



EFFECT OF UTILISING DIFFERENT STATE OF GRAINS FEED ON GROWTH PERFORMANCE, CARCASS AND PHYSICOCHEMICAL CHARACTERISTICS OF BROILER CHICKENS' MEAT

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ABSTRACT

This study evaluated the impact of wet and dry grain feeds (maize, wheat, millet, and guinea corn) on the performance, carcass, and meat characteristics of broiler chickens. Ninety-six (96) day old broilers were randomly assigned to four treatments, with each group consisting of 8 birds across 3 replicates. The study used a Randomized Completely Block Design (RCBD), and data were analyzed using Analysis of Variance (ANOVA) at a 5% significance level. Results showed significant differences ($P < 0.05$) in the performance of birds. Those fed maize, millet, and guinea corn had higher weight gains, with wet feed generally improving live performance. The dressing percentage was highest in birds fed maize, but no significant differences ($P > 0.05$) were found in feed form for most carcass traits, except for the back cut and breast, which were higher in birds fed wheat, millet, and guinea corn. Wet feed increased the performance of live birds, while dry feed enhanced the meat's physical properties. In terms of meat characteristics, birds fed maize had better water holding capacity, those fed wheat had higher cooking yield, and guinea corn-fed birds exhibited higher shear force. Wet feed increased moisture content in meat, while dry feed boosted protein levels. Interaction effects also showed similar trends. The study concluded that maize was best for promoting live performance, while wheat, millet, and guinea corn improved meat quality. It was recommended that maize be used for better live performance, and wheat, millet, or guinea corn in dry form for improved meat attributes.

Keywords: Broiler, meat, State, grains, performance, physicochemical

INTRODUCTION

In most developing countries there is inadequate supply of animal protein for the growing population. An average citizen of the developing countries consumes only about 8.6g of animal protein per day against 53.3g per head (Ojo, 2003). In order to bridge this huge gap between animal protein requirement and consumption ratio, poultry production has come into the resave. It was reported by Sanni and Ogundipe (2005) that poultry industry occupies a major position in the livestock sector of agricultural production because birds have faster and shorter gestation than any other farm animals and produce both eggs and meat for human consumption. Besides the provision of animal protein for the populace, poultry is considered to be a means of livelihood towards achieving certain level of economic independence (Ogundipe and Sanni, 2002). It was reported by Adegbola (2004) that 41.2% of animal protein yield per annum in Nigeria is sourced from poultry meat and eggs, 12.43% from pigs, and only 9.79% from cattle. In view of the foregoing, FAO (2006) opined that the best logical solution to Nigeria's meat scarcity is to increase broiler chicken production.

However, as promising as poultry industry is in providing solace for animal protein, the most important impediment that requires vital consideration in nutrition (Bashar *et al.*, 2010). It therefore, becomes the major interest of a farmer to reduce cost which usually accounts for 60 to 70% of the total cost of poultry production (Igwebuike *et al.*, 2001). This challenge has triggered current research efforts towards evaluation of alternative feed ingredients for poultry though they may have comparative nutritive value, but are cheaper than the conventional energy and protein sources and are available in large quantities (Atteh and Ologbenla, 1993). The most common conventional ingredient for poultry feed is maize, but it has dual utilization mostly for man and animal and therefore becomes expensive in its usage for poultry feeding (FAO, 2006). But the alternative ingredients that can be used and are available for poultry farmers include guinea corn (*Sorghum bicolor*, linn, finger millet (*Ehusime coracan*), wheat



which are widely grown cereal crops that have been successfully cultivated in the semi-arid regions of Asia and Africa (Ogbe *et al.*, 2021). Millet is very high in lysine, methionine and cysteine content. Sorghum grain has varied chemical composition due to climatic factors with digestibility factor of 35 to 60% or more while wheat is high in protein content of about 11 to 19% depending on the variety, therefore, their incorporation in the poultry feeds in place of maize can improve production and reduction in production cost (Ajaja *et al.*, 2002; Mammo and Sultan, 2010; Abubakar *et al.*, 2006; Etuk and Ukaefiofo, 2007; Etuk, 2008).

