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Effect of Three Sources of Fibre and Period of Feeding on the Performance, Carcase Measures, Organs Relative Weight and Meat Quality in Broilers

E.A. Iyayi[1, 2]*, O. Ogunsola[2] and R. Ijaya[2]
[1]Institut für Enährungswissenschaften, Martin-Luther-Universität, Emil-Abderhalden-Strasse 26, 06108 Halle (Saale), Germany
[2]Department of Animal Science, University of Ibadan, Ibadan, Nigeria

Abstract: One hundred and fifty male broilers were used in a 3 x 3 factorial design to evaluate the effect of 3 periods (4, 8 and 12 weeks) and 3 fibre sources namely; brewer's dried grain (BDG), palm kernel meal (PKM) and corn bran (CB) in place of maize on the performance, carcase measures and meat quality in the birds. A sensory evaluation to determine the overall acceptability of the meat was also carried out. Four diets were formulated consisting of a basal diet containing none of the test fibre ingredients. In the remaining 3 diets, either of BDG, CB or PKM was used to replace 40% of the maize. A separate balance study was also carried out to determine the digestibility of nutrients in the birds. BDG, CB and PKM significantly ($p<0.01$) reduced the weight and feed conversion in the birds but period of feeding resulted in increased body weights of the birds. BDG, CB and PKM significantly ($p<0.01$) reduced the eviscerated weights and the weights of carcase parts but period significantly ($p<0.01$) increased them. Dietary treatment, period and their interaction significantly ($p<0.01$) reduced the abdominal fat in the birds and caused a significant ($p<0.05$) increase in the lengths of the duodenum, ileum, caecum and colon as well as the weight of the intestines. Digestibility of nutrients was significantly ($p<0.1$) reduced in birds on the fibre diets. The shear force values in carcase parts were significantly increased in the BDG, CB and PKM diets while the cooking loss was significantly ($p<0.05$) reduced in these diets. Period and interaction with dietary treatment also caused a significant ($p<0.01$) reduction in cooking loss. Tenderness, flavour and juiciness were significantly ($p<0.01$) influenced by period and not treatment but overall acceptability of the meat was significantly ($p<0.05$) increased by both factors. Results of the study suggest 1) 40% BDG, CB and PKM replacement of maize has a negative effect on the weight gain and feed conversion of broilers, 2) 40 % level of BDG, CB and PKM caused an increase in the weights and lengths of the visceral organs and reduced carcase weight in broilers, 3) production of broilers up 10-12 weeks on 40% BDG, CB or PKM diet resulted in creased flavour, juiciness, higher shear force, reduced tenderness, reduced cooking loss but increased general acceptability of broiler meat.

Key words: Fibre sources, period, performance, carcass, broilers

Introduction

Broilers are an important source of table meat in Nigeria. They are fast growing and are efficient converters of feeds. According to Oluyemi and Roberts (2000), they can attain a market weight of between 1.6 to 2 kg in 6 to 8 weeks with a feed conversion ratio of 2:1. The meat of broiler is tender. However, broilers tend to lay down fats when the energy sources in the feed are not efficiently utilized and when fed for long periods. This excess fat is of health and economic importance. Lin (1981) stated that fat deposition in broiler chickens represents a waste to consumers as it results in extra cooking loss. Dietary fibre has been reported by Pond *et al*. (1988) and Gous *et al*. (1990) to reduce carcase and abdominal fat. The production of lean carcase in ducks and chickens is achieved according to Siregar *et al*. (1982) by replacing high energy feeds with bulky low energy feeds which are high in crude fibre. Potential feed resources that can prove valuable in this respect are the agricultural by-products (AIBs) and crop wastes. They are available locally, cheap and are able to replace a certain proportion of maize in broiler diets. Brewer's dried grain (BDG), palm kernel meal (PKM) and corn bran (CB) are among the common AIBs in Nigeria. According to Onifade (1993), these AIBs are known to serve as a source of virtually all feed nutrients that are required by livestock. The aim of this study was to investigate the effect of inclusion to 40% level of BDG, PKM and CB in place of maize in the diet of broilers on their performance, nutrient digestibility, carcase measures and meat quality.

