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Performance and carcass characteristics of growing pigs fed varying levels of beniseed (*Sesamum indicum L.*) hull in replacement for maize (*Zea mays* LINN)

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Abstract

Sixty (60) grower-finisher pigs (Landrace x Large white) were used to investigate the nutritional value of beniseed hull (BSH) as substitute for maize on performance, carcass, and organs characteristics of the experimental animals. Five experimental diets were formulated by incorporating BSH into basal diet to replace maize at 0, 25, 50, 75 and 100%; designated as T1 (control), T2, T3, T4 and T5, respectively. The experimental pigs were individually weighed and assigned to five dietary treatments of three replicates of four animals each in a completely randomized design. The animals were fed for 2 weeks pre-experimental period and thereafter for ten weeks during which data were collected. Feed cost per kg live weight gain (₦668.67) of the animals fed 0% BSH significantly (P<0.05) reduced to ₦620.06 (25% BSH), ₦527.24 (50% BSH), ₦509.74 (75% BSH) and ₦456.73 (100% BSH). The bled weight, scald weight, eviscerated weight, dressing percentage, bacon, fore hock, hind hock and tail were significantly (P<0.05) affected by dietary treatments. The biggest liver weight (2.27g/kg) obtained in the animals fed the control diet (0% BSH) reduced significantly (P<0.05) to 2.20 (25% BSH), 1.91 (50% BSH), 1.76 (75% BSH) and 2.00 (100% BSH). Variations obtained in the kidney weight (0.40 g/kg) of the experimental animals fed with 25% BSH-based diets were similar (P>0.05) to 0.38 g/kg in the control (0% BSH) with both significantly (P<0.05) reduced to 0.36 (50% BSH), 0.36 (75% BSH) and 0.32 (100% BSH), respectively. Beniseed hull (BSH) poses no health challenge to the pigs used in this study. There were reductions in the cost/kg and cost of feed per kilogram live-weight gain with increasing levels of BSH in the diets, the lowest being at 100% level of substitution; beniseed hull could economically and safely replace maize in pig's diets up to 100% level.

Keywords: Beniseed hull, performance, blood indices, replacement, pigs

Introduction

Feed represents the biggest single cost that livestock/pig farmers face. Even with sheep which are ruminants that typically consumed more forage than other domestic species. Feed may represent 55 percent or higher of the total production costs (Ologhobo, 2004). Longe (2006) reported that the cost of ingredients could be as high as 80% of the total cost of production of finished feed. Maize, an energy ingredient is a major cereal crop for both livestock feed and human nutrition (Prasanna *et al.,* 2001). Maize grain alone accounts for about 15 – 56% of the cost of pigs feed (NRC, 1988). Increasing feed cost due to competition between man and animals for cereal grains has stimulated interest in ways of making use of agricultural by-products in livestock diets. The unconventional feedstuffs are feed items, which are not normally the first choice materials for the supply of respective nutrients when formulating livestock rations (Iyayi, 2008). Therefore, to reduce feed cost, which accounts for 60 - 70% of total cost (Nworgu *et al.,* 2000), such alternatives should have comparative nutritive value and cheaper than the conventional sources. One of such unconventional feedstuffs is beniseed hull. Beniseed hull is a by-product obtained from beniseed grains after the extraction of its oil content. Beniseed, also called sesame meal is a high protein and oil seed. Sesame (*Sesamum indicum* L.) is a tropical and subtropical plant cultivated for its seeds, which yield about 50% of high quality oil. Investigating the nutrients of beniseed hull is the focus of this study. The use of cheap and readily available unconventional feed resource (beniseed hull) in replacing maize (major source of energy) in growing pigs′ diets has great potential of reducing the high cost of feeds and feeding pigs. Beniseed hull is readily available and there is minimal pressure on its utilization. In many States of Nigeria, it is thrown away as waste. The proximate and caloric values of the beniseed hull were investigated; as well as the performance, carcass, and organs of the growing pigs fed with graded levels of beniseed hull-based diets.