The most common form of poultry feeding is dry feeding, although wet feeding has been practiced from time immemorial at the backyard poultry ventures, but it has not been adopted for large scale intensive production probably because it did not confer any definite advantages. Awojobi and Meshioye (2001) observed superior performance of wet feed in finisher broilers over dry mash feeding for feed intake, live weight gain and feed conversion efficiency. There are evidences from early studies that there is stiff competition between humans, industries and livestock for maize which the major conventional feed stiff and has resulted in its scarcity and high cost, therefore necessitated the use of alternative grains for poultry feed (Duru and Dafwang, 2010). Also adding water to feed generally reduces cost of making pellets and improves feed conversion and growth rate (Awojobi *et al.*, 2007; Dei and Bumbie, 2011). This study was therefore, conducted to investigate the effect of utilising different state of grains feed on performance, carcass and physicochemical characteristics of broilers meat.

MATERIALS AND METHODS

The Experimental Site

This study was conducted at the commercial poultry unit of the Oluyole Local Government Council area at Idi-Ayunre Ibadan, Oyo state. Idi-Ayunre is located between latitude 7.13°N and longitude 3.52°E with an annual rain fall of 1311 mm and average monthly temperature of 26.5°C (Adetola *et al.*, 2019).

Experimental Birds and their Management

A total of 96 day-old chicks were purchased from a reputable farm at Ibadan and used for this study. The birds were brooded in a thoroughly washed, cleansed, disinfected and dried pen with deep litter and fed experimental diets *adlibitum* for one week. All routine managements including vaccination were administered following the procedures of Oluyemi and Roberts (2000). The birds (96) were randomly selected into four (4) dietary treatments with 24 birds per treatment and each treatment was replicated 3 times with 8 birds per replicate in a Randomized Complete Block Design (RCBD) and were fed for 4 weeks with both starter and finisher phases, respectively.

Experimental Diets

Four diets containing different energy sources – maize, wheat, millet and guinea corn were formulated with full fat soya beans and fish meal as protein sources to supply 3000 kcal kg-ME, 23% and 20% CP for both starter and finisher diets, respectively with methionine as supplement in the diets as shown in Tables 1 and 2 respectively.

Table 1: Percentage Nutrients composition of starter diets for Broiler chickens

Ingredients (%)	Treatments							
	T1 MD	T2 MW	T3 WD	T4 WW	T5 MTD	T6 MTW	T7 GD	T8 GW
Maize	36.80	36.80	-	-	-	-	-	-
Wheat	-	-	36.80	36.80	-	-	-	-
G/corn	-	-	-	-	-	-	36.80	36.80
Millet	-	-	-	-	36.80	36.80	-	-
Full fat (soya)	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
BDG	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Maize offal	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
*Vit. Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total calculated	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nutrient								
Crude protein (%)	22.50	22.50	22.90	22.90	22.55	22.55	22.45	22.45
Metabolisable energy (kcal/kg)	3000.11	3000.1	3050.00	3050.00	3010.0	3010.00	3025.00	3025.00

MD= Dry maize, **MW=** wet maize, **WD=** Dry wheat, **WW=** Wet wheat, **MTD=**Dry Millet, **MTW=**Wet Millet, **GD=** Dry Guinea corn, **GW=** Wet Guinea corn, **BDG=** Brewers dry grain

*Commercial Premix to provide the following per kg of feed: Vit. A 12000IU, Vit. K 1.8mg, Vit. B2 3.6mg, Biotin 0.3mg, Vit. B12 0.01mg, Chloride 12mg, Chlortetracycline 48mg, Manganese 24mg, Iron 48mg, Zinc 96mg, Copper 60mg, Iodine 1.8mg, Cobalt 0.4mg.