Materials and Methods

Diets, animal housing and management: Four diets were formulated. Diet 1 was the basal diet and contained no BDG, PKM and CB. In diets 2, 3 and 4, CB, PKM and BDG were included at a 40% level, respectively in place of maize (Table 1). One hundred and fifty 1-d-old male broiler chicks (Anak strain) were obtained from Agrited farm (Agrited Farm Ltd., Ibadan, Nigeria). The

Table 1: Composition of experimental diets

Ingredients (%)	Diets			
	Basal	40% CB*	40% PKM	40% BDG
Maize	56.00	16.00	16.00	16.00
Wheat offal	7.85	7.85	7.85	7.85
Corn bran	-	40.00	-	-
Palm kernel meal	-	-	40.00	-
Brewer's dried grain	-	-	-	40.00
Soy bean meal	15.00	15.00	15.00	15.00
Groundnut cake	13.00	13.00	13.00	13.00
Fish meal	3.00	3.00	3.00	3.00
DL-Methionine	0.10	0.10	0.10	0.10
L-Lysine	0.10	0.10	0.10	0.10
Palm oil	2.40	2.40	2.40	2.40
Bone meal	1.80	1.80	1.80	1.80
Oyster shell	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Analyzed nutrients				
CP (%)	20.8	20.2	19.0	20.1
ME (MJ/kg)	12.5	11.6	11.1	11.7
CF	4.30	5.26	8.62	7.32
Fats	5.50	5.40	4.90	5.11

* CB = Corn bran, PKM = Palm kernel meal and BDG = Brewer's dried grain

chicks were reared for four weeks on a conventional broiler starter diet. At the end of four weeks, 120 of them were weighed, randomly selected on body weight basis and distributed into 20 pens of 6 birds each. Each of the 4 experimental diets was then assigned to a group of 5 pens in a well illuminated and temperature-controlled room. They were fed and given water *ad libitum*. Body weights and feed consumption were recorded on pen basis. Another set of 6 birds per replicate were assigned to each experimental diet in a balance study to determine nutrient digestibility. Faeces was obtained daily, pooled and frozen until needed for analysis. The study was carried out at the Teaching and Research Farm of the University of Ibadan. All experimental protocol was in accordance with the approved regulation of the university animal handling and welfare regulation committee.

Carcase and sensory evaluation and organ weights: At the end of 8, 10 and 12 weeks equal number of birds were withdrawn from each pen, weighed and killed after being starved for 12 hours (Joseph *et al*., 1996). The birds were defeathered and eviscerated by carefully removing the gastrointestinal tract. The gizzards, liver, heart, proventriculus and small intestines were removed, weighed and their weights expressed as percentage of the bird's body weight. The eviscerated weight, weights of body parts and organs were recorded on pen basis. The abdominal fats recovered were also weighed and recorded. Portions from the right thigh, drum stick and breast of the slaughtered birds were taken for cooking loss and shear force evaluation. The Warner-Bratzler Shear force machine was used to determine the shear force. Portions taken from the drum stick, thigh and breast were passed through the machine and shearing made along the muscle fibre. The force required to shear through the meat sample was measured against that required for a standard meat sample. Cooking loss was determined as percentage difference in the weight of the meat sample before and after cooking for 20 minutes. The sensory evaluation was carried out by five trained panelists taught to recognize and score palatability traits on the nine point hedonic scale as described by Mehendrak *et al*. (1988).

Statistical analysis: The data were analyzed using the analysis of variance (ANOVA) and means with significant differences were separated by the least significant difference (LSD) method.

Results

The results of feed intake, weight gain and feed conversion ratio are presented in Table 2. Dietary treatment and period significantly increased ($p<0.05$) feed intake and reduced ($p<0.01$) weight gain and feed conversion in the birds. Period significantly ($p<0.01$) increased all three performance parameters. But interaction between treatment and period had no

Table 2: Performance of birds on experimental diets (n = 5 pens of 6 birds per treatment)

	Period / Diets															
	8 weeks				10 weeks				12 weeks				Pooled SEM	P (ANOVA)		
	Basal	CB[1]	BDG	PKM	Basal	CB	BDG	PKM	Basal	CB	BDG	PKM		T	P	T x P
Feed intake (g)	3138^{a}	3259^{b}	3246^{b}	3269^{c}	5438^{d}	5188^{e}	5438^{d}	5519^{e}	7445^{f}	7166^{g}	7530^{h}	7647^{i}	24.0	0.0475	0.0001	0.5081
Weight gain (g)	1055^{a}	1048^{a}	738^{b}	818^{c}	1738^{d}	1572^{e}	1165^{f}	1358^{g}	1982^{h}	1328^{i}	1528^{j}	1792^{k}	23.9	0.0001	0.0001	0.5822
Feed / BW gain	3.1^{a}	3.1^{a}	4.4^{b}	4.0^{c}	3.2^{a}	3.3^{a}	4.7^{d}	4.1^{c}	3.8^{c}	3.9^{c}	5.0^{e}	4.3^{b}	0.21	0.0001	0.0026	0.8858