Materials and methods

Site of the experiment

The experiment was carried out at the Piggery Unit of the Teaching and Research Farm of Joseph Ayo Babalola University, Ikeji- Arakeji, Osun State, Nigeria. Ikeji-Arakeji is situated on 350.52m above sea level at latitude 7^0 25′N and longitude 5^0 19′E. The area is of the rainforest vegetation characterized by hot and humid climate. The mean annual rainfall is usually about 1524mm. The atmospheric temperature usually ranged between 28^0C and 31^0C and mean annual relative humidity is usually about 80% (Ajibefun, 2011). The chemical composition of beniseed hull (BSH) with respect to proximate composition was evaluated at the Animal Care Konsult Research Laboratory in Ibadan, Nigeria.

Experimental animals, management and design

Sixty Pigs (Landrace × Large White) of about eight weeks were purchased from a reputable commercial farm in Owo, Ondo State, Nigeria**.** The Pigs were individually weighed and assigned to five dietary treatments of three replicates of four animals each in a completely randomized design. Pigs of each replicate were housed on cemented floor pen. The pigs were fed graded levels of beniseed hull-based diets for ten weeks. Medications were administered routinely as scheduled on the farm. Feed and water were given to the pigs *ad libitum.*

Data collection

Performance data collected include feed intake, weight gain and the computed feed conversion ratio (FCR) at the end of the trial. Cost of a kg feed was computed from the prevailing prices of the ingredients at the time of purchase from which cost of feed per kg live weight gain was computed. Data were also collected on carcass, and organs of the experimental animals. At the end of the 10 weeks feeding trial, the live body weights of 30 randomly selected experimental pigs (2 pigs/replicate) were recorded. The pigs were tagged according to their replicates, fasted overnight for eight hours to reduce the gastro-intestinal content (Yakubu *et al.,* 2012); for carcass and organ determination. Slaughtering was done by manual exsanguinations by severing the jugular vein, carotid arteries and trachea with a knife after stunning. The slaughtered pigs were scalded and eviscerated; their weights were measured after each operation. The internal organs and primal cuts were carefully separated and weighed to determine their weights.

Experimental diets

Five experimental diets were prepared as presented in Table 1. Beniseed hull (BSH) was incorporated into the basal diet to replace maize at 0, 25, 50, 75 and 100%; designated asT1 which served as control, T2, T3, T4 and T5 respectively. Other ingredients in the experimental diets include Groundnut cake (GNC), Soya bean Meal, Palm kernel Cake (PKC), Brewer Dry Grain (BDG), Bone meal, Oyster shell, Growers premix and Salt.

Chemical analysis

Proximate composition and the metabolisable energy of the test ingredient (beniseed hull) was carried out at the laboratory of Animal Care, Ogere, Ogun State, Nigeria.

Statistical analysis

Data obtained in the study were subjected to analysis of variance using SAS statistical package (SAS, 1999) and mean separated using Duncan Multiple Range Test (DMRT) of the same statistical software.

Table 1: Gross composition of experimental diet (%)

Ingredients	Beniseed Hull inclusion level (%)				
	D1 0.0% BSH	D2 25.0%BSH	D3 50.0% BSH	D4 75.0% BSH	D5 100.0% BSH
Maize	58.50	43.87	29.25	14.63	0.00
Beniseed hull	0.00	14.63	29.25	43.87	58.50
SBM	10.00	10.00	10.00	10.00	10.00
GNC	11.00	11.00	11.00	11.00	11.00
BDG	14.00	14.00	14.00	14.00	14.00
Fish Meal	2.00	2.00	2.00	2.00	2.00
Bone Meal	1.00	1.00	1.00	1.00	1.00
Oyster shell	1.00	1.00	1.00	1.00	1.00
Premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Vegetable Oil	1.50	1.50	1.50	1.50	1.50
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis					
CP(%)	20.27	20.54	20.80	21.06	21.32
ME (Kcal/kg)	3047.26	3006.45	2965.65	2924.86	2884.05
CF (%)	5.19	8.15	11.10	14.05	17.01