Table 2: Percentage Nutrients composition of finisher diets

Ingredients	Treatments							
	T1 MD	T2 MW	T3 WD	T4 WW	T5 MTD	T6 MTW	T7 GD	T8 GW
Maize	41.80	41.80	-	-	-	-	-	-
Wheat	-	-	41.80	41.80	-	-	-	-
G/corn	-	-	-	-	-	-	41.80	41.80
Millet	-	-	-	-	41.80	41.80	-	-
Full fat (soya)	29.40	29.40	29.40	29.40	29.40	29.40	29.40	29.40
PKM	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Oyster shell	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
*Vit. Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total calculated	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nutrient								
Crude protein (%)	19.89	19.89	20.19	20.19	20.15	20.15	20.13	20.13
Metabolisable energy (kcal/kg)	2900.50	2900.50	2900.15	2900.15	2945.20	2945.20	2948.89	2948.49

MD= Dry maize, **MW=** wet maize, **WD=** Dry wheat, **WW=** Wet wheat, **MTD=**Dry Millet, **MTW=**Wet Millet, **GD=** Dry Guinea corn, **GW=** Wet Guinea corn, **PKM=** Palm Kernel meal.

*Commercial Premix to provide the following per kg of feed: Vit. A 12000IU, Vit. K 1.8mg, Vit. B2 3.6mg, Biotin 0.3mg, Vit. B12 0.01mg, Chloride 12mg, Chlortetracycline 48mg, Manganese 24mg, Iron 48mg, Zinc 96mg, Copper 60mg, Iodine 1.8mg, Cobalt 0.4mg.

Data Collection

Performance characteristics

All performance characteristics of the birds were determined according to the procedures described by Apata and Oke (2012). Feed intake and body weight of birds were recorded on a weekly basis. Body weight gain was calculated as the difference between the final weight and the initial weight of the birds. Feed conversion ratio (FCR) was calculated as the ratio between feed intake and weight gain of the birds. Protein efficiency ratio was derived as the ratio of weight gain and the weight of protein consumed by the birds.

Carcass Characteristics

At the end of the feeding trials, a total of Seventy-two (72) birds, 6 birds per treatment were randomly selected and fasted overnight slaughtered for carcass and organ evaluation which included the heart, liver, pancreas, gizzard intestines (small and large) as well as primal cut and dressing percentage of the carcasses. (Apata *et al.*, 2011; Augustine *et al.*, 2017).

Physical Characteristics of the Birds' Meat

The physical attributes of meat from experimental birds including colour, cooking loss, cooking yield, cold and thermal shortening drip loss, water holding capacity (WHC) and shear force were measured following the procedures of Apata (2011).

Chemical Analysis of the Meat

The chemical analysis (Moisture, Crude protein, Ether Extract, Ash, NFE and pH) of chickens' meat was carried out following the procedures of AOAC (2002).

Experimental Design and Data Analysis

The design for this study was Randomized Complete Block Design (RCBD) and all the data collected were analysed using Analysis of Variance (ANOVA) with (SAS, 2000) while the significant differences between treatments were separated with multiple range test of the same software (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of Dietary Energy Sources and State of Feed on Performance Characteristics of Broilers

The results of the main effects of dietary energy sources and feed form on performance characteristics of broiler chickens are shown on Table 3. There were significant ($p < 0.05$) differences in the dietary energy sources and in forms in which they were fed. Weight gain was highest in the group of broilers fed maize (1526.71g) followed by guinea corn (1470g), millet (1462.21g) and wheat (1438.60g) in that order while the feed intake was highest in birds fed guinea corn followed by those fed millet diet. In overall, the performance characteristics were higher in broiler fed maize energy source which was contrary to the findings of Rama Rao *et al.* (2003) and Bulus *et al.* (2014) who reported that birds fed pearl millet showed better performance than those fed maize and guinea corn but was in agreement with findings of Rama Rao *et al.* (2002) who reported that replacing maize with low tannin guinea corn did not reduce body weight of fed birds.

The results showed that weight gain and feed intake were higher in broilers fed wet diets in this study supporting the earlier report by Awojobi *et al.* (2007) that wet feed mash have advantages over dry mash as it significantly increased body weight and feed conversion ratio hence better performance of the birds.