^{a,b,c,d,e,f,g,h,i,j,k}Values with different superscripts on same row are significantly (p<0.05) different according to LSD. [1]CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal, T = treatment and P = period

Table 3: Carcase measure in birds on experimental diets (n = 5 pens of 6 birds per treatment)

Carcase parts(g)	Period / Diets															
	8 weeks				10 weeks				12 weeks				Pooled SEM	P (ANOVA)		
	Basal	CB[1]	BDG	PKM	Basal	CB	BDG	PKM	Basal	CB	BDG	PKM		T	P	T x P
Eviscerated weight	74^{a}	69^{a}	68^{a}	67^{a}	82^{b}	79^{b}	77^{b}	80^{b}	86^{c}	82^{c}	83^{c}	82^{c}	3.22	0.003	0.0001	0.5314
Drumstick	5.46	4.95	5.77	5.42	7.90	5.98	6.29	6.42	5.90	5.56	5.49	5.74	0.56	0.367	0.0243	0.7526
Thigh	5.05	4.80	4.92	4.82	5.59	5.30	6.16	6.12	4.84	5.31	5.00	5.41	0.34	0.235	<0.001	0.1083
Back	16.1^{a}	14.3^{b}	14.1^{b}	14.1^{b}	13.3^{c}	8.35^{d}	14.8^{b}	15.0^{b}	14.7^{b}	14.3^{b}	13.4^{c}	14.1^{b}	0.78	0.005	0.0097	0.0005
Breast	17.1^{a}	16.2^{b}	17.4^{c}	16.6^{b}	19.2^{d}	14.7^{f}	19.8^{d}	22.1^{e}	18.3^{g}	15.6^{h}	17.3^{c}	17.9^{c}	0.34	0.0001	0.0014	0.0055
Abdominal fat	1.26^{a}	1.24^{a}	0.91^{c}	1.19^{d}	1.20^{d}	0.94^{c}	0.32^{e}	0.29^{f}	1.32^{g}	0.56^{h}	0.20^{j}	0.23^{k}	0.04	0.0001	0.0001	0.0439

^{a,b,c,d,e,f,g,h,i,j,k}Values with different superscripts on same row are significantly (p<0.05) different according to LSD. [1]CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal, T = treatment and P = period

Table 4: Organs relative weight of birds on experimental diets (n = 5 pens of 6 birds per treatment)

	Period / Diets															
	8 weeks				10 weeks				12 weeks				Pooled SEM	P (ANOVA)		
Organs	Basal	CB1	BDG	PKM	Basal	CB	BDG	PKM	Basal	CB	BDG	PKM		T	P	T x P
Gizzard (g)	1.97^{a}	2.04^{b}	2.27^{c}	2.81^{d}	1.77^{a}	1.79^{b}	2.65^{c}	3.01^{d}	2.12^{a}	2.47^{b}	2.33^{c}	2.81^{d}	0.13	<.001	0.43	0.1513
Heart (g)	0.47^{a}	0.38^{b}	0.43^{c}	0.51^{d}	0.40^{a}	0.37^{b}	0.36^{c}	0.47^{d}	0.34^{a}	0.27^{b}	0.28^{c}	0.37^{d}	0.05	0.0027	<.001	0.9678
Liver (g)	1.98^{a}	2.02^{b}	2.01^{b}	2.24^{b}	2.10^{a}	2.64^{b}	2.05^{c}	2.45^{d}	1.97^{a}	1.95^{a}	1.92^{a}	2.13^{b}	0.14	0.412	0.81	0.6016
Intestine (g)	5.78^{a}	6.10^{b}	7.84^{c}	8.09^{d}	4.31^{a}	4.74^{b}	6.60^{c}	5.93^{d}	6.01^{a}	5.75^{b}	6.48^{c}	6.42^{d}	0.17	0.003	0.004	0.6117
Duodenum (cm)	27.7^{a}	29.7^{b}	32.3^{c}	32.3^{d}	35.0^{e}	33.3^{d}	37.0^{f}	34.7^{e}	37.3^{f}	38.0^{f}	31.7^{c}	38.7^{f}	1.15	0.371	<.001	0.0068
Ileum (cm)	147^{a}	148^{a}	148^{a}	155^{b}	157^{c}	178^{d}	185^{e}	164^{f}	190^{g}	193^{h}	174^{i}	188^{j}	3.78	0.53	<.001	0.0826
Caecum (cm)	17.2^{a}	17.2^{a}	17.9^{b}	18.0^{b}	23.2^{c}	23.8^{c}	23.7^{c}	23.0^{c}	25.0^{d}	24.0^{d}	25.3^{d}	24.7^{d}	0.88	0.94	<.001	0.9903
Colon (cm)	7.00^{a}	7.20^{b}	7.57^{c}	7.47^{d}	7.33^{a}	10.3^{b}	11.0^{c}	10.7^{d}	12.3^{a}	11.3^{b}	13.0^{c}	11.3^{d}	0.33	0.02	<.001	0.0149

