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WEANER PIGS FED GRADED LEVELS OF MAIZE OFFAL AS REPLACEMENT FOR MAIZE. 2. EFFECT ON SERUM METABOLITES

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Target Audience: Livestock scientists, extension staff and farmers.

ABSTRACT

Eighteen largewhite x Landrace weaner pigs, between 49-56 days of age, averaging 7.00 ± 0.26kg were used in a 56-day feeding trial to determine the effect of replacing maize with maize offal (at 0,25 and 50% of the maize fraction) in the diet on the serum metabolites of the pigs. The diets were isonitrogenous, containing an average of 20% crude protein. The dry matter and protein intake were higher at the 50% maize offal (MO) inclusion ($P<0.05$). The inclusion of MO in the diets increased the crude fibre and decreased the ether extract contents numerically, thereby diluting their energy concentration as the inclusion levels increased ($P<0.05$). Serum total proteins, albumin, globulin, urea, cholesterol and glucose contents of the pigs across the treatments were not significantly ($P>0.05$) influenced by inclusion of MO in the diets. The result was an indication that this class of pigs could tolerate the MO inclusion without any adverse effect on its well being.

Key words: Serum metabolites, weaner pigs, maize offal, maize.

DESCRIPTION OF PROBLEM

The shortage of energy and protein feeds for non-ruminants, which to a great extent depends on compounded feeds, has necessitated the use of agro-industrial by-products, farm wastes or crop residues as alternative feed sources. However, a feature of most locally availabe agro-industrial by-products and wastes is fibrousness, which may limit their use (1). Various

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studies have suggested that pigs can utilize fibre for their growth since it can be degraded by microbial fermentation (2,3).

The addition of fibre to swine diet has been reported to decrease metabolisable energy concentration of the diet (4,5) and often results in bulk feeds. When dietary crude fibre exceeds 10-15% of the diet, feed intake may be depressed because of excessive bulk or reduced palatability (6). Utilization of crude fibre by non-ruminants have been shown to vary considerably depending on fibre source (7) and level of inclusion (8,9). Fibre utilization is also influenced by the physical and chemical compositions of the total diet (10). Several researchers have observed, that an increase in the dietary level of fibre decreases protein digestibility (2,11).

The fibrous portion of feed, however, being fairly indigestible to pigs has been reported to influence the digestibility of the other constituents by exerting a protective action, encasing these constituents in a digestion - proof shield, as it were (12). Study was therefore designed to evaluate the effect of graded levels of maize offal as replacement for maize on the serum metabolites of weaner pigs.

MATERIALS AND METHODS

Source and Processing of Test Ingredient

The maize offal used in this study was purchased from the local grain millers in Bodija market, Ibadan. It was further dried in the sun to a constant weight before being incorporated into the diets. The other feed ingredients were purchased at Solas-Daras Nigeria Limited, Ojoo and Ola-Omolola Feeds, Iwo Road, both in Ibadan. The experiment was carried out at the Teaching and Research Farm of the Faculty of Agriculture and Forestry, University of Ibadan, Ibadan.

Experimental Diets

There were three dietary treatments in the experiment. They included (1) 0% Maize offal (maize-based) control, (2) 25% replacement of maize with maize offal and (3) 50% replacement of maize with maize offal. The maize offal was added to replace 25 and 50% of the metabolizable energy (ME) supplied by maize in the control diet. The diets were formulated to contain 20% crude protein. The percentage composition of the experimental diets is shown on Table 1.

Experimental Animals

Eighteen Large White x Landrace weaner pigs, between 49-56 days of age, averaging 7.00+0.25kg body weight were used in the 56-day growth trial to evaluate maize offal as a replacement for maize in the diets of weaner pigs. The pigs were injected with Ivomec (R) (Ivermectin) subcutaneously against endo- and ecto-parasites (1ml/50kg liveweight). They were randomly allotted to the three treatment groups based on body weight, sex and litter origin in a

completely randomized design. Each group of six pigs, comprising of three males and three females were individually penned.

Table 1: Gross Compositions (%) of Weaner Diets with graded levels of Maize Offal (M.O) as replacement for maize.