Table 3: Main Effect of Dietary Energy Sources and State of Feed on Performance Characteristics of Broilers

Variable	Treatments					Forms		
	Maize	Wheat	Millet	G/C	SEM	Dry	Wet	SEM
Initial weight (g)	40.79	41.23	41.62	42.73	0.33	41.38	41.38	0.23
Final weight (g)	1567.50 ^a	1479.83 ^b	1503.83 ^a	1513.00 ^a	38.96	1428.25 ^b	1603.83 ^a	27.55
Weight gain (g)	1526.71 ^a	1438.60 ^b	1462.21 ^b	1470.27 ^b	38.98	1386.87 ^b	1562.03 ^a	27.56
Total feed intake (g)	5511.51 ^c	5609.46 ^b	5665.90 ^b	5778.39 ^a	11.83	5542.15 ^b	5740.49 ^a	18.36
Feed Intake/bird/DAY(g)	98.42 ^d	100.17 ^c	101.18 ^b	103.19 ^a	0.21	98.91 ^b	100.74 ^a	0.15

Means with different superscripts in a row differ significantly ($p < 0.05$)

G/C= Guinea corn

The interaction effect of dietary energy sources and feed forms on performance characteristics of broilers (Table 4) revealed that broilers fed wet diets performed significantly higher ($P < 0.05$) than those fed dry diets. These results were in agreement with the report of Awojobi and Meshoye (2001) who reported superiority in performance when wet diet was fed to broilers over dry feed.

Table 4: Interaction Effect of Dietary Energy Sources and Feed Forms on Performance Characteristics of Broiler Chickens

Broiler Chickens									
	Treatments								
	Dry				Wet				
Variable	Maize	Wheat	Millet	G/C	Maize	Wheat	Millet	G/C	SEM
Initial weight (g)	41.13	41.00	40.71	42.71	40.45	41.46	42.54	42.75	1.27
Final weight (g)	1490.00 ^b	1354.33 ^b	1420.33 ^b	1448.33 ^b	1645.00 ^a	1605.33 ^a	1587.33 ^a	1577.67 ^a	30.50
Weight gain (g)	1448.87 ^b	1313.33 ^b	1379.62 ^b	1405.62 ^b	1604.55 ^a	1563.87 ^a	1544.79 ^a	1534.92 ^a	30.50
Total feed intake (g)	5445.25 ^b	5519.97 ^b	5581.16 ^b	5622.20 ^b	5577.76 ^a	5698.95 ^a	5750.64 ^a	5934.59 ^a	30.52
FCR	3.75	4.20	4.04	3.99	3.47	3.64	3.72	3.6	0.07
FI/bird/dav (g)	97.23 ^b	98.57 ^b	99.66 ^b	100.40 ^a	99.60 ^a	101.76 ^a	102.69 ^a	105.98 ^a	0.64

Means with different superscripts in a row differ significantly ($p < 0.05$)

FI= Feed Intake, **G/C**= Guinea corn, **FCR**= Feed conversion ratio.

Effect of Dietary Energy Sources and State of Feed on Primal Cuts and Offals of Broilers

Table 5 shows the results of main effects of dietary energy sources and feed forms on primal cuts and offal of broiler chickens. The primal cuts weight obtained from the carcasses showed similarly to the pattern of performance of the birds according to the diet, maize fed broilers showed highest dressing percentage followed by millet/wheat and guinea corn, while the breast and back weights were higher in guinea corn/millet and maize followed by wheat and the eight of full intestine was higher in birds fed wheat. But there were no significant effects ($P > 0.05$) of energy.

Sources on other offals of the birds. The results showed further birds fed dry diets had bigger primal cuts than those wet diets. The results of effects dietary sources on primal cuts in this study agreed with the findings of Davis *et al.* (2003) and Medugu (2010) who reported that when guinea corn or millet are utilized in replacement of maize, broilers performance could be enhanced leading to superior carcass and primal cuts weight, however the results on feed forms was contrary to the report of Awojobi and Meshioye (2001) that broilers fed wet diet had increased carcass and primal cuts. The results obtained in this study could be due to inaccurate fabrication of the carcasses due to cutting dexterity of the fabricator and equipment.