*Contained vitamins A (10,000,000.00 IU); D3 (2,000,000.00 IU); E (20,000.00mg); K3 (2000.00mg); B1 (3000.00mg); B2 (5000.00mg); Niacin (45,000.00mg); Calcium pantothenate (10,000.00mg); B12 (20.00mg); Choline Chloride (300,000mg); Folic Acid (1000.00mg); Biotin (50.00mg); Manganese (300,000.00); Iron (120,000.00mg); Zinc (80,000.00mg); Copper (8,500.00mg); Iodine (1500.00mg); Cobalt (300.00mg); Selenium (120.00mg); Antioxidant (120,000.00) per 2.5kg;

BSH = beniseed hull; SBM = soybean meal; GNC = groundnut cake; BDG = brewer dried grain; D1-D5 = Diets; CP = crude protein; CF = crude fiber

Chemical analysis

Proximate composition and the metabolisable energy of the test ingredient (beniseed hull) was carried out at the laboratory of Animal Care, Ogere, Ogun State, Nigeria.

Statistical analysis

Data obtained in the study were subjected to analysis of variance using SAS statistical package (SAS, 1999) and mean separated using Duncan Multiple Range Test (DMRT) of the same statistical software.

Results

Gross, proximate and metabolisable energy compositions of the experimental diets and beniseed hull

The gross, proximate and energy values of the experimental diets are presented in Table 1. The crude protein (%) increased from 20.27 for the control diet (0% BSH) to 20.54 (25% BSH), 20.80 (50% BSH), 21.06 (75% BSH) and 21.32 (100% BSH), respectively. The crude fibre followed the same trend. The metabolisable energy (kcal/kg) were 3047.26, 3006.45, 2965.65, 2924.86 and 2888.05 for 0, 25, 50, 75 and 100%, respectively BSH-based diets. Table 2 shows the proximate composition of beniseed hull with crude protein of 11.82%, crude fibre (22.15%), Ash (19.95%), ether extract or fat (24.40%) and moisture (3.96%). The metabolisable energy value is 3155.00 kcal/kg.

Table 2: Proximate composition (g/100g) and calculated values of beniseed hull

Components	**Values (%)**
Crude Protein	11.82
Crude Fat	24.40
Moisture	3.96
Crude fibre	22.15
Ash	19.95
Nitrogen free extract	17.72
Metabolisable energy (kcal/kg)	3155.00
Calculated values	
Dry matter	96.04
Organic matter	80.04
Protein/Fat	0.48
Fatty acid	19.52

Performance characteristics of growing finishing pigs fed beniseed hull-based diets

Performance indices of the experimental animals are presented in Table 3. Among performance parameters investigated, only the feed cost per kilogram and feed cost per kilogram live-weight gain were significantly (P<0.05) affected by dietary treatments. The two cost elements reduced with BSH inclusion level. The feed cost per kg (□160.48) of the control diet (0% BSH) reduced significantly (P<0.05) to □152.10 (25% BSH), □128.70 (50% BSH), □122.83 (75% BSH) and □108.23 (100% BSH). Feed cost per kg live weight gain (□668.67) of the animals fed with the control diet (0% BSH) significantly (P<0.05) reduced to □620.06 (25% BSH), □527.24 (50% BSH), □509.74 (75% BSH) and □456.73 (100% BSH). All other performance parameters (average initial body weight, final body weight, average daily weight gain, average daily feed intake, feed conversion ratio and feed efficiency were not significantly (P>0.05) affected by the dietary treatments.

