum offal diets (diet 3), accompanied by maize offal (diet 2). Better gross returns and profit were achieved also in birds fed Sorghum offal (SO), followed by those fed Maize offal (MO), indicating that 100% replacement level of sorghum offal and maize offal are superior, cheaper and more economical than maize. This agreed with the report of Edache *et al*. (2005) who stated that the highest total weight gain, best feed/gain ratio and lowest feed cost per kilograms were recorded on sorghum offal diet.

4. CONCLUSION

Based on this study, it can be concluded that sorghum and maize offal by-products from local milling industries, can be used to replace maize grain at 100% in situation of acute shortage of maize without any depression on growth performance, carcass characteristics and feed utilization. To reduce the stiff competition for maize grains among human, brewery industries and non-ruminant animals (broiler chickens), it is therefore recommended that maize offal and sorghum offal can replace maize grains as source of energy in the diets of broiler chickens.

STATEMENT OF ANIMAL RIGHTS

We declare that the experiments on animals were conducted in accordance with in force laws and regulations as regards care and use of laboratory animals.

We declare that the principles of ethics in research on animals were fully fulfilled.

5. REFERENCES

[1]. Mutetwa, L.R. The Utilization of Millet as a substitute for maize in cereal-based broiler diets. M.Sc. Thesis, University of Zimbabwe, 1996.

[2]. Iji, P.A. Alternative Feed Ingredients to meet the Present Environmental Challenges: Lessons from Other Parts of the World. *Nigeria Poultry Science J. 6; 5, 2010*.

[3]. F. M. A. & W.R. Federal Ministry of Agriculture and Water Resources National Policy on Agriculture for National Food Security, 2008.

[4]. Cheeke, P.R. Editorial: The potential role of Rabbit in meeting World Food Need. *Journal of Applied Rabbit Research*. 36: 3 – 5, 1999.

[5]. Luis E.S. Nutrient composition and feeding value of millets, sorghum grains and corn in poultry diets. Ph.D. Dissertation, University of Nebraska, Lincoln, 2000.

[6]. Uko, O.J., Ataji, A.M. and Tanko, H.B. Response of rabbits to cereal by- products as energy source in diets. *Archivos de Zootecnia.*1999, 48: 285 – 294.

[7]. [7] Usman, B.A. Vulnerability and adaptation capability of rural poor to climate change. Effect in Kwara State, Nigeria. *Lapai Sociological Review*, 2013, 4(1): 142 – 162.

[8]. Osborne, D.R. and P. Voogt. The Analysis of Nutrients in Foods. Food Science and Technology Series. London, New York, Academic Press, 1978.

[9]. A.O.A.C. Association of Analytical Chemist. Official Methods of Analysis of the 16th edition, Washington DC. 1995.

[10]. Pearson, D. The Chemical Analysis of Foods (7th edn.). Churchill, Livingstone, London. 1976.

[11]. Oluyemi, J.A. and Roberts, F.A. Poultry Production in Warm Wet Climates. Macmillan Publication Ltd. London. 2nd Edition, 2000.

[12]. Steel R.G.D. and Torrie J.H. Principles and Procedures of Statistics. A biometrical approach. Mc. Graw-Hill Book Company Inc. New York. 1980.

[13]. Duncan, D.B. Multiple Range and F-test. *Biometrics*. 1955, 11: 1 – 42.

[14]. Olupona, J. A., J. A. Abodunwa, O. O. Adejinmi, F. O. Ogunleke and J. B. Fapohunda Performance of rabbits fed brewers' dried grains from different sources. *Proc. 27th Ann. Conf. Nig. Soc. for Anim. Prod. (NSAP).* March 17 – 21, 2002, Fed. Univ. of Tech. Akure, Nigeria.

[15]. Uchegbu, M. C. and Udedibie, A. B. I. Maize/sorghum based brewers' dried grains in

broiler finisher diets. *Nigerian Journal of Animal Production.* 1998, 25: 13-16

[16]. Olumo, J.M. *Monogastric Animal Nutrition*. Ajachem Publishers Benin City, Nigeria. 2011.

[17]. Ajaja, K., J.O. Agbede and V.A. Aletor. Replacement value of sorghum dust for maize in diets for broiler-chicks. *In processing of 2nd Annual Conference of Nigerian Society for Animal Production, March 17 – 21,* 2002, *pp. 109 – 112.*

[18]. Verma, S., Mandal, S. and Tyagi,P. Utilization of coarse cereals and byproducts of oilseed based cropping system for poultry production. Annual Report of Lead Centre, Central Avian Res. Institute. Izatnagar. 2001.

[19]. Edwin, S.C., Vishwanathan, K., Kumararaj, R. and Rangareddy, P. Effect of replacing maize with broken rice on growth performance of broilers. *Indian J. Poult. Sci*., 2002. 37(2): 187-189.

[20]. Smith, A.J. *Poultry; Tropical Agriculturalist*. 2nd edition. Macmillan educational Ltd. United Kingdom. 2001.

[21]. Tornekar, A.P., Munde, V.K. and Kokanee, S.S. Effect of replacing maize with bajra (Pearl Millet) on performance of broilers. *Vet. World*, 2009, 2(8): 310-312.

[22]. Ravinder, S., Berwal, R.S. and Sihang, Z.S. Effect of replacing maize with sorghum on the performance and utilization of nutrients in broilers. *Haryana Vet*., 2011, 50: 85-88.

[23]. Ironkwe, M.O. and Bamgbose, A.M. Effect of replacing maize with brewer's dried grain in broiler finisher diet. *Bull. Env. Pharmacol. Life Sci*., 2012, 1(6): 17- 20.

[24]. Edache, J.A., Musa U., Haruna E.S., Esilonu, J.O., Jibrin, J., Okpala, E.U. and Dogo, I.G. Replacement value of Guinea corn for maize in practical diet fed to quail (*Cortunix japonica*) chicks. *Anim. Res. Int*., 2005, 2 (27): 311 – 313.