Table 5: Main Effect of Dietary Energy Source and Feed Forms on Primal Cuts and Offals of Broiler Chickens

Variable	Treatments					Feed forms		
	Energy sources		Millet	G/C	SEM	Dry	Wet	SEM
	Maize	Wheat						
Live weight wt (g)	1535	1485	1517.5	1397				
Carcass weight (g)	1175	1088.5	1101.00	986				
Dressing %	76.54 ^a	73.30 ^b	72.66 ^b	70.57 ^c		72.96	73.68	
Breast (g)	28.18 ^a	25.39 ^b	28.53 ^a	28.64 ^a	8.15	28.39 ^a	26.97 ^b	5.68
Back (g)	12.30 ^b	14.49 ^a	14.07 ^a	14.25 ^a	2.58	13.79	13.77	2.73
Drumstick (g)	16.28	15.84	15.40	15.73	9.50	16.06	15.57	27.58
Wings (g)	14.15	14.92	15.08	14.18	0.56	14.60	14.56	1.94
Thigh (g)	15.74	15.84	16.06	15.22	9.81	16.31	15.28	7.88
Head (g)	3.11	3.17	3.35	3.28	1.96	3.12	3.29	2.78
Shank (g)	4.44	4.45	4.39	4.23	1.66	4.35	4.49	1.18
Neck (g)	2.68	3.21	3.31	3.36	1.84	2.96	3.32	4.02
Gizzard (g)	3.27 ¹	3.42 ¹	3.57 ¹	3.18 ¹	1.61	3.18	2.69	1.11
Liver (g)	2.55	2.63	2.52	2.66	1.82	2.62	2.56	1.99
Crop (g)	0.66	0.68	0.66	0.68	0.12	0.65	0.69	0.22
Heart (g)	0.66 ^a	0.44 ^d	0.54 ^c	0.55 ^b	0.27	0.55 ^a	0.54 ^b	0.22
Full Intestine (g)	14.68 ^b	15.70 ^a	14.13 ^b	14.23 ^b	3.92	13.97 ^b	15.4 ^a	3.85
Intestine (Empty) (g)	6.38	6.53	5.60	6.23	1.30	5.72	6.65	1.84

Means with different superscripts in a row differ significantly ($p < 0.05$)

G/C= Guinea corn

Table 6 depicted the interaction between dietary energy sources and feed forms on primal cuts and offals of broilers. There were significant ($P < 0.05$) differences in interaction between primal cuts of broiler chickens fed dry and wet diets. It was observed that birds fed dry wheat (27.45%) and millet (29.69%) diets had higher ($P < 0.05$) breast cuts than those fed the same diets in wet form, while those fed wet guinea corn (28.65%) had higher ($P < 0.05$) breast weight cuts than those fed dry form (27.36%) of the same diet.

The back cut was higher ($P < 0.05$) in birds fed dry millet diet (15.57%) than those fed wet form (12.57%), but it was higher ($P < 0.05$) in those birds fed wet wheat (15.31%) and guinea corn (14.91%), while only birds fed dry maize diet (17.34%) had higher drum stick cuts than those fed wet maize diet (15.22%), those fed dry wheat diet had higher (15.67%) wing cut than those fed dry millet diet (14.50%), while only those birds fed dry maize diet had higher ($P < 0.05$) thigh cut (17.01%) than those fed wet maize diet (14.46%).

However, no significant differences were observed in all the external offals of the birds fed both dry and wet diets, but there was no significant differences in the internal offals except in full (17.01) intestine in birds fed wet wheat but higher ($P < 0.05$) than full intestine (14.38) of birds fed dry wheat. The same pattern of results was observed in empty intestine of birds fed both dry and wheat. The results of interaction between the sources of diets and forms of feed were on primal cuts and external offals of birds were not consistent with the report of Atapattu and Wickrama Snighe (2008) who opined that wet diets improved carcass weight hence the primal cuts. Though the results of internal offals tended to conform with the above authors report as increase in size of these organs might have aided higher rate of feed intake in birds fed wet diets in this study with subsequent increase in carcass weight.