Table 3: Performance characteristics of growing -finishing pigs fed graded levels of beniseed h ull-based diets

Parameters	Beniseed Hull inclusion level (%)					SEM
	D1 0.00% BSH	D2 25.00% BSH	D3 50.00% BSH	D4 75.00% BSH	D5 100.00% BSH	
Average Initial live weight (kg)	7.67	7.33	7.33	7.33	7.67	0.42
Average Final live weight (kg)	30.67	30.00	29.33	27.33	28.00	1.67
Average Daily feed intake (kg)	1.37	1.33	1.28	1.18	1.25	0.08
Average Weight gain (kg)	23.00	22.67	22.00	20.00	20.33	1.60
Average Daily weight gain (kg)	0.33	0.32	0.31	0.29	0.28	0.01
Feed conversion ratio	4.17	4.08	4.10	4.15	4.32	0.13
Feed efficiency	0.24	0.24	0.24	0.24	0.23	0.01
Feed intake (kg)	95.73	92.32	89.74	87.78	82.05	5.68
Feed cost/kg (□)	□160.48^{a}	□152.10^{b}	□128.70^{c}	□122.83^{d}	□108.23^{e}	11.49
Feed cost/kg live weight gain (□)	□668.67^{a}	□620.06^{a}	□527.24^{b}	□509.74^{ab}	□456.73^{c}	49.38

^{abcde}: Means within the same row with different superscripts differ significantly (P<0.05)

Carcass characteristics and organs weights

Table 4 shows the carcass and organs weight of pigs fed varying levels of BSH as replacement for maize. The bled weight, scald weight, eviscerated weight and dressing percentage were significantly (*P<0.05*) affected by the dietary treatments. The percentage bled weight of pigs on control diet (85.80)was similar to those fed with 25 (86.10) and 50% (84.90) beniseed hull-based diets but significantly (P<0.05) higher than those fed with 75 (81.55) and 100% (76.66) beniseed hull-based diets. The scald weight of pigs fed control diet was similar to those fed 25 and 50% beniseed hull-based diets but significantly (P<0.05) higher than pigs fed 75 and 100% beniseed hull-based diets. The eviscerated weight of pigs fed the control diet was similar (P>0.05) to those fed 25 and 50% beniseed hull-based diets; but significantly (*P<0.05*) higher than pigs fed 75 and 100% beniseed hull-based diets. The percentage dressed weight (58.30)of pigs fed with control diet was similar (P>0.05) to those fed 25% BSH (58.65) but significantly (P<0.05) higher than 56.00 (50% BSH), 53.70 (75% BSH) and 51.10 (100% BSH) in other treatments.

All the internal organs (heart, liver, kidney, spleen, intestine and stomach) expressed in g/kg differed significantly (P<0.05) across the dietary treatments. The lung, however, was similar (P>0.05) across the treatments. The biggest heart weight (g/kg) 0.51 (75% BSH) was significant (P<0.05) compared with 0.37 (0% BSH), 0.40 (25% BSH), 0.41 (50% BSH) and 0.43 (100% BSH). The biggest liver weight (2.27g/kg) obtained in the animals fed the control diet (0% BSH) reduced significantly (*P<0.05*) to 2.20 (25% BSH), 1.91 (50% BSH), 1.76 (75% BSH) and 2.00 (100% BSH). Variations obtained in kidney weight (0.40g/kg) of the experimental animals fed with 25% BSH-based diets were similar (P>0.05) to 0.38 g/kg in the control (0% BSH) with both significantly (*P<0.05*) reduced to 0.36 (50% BSH), 0.36 (75% BSH) and 0.32 (100% BSH) respectively. Spleen weight (0.21 g/kg) of the control was similar to 0.22 (25% BSH) both significantly (P<0.05) reduced to 0.16 (50% BSH), 0.15 (75% BSH) and 0.14 (100% BSH) respectively. The empty intestine values (g/kg) were 8.7 (0% BSH), 9.87 (25% BSH), 9.65(50% BSH), 10.37 (75% BSH) and 8.84 (100% BSH). The corresponding values (g/kg) of the empty stomach were 2.44, 1.53, 2.53, 2.30 and 2.94 for 0, 25, 50, 75; and 100% BSH-based diets, respectively.