^{a,b,c,d,e,f,g,h,i,j,}Values with different superscripts on same row are significantly (p<0.05) different according to LSD. 1 CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal, T = treatment and P = period

Table 5: Nutrient digestibility (% retention) in broilers on experimental diets (n = 5 pens of 6 birds per treatment)

	Basal	CB[1]	PKM	BDG	Pooled SEM	P (ANOVA)
Dry matter	85^{a}	73^{b}	60^{c}	54^{d}	0.10	0.0001
Crude protein	73^{a}	53^{b}	43^{c}	45^{d}	0.22	0.0001
Ether extract	94^{a}	84^{b}	82^{b}	81^{b}	0.90	0.0001
Crude fibre	52^{a}	41^{b}	36^{bc}	39^{b}	1.07	0.0001
Ash	62^{a}	38^{b}	27^{c}	25^{d}	0.54	0.0001
Nitrogen free extract	93^{a}	87^{b}	78^{c}	81^{d}	0.63	0.0001

a,b,c,d, Values with different superscripts on same row are significantly (p<0.05) different according to LSD. [1]CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal.

Table 6: Cooking loss (%) of carcase parts in broilers on experimental diets(n = 5 pens of 6 birds per treatment)

Carcase part	Period / Diets															
	8 weeks				10 weeks				12 weeks				Pooled SEM	P (ANOVA)		
	Basal	CB[1]	BDG	PKM	Basal	CB	BDG	PKM	Basal	CB	BDG	PKM		T	P	T X P
Drumstick	34^{bc}	$29b^{cd}$	20^{cf}	46^{a}	27^{cde}	36^{b}	20^{ef}	25^{de}	21^{ef}	16^{f}	21^{ef}	20^{ef}	2.19	0.0006	0.0001	0.0001
Breast	35^{b}	$30b^{c}$	31^{bc}	43^{a}	33^{b}	33^{b}	23^{cde}	29^{bcd}	22^{cde}	17^{e}	22^{de}	20^{e}	1.92	0.0545	0.0001	0.0221
Thigh	33^{ab}	30^{abc}	39^{a}	30^{abc}	32^{abc}	36^{abc}	27^{bc}	31^{abc}	27^{bc}	20^{c}	26^{bc}	26^{bc}	2.80	0.001	0.001	0.001

a,b,c,d,e,f Values with different superscripts on same row are significantly (p<0.05) different according to LSD. [1]CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal.

Table 7: Values of shear force (kg) of carcase parts in broilers on experimental diets(n = 5 pens of 6 birds per treatment)

Carcase part	Period / Diets															
	8 weeks				10 weeks				12 weeks				Pooled SEM	P (ANOVA)		
	Basal	CB[1]	BDG	PKM	Basal	CB	BDG	PKM	Basal	CB	BDG	PKM		T	P	T x P
Drumstick	0.52^{c}	1.27^{abc}	1.42^{ab}	1.40^{ab}	0.67^{bc}	1.28^{abc}	1.70^{a}	1.57^{a}	1.44^{ab}	1.32^{abc}	1.94^{a}	1.45^{ab}	0.21	0.02	0.002	0.042
Breast	1.82^{bc}	2.53^{bc}	2.36^{bc}	1.67^{bc}	1.59^{c}	1.59^{c}	3.41^{abc}	2.50^{bc}	3.03^{bc}	5.42^{a}	4.14^{ab}	3.44^{abc}	0.45	0.02	0.002	0.042
Thigh	1.20^{ab}	1.02^{b}	1.20^{ab}	1.10^{ab}	1.23^{ab}	1.23^{ab}	1.57^{ab}	1.58^{ab}	1.55^{ab}	1.00^{b}	1.64^{ab}	1.77^{a}	0.18	0.05	0.06	0.071

a,b,c,d,e,f Values with different superscripts on same row are significantly (p<0.05) different according to LSD. [1]CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal

Table 8: Sensory evaluation of carcase part in broilers on experimental diets (n = 5 pens of 6 birds per treatment)

Variables	Period / Diets															
	8 weeks				10 weeks				12 weeks				Pooled SEM	P (ANOVA)		
	Basal	CB[1]	BDG	PKM	Basal	CB	BDG	PKM	Basal	CB	BDG	PKM		T	P	T x P
Tenderness	8.00^{a}	6.47^{ab}	6.07^{b}	6.33^{ab}	6.67^{ab}	6.33^{ab}	6.53^{ab}	6.73^{ab}	6.20^{ab}	5.40^{b}	5.40^{b}	5.93^{b}	0.51	0.11	0.02	0.66
Flavour	2.27^{e}	3.53^{e}	$2.87d^{e}$	4.33^{bcd}	4.13^{cd}	4.13^{cd}	4.13^{cd}	4.40^{bcd}	6.07^{a}	5.87^{ab}	5.33^{abc}	4.40^{bcd}	0.49	0.42	0.0001	0.20
Juiciness	5.20^{cd}	5.67^{bcd}	$5.73b^{cd}$	6.13^{abc}	5.67^{bcd}	$4.73d^{e}$	3.87^{e}	4.93^{cde}	7.27^{a}	6.67^{ab}	6.87^{ab}	6.20^{abc}	0.39	0.39	0.0001	0.04
Overall acceptability	6.20^{bc}	6.93^{ab}	5.27^{cd}	6.47^{b}	6.33^{bc}	4.93^{d}	5.20^{cd}	5.87^{bcd}	7.87^{a}	7.00^{ab}	7.00^{ab}	6.80^{ab}	0.38	0.02	0.0001	0.03

a,b,c,d,e,f Values with different superscripts on same row are significantly (p<0.05) different according to LSD. [1]CB = corn bran, BDG = brewer's dried grain, PKM = palm kernel meal.

significant effect on the birds' performance. Results of carcase measures are presented in Table 3. Eviscerated weight, weights of drum stick, thigh, back and breast were significantly (P<0.05) increased by the period of feeding and not by dietary treatment. Birds on the BDG, PKM and CB diets had significantly reduced back, breast weights and abdominal fat content. The results of the organs relative weights are presented in Table 4. Dietary treatment and period significantly (P<0.05) increased the weights of the gizzard, heart, intestine and length of the colon while period in addition had a significant (P<0.05) effect on the length of the duodenum, ileum and caecum. The results of nutrient digestibility are presented in Table 5. The BDG, PKM and CB diets caused a significant (P<0.01) reduction in the digestibility of the nutrients compared to the basal diet. The effect was more on the PKM and CB diets compared to the BDG diet. Cooking loss was significantly (P<0.05) reduced by period, dietary treatment and their interaction (Table 6). The results of the values of shear force of carcase parts are presented in Table 7 while those of sensory evaluation are presented in Table 8. Dietary treatment, period of feeding and interaction of both factors caused a significant (P<0.01) increase in the values of shear force of the carcase parts. Tenderness, flavour and juiciness of the carcase parts were significantly (P<0.01) influenced by period of feeding and not treatment but overall acceptability was influenced by both factors.