Table 6: Interaction Effect of Dietary Energy Sources and Feed Forms on Primal Cut and Offals of Broiler Chicken

Broiler Chicken									
Variable	Treatments								SEM
	Dry				Wet				
	Maize	Wheat	Millet	G/C	Maize	Wheat	Millet	G/C	
Breast %	27.79	27.45 ^a	29.69 ^a	27.36 ^b	28.56	23.32 ^b	27.36 ^b	28.65 ^a	16.91
Back	12.33	13.67 ^b	15.57 ^a	13.58 ^b	12.27 ^b	15.31 ^a	12.57 ^b	14.91 ^a	9.18
Drum stick %	17.34 ^a	15.68	15.49	15.71	15.22 ^b	16.00	15.32	15.74	18.76
Wings %	14.02	15.67 ^a	14.56 ^b	14.16	14.28	14.17 ^b	15.61 ^a	14.19	9.28
Thigh %	17.01 ^a	16.10	16.25	15.23	14.46 ^b	15.58	15.8	15.21	9.02
Head %	3.13	2.90	3.15	3.28	3.09	3.44	3.35	3.28	1.99
Shank %	4.28	4.14	4.49	4.50	4.60	4.76	4.28	4.35	3.64
Neck %	2.20	3.155	3.22	3.25	3.15	3.26	3.39	3.46	3.44
Gizzard %	2.87	3.30	3.51	3.07	3.48	3.54	3.62	3.46	3.71
Liver %	2.52	2.47	2.73	2.76	2.58	2.78	2.31	2.55	2.95
Crop %	0.68 ^a	0.64 ^a	0.63 ^b	0.65 ^b	0.63 ^b	0.71 ^a	0.69 ^a	0.72 ^a	0.57
Heart %	0.68 ^a	0.53 ^a	0.48 ^b	0.50 ^b	0.64 ^b	0.34 ^b	0.59 ^b	0.60 ^a	0.55
Full intestine %	14.27	14.38 ^b	13.90	13.32 ^b	15.09	17.01 ^a	14.36	15.14 ^a	11.85
Intestine (empty)	6.09	5.28 ^b	5.46	6.06	6.67	7.78 ^a	5.73	6.40	1.20

Means with different superscripts in a row differ significantly ($p < 0.05$)

G/C= Guinea corn

Effect of Dietary Energy Source and Feed Forms on Physical Characteristics of Broiler Meat

Table 7 presents the results of main effects of dietary energy source and feed forms on physical characteristics of broiler chickens' meat. Cooking loss (36.92), cold (31.70), thermal shortening (25.99) and drip losses (17.99) were higher ($P < 0.05$) in meat of birds fed millet diet, and lower in meat samples of birds fed maize diet while dressing percentage (76.54) and water holding capacity (68.79) figures were higher ($P < 0.05$) in meats of birds fed maize diet and least ($P < 0.05$) in meat of birds fed guinea corn. In the case of feed form, the results showed that there were significant differences ($P < 0.05$) in the dressing percentage (73.96) and water holding capacity (67.52) figures of meat from chickens fed wet feed, cooking loss (33.65), drip loss (16.99), thermal shortening (14.98) and shear force (4.77) values were higher ($P < 0.05$) in the meat of birds fed dry feed.

Although, it is not very common to feed chickens wet, in this study, it was observed that meat from birds fed wet feed were better perhaps the birds consumed more of the wet feed in the absence of enough water supply to the birds which translated into most better physical quality of the meat which was not in support of the report of Awojobi and Meshioye (2001).