Table 4: Carcass and Organs weight of pigs fed varying levels of BSH as replacement for maize

Parameters	Beniseed Hull inclusion level (%)					SEM
	D1 0.00% BSH	D2 25.00% BSH	D3 50.00% BSH	D4 75.00% BSH	D5 100.00% BSH	
Live weight(g)	30.00	27.10	27.40	29.00	26.85	1.64
Bled (%)	85.80^{a}	86.10^{a}	84.90^{ab}	81.55^{b}	76.66^{c}	1.05
Scald (%)	90.00^{a}	87.85^{ab}	86.66^{ab}	83.55^{bc}	78.55^{c}	1.22
Eviscerated Wt.(%)	70.00^{a}	68.90^{ab}	68.20^{ab}	65.35^{b}	65.35^{b}	0.70
Dressing (%)	58.30^{a}	58.65^{a}	56.00^{ab}	53.70^{bc}	51.10^{c}	0.85
Internal organs (g/kg)						
Heart	0.37^{b}	0.40^{ab}	0.41^{ab}	0.51^{a}	0.43^{ab}	0.02
Lung	1.24	1.03	1.06	1.08	1.16	0.03
Liver	2.27^{a}	2.20^{ab}	1.91^{bc}	1.76^{c}	2.00^{abc}	0.06
Kidney	0.38^{ab}	0.40^{a}	0.36^{b}	0.36^{b}	0.32^{c}	0.01
Spleen	0.21^{a}	0.22^{a}	0.16^{b}	0.15^{b}	0.14^{b}	0.01
Empty Intestine	8.70^{c}	9.87^{ab}	9.65^{abc}	10.37^{a}	8.84^{bc}	0.21
Empty Stomach	2.44^{ab}	1.53^{b}	2.53^{ab}	2.30^{ab}	2.94^{a}	0.17

[abc]: Means within the same row with different superscripts differ significantly (P<0.05)

Primal cuts

Among primal cuts investigated, only the bacon, fore hock, hind hock and tail were significantly (P<0.05) affected by the dietary treatments. Pelt, ham, shoulder, loin, back, head and rib were not significantly (P>0.05) affected by the BSH inclusion levels. Percentage bacon weight (5.30) of the experimental pigs fed control diet (0% BSH) was similar to those fed 25 (4.45) and 50% (4.55) beniseed hull-based diets; but significantly (P<0.05) higher than pigs fed with 75% (3.15) and 100% (3.35) beniseed hull-based diets. The percentage fore hock weight (0.70) of pigs fed with control diet (0% BSH) was lower (P<0.05) than 0.95 (25% BSH), 1.00 (50% BSH), 0.90 (75% BSH) and 0.80 (100% BSH) respectively. The highest (*P<0.05*) hind hock percentage weight (1.40) obtained each at 50 and 75% BSH compared with 1.30 (0% BSH), 1.20 (25% BSH) and 1.25 (100 BSH). The percentage tail weight (0.20) of pigs fed control diet (0% BSH) was the same with those of pigs fed 25, 50 and 100% beniseed hull-based diets, but significantly (P<0.05) higher than pigs fed with 75% beniseed hull-based diet.

Table 5: Primal cuts of pigs fed varying levels of BSH as replacement for maize

Parameters	Beniseed Hull inclusion level (%)					SEM
	D1 0.00% BSH	D2 25.00%BSH	D3 50.00% BSH	D4 75.00%BSH	D5 100.00% BSH	
Pelt (%)	3.30	3.05	3.12	2.65	2.75	0.10
Ham (%)	13.27	13.35	14.25	14.31	12.65	0.26
Shoulder (%)	11.50	13.25	12.75	12.13	12.25	0.73
Loin (%)	3.38	4.60	3.55	2.85	3.80	0.25
Back (%)	4.55	4.95	3.60	3.60	3.75	0.22
Head (%)	10.10	10.00	9.85	9.70	8.90	0.21
Rib (%)	12.95	13.90	13.45	14.30	14.00	0.37
Bacon (%)	5.30^{a}	4.45^{a}	4.55^{a}	3.15^{b}	3.35^{b}	0.24
Fore hock (%)	0.70^{b}	0.95^{a}	1.00^{a}	0.90^{ab}	0.80^{ab}	0.04
Hind hock (%)	1.30^{ab}	1.20^{b}	1.40^{a}	1.40^{a}	1.25^{ab}	0.03
Tail (%)	0.20^{a}	0.20^{a}	0.20^{a}	0.15^{b}	0.20^{a}	0.07