Discussion

The feed intake seemed to have been dictated by the source of fibre in the diets. Increased dietary fibre inclusion causes a dilution of the energy content of the ration (Onifade, 1993) and therefore the birds on the BDG, PKM and CB diets had to consume more feed in an attempt to meet their energy and other nutrient requirements. Birds on the PKM diets had the highest feed intake followed by those on the BDG, CB and basal diets. The extent to which an animal will consume a particular feed is dependent on the fibre source (Linderman *et al*., 1986), palatability of the diet (Cherry and Jones, 1982), lignification of the feed and chemical variation in the fibre itself (Kass *et al*., 1980). The nutrient volume per unit weight of feed which according to Longe and Adekoya (1988) is an important factor that affect feed intake, was probably lowest in the PKM and BDG diets compared to the CB and basal diets. Birds on the PKM and BDG diets also had lower weight gain than those on the basal and CB diets. The primary reason for this is the lower nutrient intake in these feeds. With lower nutrient intake and poorer feed conversion birds on the PKM, BDG and CB diets had lower weight gain compared to those on the basal diet. The performance of the birds was also significantly affected by the period and interaction of the dietary treatment and period of feeding. As the experiment lasted beyond 8 weeks and up to 12 weeks, the birds' performance was reduced. And the effect was more pronounced in birds on the BDG, PKM and CB diets. It does suggest therefore that when these AIBs are fed in place of maize and with respect to performance of the birds, the period of feeding should not be more than 8 weeks.

The eviscerated weight was similarly influenced by the diets as was the live weight. While the highest live weight was on the basal diet, the lowest was on the PKM diet. The results of influence of period on the eviscerated weight agree with the earlier findings of Leeson and Summers (1980) who reported that dressing percentage improves with age. The effect of diets on the eviscerated weights reflected the influence of nutrient density on performance and carcase measures as reported by Campbell (1988). Thus as the authors suggested, it appears that dietary nutrients are diverted from growth of edible carcase to accretion of intestinal and visceral organs when high fibrous ingredients are fed to broilers. At all periods of feeding, the relative weights of gizzard and heart as well as the length of the colon and intestine were increased in birds on the BDG, PKM and CB diets when compared with birds on the control diets. Koong *et al*. (1985) reported that chickens and other monogastrics fed on high fibrous diets usually produced more offal. At all periods of slaughter, the highest abdominal fat was recovered from birds on the basal diet while the least was recovered from birds fed on the BDG based diet. According to Pond *et al*. (1988) and Gous *et al*. (1990) dietary fibre reduces carcase and abdominal fat. The significant reduction in abdominal fat in birds fed the BDG, PKM and CB diets may be attributed to low dietary calorie since a positive correlation between dietary intake and abdominal fat content has been reported by Smith and Teeter (1987). Digestibility of all the nutrients were significantly reduced in birds on the BDG, PKM and CB diets; another reason why the animals on these diets performed significantly poorer than those on the basal diets. Reduced nutrient digestibility is attributed to the effect of replacement of a highly digestible carbohydrate source, maize by one of low digestibility as in the BDG, PKM and CB diets. High fibre in diets results in increased rate of passage of the fibrous feed through the gastro-internal tract with a consequent reduction in the time of ingesta (or nutrient) exposure to enzymatic degradation and time of nutrient contact with the absorptive membrane (Longe, 1985 and Varel *et al*., 1988). The percentage cooking loss was least in the BDG, PKM and CB diets than in the control diet due to higher values of shear force (Table 7) produced by these diets. As shown by the effect of period, prolonged feeding resulted in reduced percentage loss and higher value of shear force. The results are in agreement with those of Paul (1975) who reported that percentage moisture loss from meat reduced as the slaughter weight increased. The decrease in percentage cooking loss due to dietary treatment and period could be attributed to the increased collagen content in the meat with increase fibre intake. This makes the meat stronger with less water being released from it on heating. The observed increase in flavour, juiciness, and decrease in tenderness with increase in period and the BDG, PKM and CB diets, are in agreement with the report of Schonfeldt *et al*. (1993). They reported that meat from young animals were tenderer and contained less fibrous tissue residue than meat from older animals. Kemble *et al*. (1989) reported that the tenderness of goat meat reduced with age. Results showed that the increase in toughness of the meat with increased period of feeding or with the feeding of BDG, PKM and CB in place of maize did not reduce the general overall acceptability of the broiler chicken meat; an observation that confirmed the preference of meat consumers in this region for less tender meat from young animals. This was evident as scoring was highest at the 12-week period for all dietary treatment and also at each period on the BDG, PKM and CB diets. In conclusion, results of the study showed that 40% replacement of maize with BDG, PKM and CB in broiler finisher diets 1) reduced the nutrient digestibility, performance and abdominal fat in the birds. 2) BDG, PKM and CB in the diets resulted in reduced weights of carcase parts but increased weights and lengths of the visceral organs. 3) Feeding broilers for 10-12 weeks on diets in which BDG, PKM and CB has replaced maize resulted in increased flavour, juiciness, higher shear force value, reduced tenderness and cooking loss in the meat but with increased general acceptability.

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