Table 7: Main Effect of Dietary Energy Source and Feed Forms on Physical Characteristics of Broiler Meat

Variable	Treatments							
	Energy sources				SEM	Feed forms		
	Maize	Wheat	Millet	G/C		Dry	Wet	SEM
Dressing (%)	76.54 ^a	73.30 ^b	72.55 ^b	70.57 ^c	8.58	72.58 ^b	73.96 ^a	6.07
Cooking yielded (%)	67.98 ^b	73.29 ^a	63.08 ^d	66.75 ^c	5.20	65.17 ^b	69.35 ^a	3.70
Cooking loss (%)	32.02 ^c	26.71 ^d	36.92 ^a	33.25 ^b	2.88	33.65 ^a	30.83 ^b	2.03
Cold shortening (%)	18.68 ^d	27.40 ^b	31.70 ^a	21.04 ^c	5.71	14.44	14.96	4.04
Thermal shortening (%)	14.64 ^d	15.40 ^c	25.99 ^a	16.38 ^b	5.26	14.98 ^a	11.23 ^b	3.72
Drip loss (%)	14.56 ^c	16.54 ^b	17.99 ^a	16.00 ^b	1.79	16.99 ^a	15.58 ^b	1.26
Water holding capacity (%)	68.79 ^a	67.58 ^b	66.57 ^c	65.04 ^d	0.48	66.46 ^b	67.52 ^a	0.34
Shear force (N)	3.20 ^b	3.33 ^b	3.92 ^b	5.29 ^a	0.09	4.77 ^a	3.09 ^b	0.06

Means with different superscripts in a row differ significantly ($p < 0.05$)

G/C= Guinea corn

The interaction effects of dietary energy sources and forms on physical properties of broiler meat (Table 8) showed that, meat from broilers furnished better physical properties when fed wet maize and wheat, while the physical characteristics of broiler meat were better when fed dry millet and guinea corn. Broiler chicken in this study consumed more of maize and wheat feed when wet probably as a result of the softness of the feed which could have facilitated ease of swallow, in case of dry millet of guinea corn could be due to the palatability of dry feed of these grains which might have aided the consumption of more of the feed thereby eliciting better meat physical properties.

Table 8: Interaction Effect on Dietary Energy Sources and Feed Forms on Physical Characteristics of Broiler Meat

Variable (%)	Treatments								SEM
	Dry Maize	Wheat	Millet	G/C	Maize	Wet Wheat	Millet	G/C	
Dressing (%)	72.26 ^a	73.09 ^b	69.37 ^b	72.40 ^a	75.74 ^a	73.49	76.58 ^a	68.58 ^b	17.15
Cooking yielded	64.71 ^b	75.54 ^a	67.16 ^a	69.28 ^a	71.25 ^a	71.02 ^b	58.98 ^b	64.17 ^b	10.20
Cooking loss	35.29 ^a	24.46 ^b	32.84 ^b	30.72 ^b	28.75 ^b	28.98 ^a	41.02 ^a	35.83 ^a	5.76
Cold shortening	14.56 ^b	16.42 ^b	24.72 ^a	22.07 ^a	22.80 ^a	28.49 ^a	20.68 ^b	12.04 ^b	11.42
Thermal shortening	10.43 ^b	19.96 ^a	23.89 ^a	13.64 ^a	18.57 ^a	15.85 ^b	18.09 ^b	16.11 ^a	10.51
Drip loss	14.32	15.67 ^b	18.19 ^a	18.15 ^a	14.81	202.20 ^a	14.88 ^b	14.07 ^b	3.57
Water holding capacity	64.23 ^b	66.17	68.29 ^a	67.42 ^b	66.94 ^a	66.99	67.29 ^b	68.55 ^a	0.95
Shear force (N)	5.02 ^a	3.6	4.29	3.17 ^b	3.38 ^b	3.05	3.55	4.40 ^a	0.17

a, b, c, d = Means with different superscripts in a row differ significantly (P<0.05)

G/C= Guinea corn

Effect of Dietary Energy Source and Feed Forms on Chemical Composition of Broilers Meat

Table 9 present the results of the main effect of dietary sources and feed forms on chemical composition of broilers' meat. The moisture content of the meat samples was higher in meats of chickens fed maize and guinea coin diets and lower (p<0.05) in the meats of those fed wheat and millet diets respectively. In the same vein, crude protein was higher in meat from chickens fed wheat and millet diets as well as nitrogen free extract (NFE). The results obtained from this study revealed that dry wheat and millet had lower mixture content and subsequently higher crude protein (Table 1 & 2). Moisture and crude proteins as postulated by Apta *et al.* (2011) have an inverse relationship, when moisture is high, crude protein would be low and vise versa. Wheat and millet have higher crude protein content which could have been translated into the meat composition in the chicken. This observation in further shown in the feed forms whereby wet-feed furnished lower crude protein due to higher moisture and dry feed with higher protein and lower moisture content value.