^{ab}: Means within the same row with different superscripts differ significantly (P<0.05)

Discussion

The increasing nutrients (crude protein and crude fibre) and decreasing caloric components of the experimental diets were reflections of the higher values of nutrients and lower values of metabolisable energy of the beniseed hull and maize respectively; as used in the formulation of experimental diets. The experimental diets were formulated to meet the nutrient requirementsof growing pigs as recommended (NRC, 1988; Oluyemi and Roberts, 2000). The crude protein, ether extract, crude fiber, ash and metabolisable energy values obtained for the beniseed hull in this study were higher than the values obtained by Ngele *et al.* (2011).

Similar values for performance parameters (average initial body weight, final body weight, average daily weight gain, average daily feed intake, feed conversion ratio, feed efficiency and feed intake) obtained across the dietary treatments may generally point to adequacy of the nutrients and energy contents of all experimental animals. The numerical but insignificant (P>0.005) lower feed intake and weight gain of the animals fed BSH-based diets than the control i.e. numerical decreasing feed intake and weight gain may point to presence of residual anti-nutrients in BSH. Similar reductions in feed intake and weight gain were reported for birds fed with diets having anti-nutritional factors (King *et al.*, 2000; Tanveer *et al.*, 2000; Olajide 2012).

Under *ad-libitum* feeding condition, pigs are reportedly known to consume primarily to satisfy their energy requirement (Leeson *et al*., 2000; Atteh, 2004). However, despite the lower energy contents of the beniseed-hull based diets compared with the control, the experimental animals consumed lesser of the former diets. There were also no differences in the final weight between the control and other treatments. There was a high energy content in maize-based diets. Another probable reason for lower feed intake may be the contents of the fiber which increased with the beniseed hull inclusion level. This may have caused earlier gut fill in pigs fed beniseed hull-based diets. Kass *et al.* (1980) reported that high dietary fiber level would have exerted depressive effect on nutrient intake by causing early gut-fill. Mc Donald *et al.* (1998) also observed that fibrous feed tends to spend longer time in digestive tract thereby resulting in reduced feed and nutrient intake. The growth rate of animal is obviously dependent on its level of feeding and if the level is high, growth will be rapid and the animal reaches a specified weight at an early stage. Pigs fed varying levels of beniseed hull had lower numerical weight gain than those fed on control diet. Increasing the level of beniseed hull in the experimental diets depresses the weight gain of the pigs. The weight of pigs at any point in time is a function of cumulative growth of component parts, provided all things being equal (Liu *et al.,* 1995). The feeds (control and BSH-based diets) were similarly utilized as shown by both FCR and efficiency of feed utilization. In fact, the FCR of 25 – 75% BSH were lower than control; but slightly higher than 100% BSH. The same for EFU which were similar for 0, 25, 50 and 75% BSH but slightly (P>0.05) higher than (100% BSH); 4.17% reduction in efficiency of utilization of feeds by the animals fed the control and those fed 25, 50 and 75% BSH over those fed with 100% beniseed –hull based diets. This may be explained by contents of residual anti-nutritional factors in BSH. Pigs that have low feed conversion ratio are considered efficient users of feed. Several factors including nature of feed and age of the animal are known to affect feed conversion ratio. Generally, the average daily feed intake of 1.18-1.37 kg per day in this study is less than the range reported by Adebiyi and Muibi (2016) for cross bred Landrace and Large White provided with different cooling systems. The weight gain (20-23 kg/pig) and feed conversion ratio (4.08-4.32) however, compares favourably with the values reported by these authors. Cost per kilogram of the experimental diets and the average cost of feeding each animal decreased as the levels of beniseed hull in the diets increases. Diet D1 (0% BSH) had the highest while diet D5 (100%BSH) had the lowest values of the two cost elements. There were 5.22, 19.80, 23.46 and 32.56% reductions in the cost of a kg feed at 25, 50, 75 and 100% BSH inclusion levels. The corresponding reductions in the cost of feed per kg live weight gain were 7.27, 21.15, 23.77 and 31.70 % in the same order. The main purpose of the utilization of unconventional feed ingredients is to lower the cost of production (Bawa *et al*., 2003 and Olajide *et al.,* 2007). The feed becomes cheaper as the levels of beniseed hull in the diets increased. It is not the cost per kilogram of feed that really matters but how efficient the feed can be utilized and converted to products. Therefore, cheap diets do not necessarily mean better profit margin to the farmer.