Ingredient	Level of M.O. Inclusion (%)		
	0	25	50
Maize	51.26	38.59	25.63
Maize Offal	0.00	13.09	26.45
Soybean Cake	28.99	28.57	28.17
Palmkernel Cake	10.00	10.00	10.00
Brewers Dried Grain	5.00	5.00	5.00
Bone Meal	3.00	3.00	3.00
Oyster Shell	1.00	1.00	1.00
Premix (Vit-min)*	0.25	0.25	0.25
Salt	0.25	0.50	0.50
TOTAL	100.00	100.00	100.00

**Vit A 10,000,000 IU; Vit D_3 2,000,000 IU; Vit E 8,000 IU; Vit K 2,000 mg; Vit B_1 2,000mg; Vit B_2 5,500 mg; Vit B_6 1,200mg; Vit B_{12} 12mg; Biotin 30 mg; Folic Acid 600 mg; Niacin 10,000 mg; Panthothenic Acid 7,000 mg; Chloride 500,000 mg; Vit C 10,000 mg; Iron 60,000 mg; Mn 80,000 mg; Cu 8,000 mg; Zn 50,000 mg; Iodine 2,000 mg; Cobdalt 450 mg; Selenium 100 mg; Mg 100,000 mg; Anti Oxidant 6,000 mg.*

All the pigs were housed on concrete floored pens equipped with feeding and watering troughs to allow ad libitum consumption of feed and water, respectively.

Chemical Analyses

The test ingredient and feed samples were analyzed for the proximate compositions using the methods of the Association of Official Analytical Chemists (4). The metabolizable energies were also determined with the prediction equation based on their proximate compositions (5).

Blood Analyses

Four (two males and two females) of the six experimental pigs in each of the three dietary treatment groups were randomly selected and bled both at the beginning and at the end of the feeding trial. The bleeding was done in the morning before feeding and 10ml of blood was obtained from the jugular vein into a sample bottle using a sterilized needle and syringe. The samples were allowed to clot before centrifuging to obtain the serum. The separated sera were decanted into Bijoh bottles and stored at -10°C until analysed. The serum metabolites (total protein, albumin, globulin, creatinitine, urea, cholesterol and glucose) were determined (16, 17).

Statistical Analyses

All the data obtained were subjected to analysis of variance and where statistical significance was observed, the means were compared using the Duncan's Multiple Range (DMR) test. The SAS Computer software package (18) was used for all statistical analyses.

RESULTS AND DISCUSSION

Chemical Composition

The chemical compositions of the test ingredient (maize offal) and the diets used in the study are shown in Table 2. The experimental diets were isonitrogenous with the determined crude protein values being slightly higher numerically than the calculated value (20.00%). The crude fibre content increased with increasing maize offal (MO) inclusion from 4.73% for the maize-based control diet to 7.35% for 50% M0 inclusions. The reverse was obtained for the ether extract content with the control diet having the highest value of 7.80% and 5.20% for 50% Mo inclusions. The ash and nitrogen free extract contents followed no definite pattern. However, the metabolizable energy contents of the diets decreased numerically with increasing MO inclusion.

The proximate composition of the maize offal employed in this study was similar to those reported (1, 19). The crude protein, crude fibre and ether extract values obtained in this study were slightly higher than those obtained (1) but lower than those of another study (19) numerically.

Table 2: Proximate Composition (% DM Basis) of Maize Offal and the Test Weaner diets

Item	0	25	50	MO
Dry Matter	89.20	86.00	86.20	89.70
Analyses, % of DM				
Crude protein	20.65	20.35	20.70	10.15
Crude Fibre	4.73	6.05	7.35	9.20
Ether Extract	7.80	6.20	5.20	2.60
Ash	8.00	7.50	8.80	1.50
Nitrogen Free Extract	58.82	59.99	57.95	76.55
Metab. Energy (KcalME/kg)**	3532.38	3374.52	3086.90	3292.86

***Estimated by prediction equation (14).*

The energy and protein values of the diets were in the range recommended (20) for weaner pigs in the tropical environment. The corresponding increase in the fibre contents of the diets as the level of maize offal inclusion increased could be attributed to the high fibre content of the maize offal being incorporated.

The findings (21) of an inverse relationship between energy values of feedstuffs and fibre content agree with the observed decrease in energy content as the fibre level increased. The increased dietary inclusion of maize offal in animal rations has also been reported (1) to cause dilution of the energy concentration of the total ration.