Table 9: Main Effect of Dietary Energy Source and Feed Forms on Chemical Composition of Broilers Meat

Variable	Treatments					Feed forms		
	Energy sources Maize	Wheat	Millet	G/C	SEM	Dry	Wet	SEM
Moisture (%)	70.88 ^a	68.69 ^b	69.09 ^b	70.69 ^a	0.15	70.23 ^b	71.53 ^a	0.10
Crude protein (%)	20.14 ^b	21.54 ^a	21.45 ^a	20.42 ^b	0.25	21.42 ^a	20.35	0.18
Ether Extract (%)	6.6	6.04	6.18	6.34	0.06	6.27	6.33	0.43
Ash (%)	1.60	1.44	1.56	1.60	0.04	1.55	1.61	0.27
NFE (%)	0.64 ^c	2.29 ^a	1.2 ^a	0.95 ^b	1.7 ^a	0.53 ^a	0.18 ^b	0.12
pH	6.57	6.62	6.60	6.60	0.7	6.57	6.62	0.46

a, b, c, d = Means with different superscripts in a row differ significantly (P<0.05)

G/C= Guinea corn

The results interaction effects of dietary energy sources and feed form on chemical composition of broiler chickens meat are presented on Table 10. Moisture and nitrogen free extract (NFE) were lower in dry feed, while crude protein was higher, whereas, moisture and nitrogen free extract (NFE) were higher in wet feed, while crude protein lower, but there were no significant (p>0.05) differences in the

values of ether extract (fat), ash and pH of the meat samples across the treatments. The results of interaction also confirmed the findings of Apata *et al.* (2011) that moisture content and crude protein are inversely related. The high moisture observed in wet feed in this study might be due to the additional water added to the feed during treatment and subsequently decreased. The protein content of the feed by dilution, whereas the protein in dry feed remained high.

Table 10: Interaction Effects of Dietary Energy Sources and Feed Form on Chemical Composition of Broilers Meat

Variable	Treatments								SEM
	Dry Maize	Wheat	Millet	G/C	Maize	Wet Wheat	Millet	G/C	
Moisture (%)	70.0 ^{b3}	70.68 ^b	70.08 ^b	71.01 ^b	71.33 ^a	71.70 ^a	71.10 ^a	72.13 ^a	0.11
Crude protein (%)	20.30 ^a	22.90 ^a	21.55 ^a	20.91 ^a	16.18 ^b	18.10 ^b	17.35 ^b	16.21 ^b	0.22
Ether Extract (%)	6.63	5.97	6.20	6.28	6.66	6.10	6.16	6.38	0.06
Ash (%)	1.62	1.40	1.55	1.62	1.77	1.48	1.60	1.60	0.02
NFE (%)	1.42 ^b	0.05 ^b	0.62 ^b	0.18 ^b	4.06 ^a	2.62 ^a	3.79 ^a	3.68 ^a	0.08
pH	6.45	6.63	6.60	6.60	6.70	6.60	6.62	6.60	0.03

^{a, b, c, d} = Means with different superscripts in a row differ significantly (P<0.05)

G/C= Guinea corn

CONCLUSION AND RECOMMENDATION

It can be concluded from the results obtained in this study that maize feed furnished higher and most desirable characteristics in both live chicken and in the meat, though wheat, millet and guinea corn also elicited relatively high variables values in chickens' meat. Though, wet feed gave comparatively higher results of the live chickens, dry feed furnished the most desirable characteristics in live chicken and meat qualities for both farmers and meat poultry processors. Therefore, either of wheat, millet or guinea corn could be used to replace maize preferably in dry feed.

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