Generally, there were reductions in the carcass indices monitored especially the bled, scald, eviscerated and dressing percentages across the dietary treatments with increasing inclusion levels of beniseed hull in the diets. Although, this may be associated with differences in the diets; but could not be expressly stated to be linearly connected with the live weight of these animals. If it were to be so, experimental animals fed with 75% beniseed hull-based diets would have had second highest value of all indices. It must also be stated that higher value of dressing percentage of animals fed the control is a plus for the diet; the higher bled weight also obtained in these same group of animals fed the control may not be desirable. The later may suggest the possibility of higher blood retained which may in the long run affect the keeping quality of the carcass. The trend obtained in the heart was not consistent to be linked to the effect of diets. Although, Carew *et al.* (2003) have linked increase in weights of organs of broilers to the presence of anti-nutritional factors in mucuna, the authors, however, submitted that enlargement of the heart muscle was not a consistent change in birds fed Velvet beans. If it does, the authors asserted, it may represent extra workload imposed by stress or disease. The lower values of the liver and the kidney of the pigs fed beniseed hull-based diets than those fed the control could mean that the residual anti-nutritional factors present in beniseed hull did not cause abnormal size of these organs which are the organs of biotransformation in animals. Onyeyili *et al.* (1998) identified these organs as the primary organs of biotransformation and linked the changes in these organs to their roles in elimination of metabolic wastes and toxins from the animals′ body. The spleen reduced with increasing contents of beniseed hull in the diets. The trends obtained for the intestine and stomach was not definite to be associated with the effect of diets. The lungs were similar across the dietary treatments. Variability in carcass weight may have contributed to variation in some visceral organ mass (liver, intestine and heart). Some factors known to influence visceral organ size are body weight, feeding level, diet composition and Pig genotype (Nyachoti, 1998). The relationship between visceral organ mass and body weight appear to reflect both changes in feed intake and maintenance energy requirement with increasing body weight (Van and Noblet, 2003). Although the bacon, fore hock, hind hock and tail varied with the dietary treatments; the trends obtained for these parameters were not definite to be linked with the effects of the dietary treatments. Pelt, ham, shoulder, loin, back, head and rib were similar for the control and all beniseed hull-based diets. Generally, pigs with larger body weight had higher values for head, ham, shoulder, loin, bacon, rib, fore hock and hind hock. This was in line with the findings of Latorre *et al.* (2008) that the weight of ham, shoulder and loin increased with weight at slaughter. However, the observation contradicts the findings of Virgili *et al.* (2003) that primal cut proportion decreases with increasing body weight and the growth rate of the whole body.

Conclusion

Result of the study showed that beniseed hull (BSH) poses no health challenge to the experimental pigs depicted by normalorgans; coupled with the reduction in the cost/kg feed and cost of feed per kilogram live-weight gain, the lowest being at 100% level of substitution and similar performance across the dietary treatments; beniseed hull could economically and safely replace maize in pigs′ diets up to 100% level.

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