Serum Metabolites

The effect of the dietary treatment on the serum metabolites analysed are shown in Table 3. The total protein, albumin, globulin, urea, cholesterol and glucose concentration in the serum were not significantly (P>0.05) affected by the inclusion of up to 50% MO in the rations of weaner pigs. However, the serum creatinine concentrations of pigs on the 25% levels was significantly higher (P>0.05) than those on the 0 and 50% levels.

Table 3: Serum Metabolites of Weaner Pigs fed graded levels of Maize offal as replacement for Maize in diets.

Metabolite	Level of Maize Offal Inclusion (%)		
	0	25	50
Total Protein (g/dl)	6.23 ± 0.06	6.33 ± 0.13	6.28 ± 0.10
Albumin (g/dl)	4.23 ± 0.17	4.08 ± 0.22	4.05 ± 0.16
Globulin(g/dl)	2.00 ± 0.17	2.25 ± 0.26	2.23 ± 0.22
Creatinine(g/dl)	1.43 ± 0.09	1.70 ± 0.16	1.40 ± 0.04
Urea (mg/dl)	33.75 ± 2.56	37.00 ± 2.71	33.00 ± 2.27
Cholesterol (mg/dl)	114.50 ± 16.38	111.75 ± 5.36	114.75 ±15.28
Glucose (mg/dl)	73.00 ± 5.85	75.50 ± 2.50	71.00 ± 4.49

The serum total protein of weaner pigs fed the test diets were observed to be unaffected by the varying levels of MO inclusions. Total serum protein or albumin has been reported (22) to represent protein reserves in the animal and changes in total protein content indicates alterations in the albumin fraction. These variations in turn result in marked alteration of albumin to globulin ratio. The result of this study showed that the protein levels in the diets were able to support the normal protein reserve in the pigs in all the groups. Moreso, that the average serum albumin contents of the pigs across the groups were equally unaffected by the varying MO inclusions.

The albumin content was reported to be specifically influenced by protein shortage (23). However, the similarities in the values obtained across the groups could be as a result of the isonitrogenous nature of the diets. It has been reported that albumin level tends to remain constant throughout life after reaching a maximum at about three weeks of age (24). The observed values were within the normal ranges of 4.80-10.00g/dl and 1.80-5.60g/dl reported for serum total proteins and albumin, respectively (25).

The serum globulin contents of the pigs across the groups were not influenced by the MO inclusion levels nor the resultant varying crude fibre contents. This is in agreement with the findings that total globulin showed little or no change even when changes were observed with the total protein (22). The average serum creatinine contents of pigs on the 25% MO diet was comparably higher (Pá0.05) than those obtained with the maize-based control and the 50% MO diet. This indicated an observable muscular wastage at this level of MO inclusion brought about by the inadequacy of the protein relative to the other levels (0 and 50% levels). Even when the protein intake of the pigs on this diet was comparable (P>0.05) to that of the control, the higher creatinine level may be as a result of poor digestibility or utilization of the protein (26).

The higher protein intake of pigs on the 50% MO diet compared to the other two diets could be responsible for the similarity to the creatinine value obtained for the pigs on the control diet even when the PER was inferior and unable to support equal growth rate. However, the values obtained for the three dietary groups were within the range (1.00-2.7mg/dl) reported (17). Catabolism of amino acids increased when proteins of lower biological values are fed and this was reported to be responsible for high urea values (27). This could explain the higher values obtained in this study compared to the ranges reported (25), (17). The major protein sources in the diets were mainly of plant origin and (28), (29) reported proteins of plant origin to be inferior to those of animal origin.

The dietary treatments had no significant (P>0.05) effect on the serum cholesterol levels of pigs across the groups. The observed values were in agreement with the normal range of 76-174mg/dl reported (25). This could probably be as a result of the fact that the 10-25% dietary crude fibre limit in swine diets (6) was not exceeded (Table 2). Lower levels of serum cholesterol have been reported for growing pigs by increasing the protein content of the ration. However, since the diets were isonitrogenous, the observed similarity in the values obtained across the group was expected. This tends to agree with the study (32) which reported similar serum cholesterol levels for pigs allowed different access to the same food. Although the ether extract content of the diets decreased with increasing crude fibre in the diets resulting from the increasing MO inclusion, it had no significant (P>0.05) effect on the serum cholesterol level as against other findings (30,32). They reported the serum cholesterol levels in pigs to be affected by the amount of dietary fat, which in the case of this study could be measured in the form of the ether extract.

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