GROWTH AND REPRODUCTIVE PERFORMANCE OF PIGS FED WITH RAW AND DIFFERENTLY PROCESSED VELVET BEANS *(MUCUNA PRURIENS)* AS PARTIAL REPLACEMENT FOR SOYA BEAN MEAL

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Abstract: The increasing competition for the conventional plant protein sources for food, feed and other industrial uses necessitated researches into potential feed resources that are relatively underutilized. Velvet beans (*Mucuna pruriens*) is a leguminous plant that is widely available in most tropical, subtropical and temperate region. In Nigeria, it grows luxuriantly uncultivated and is often used as browse plant for ruminants, but it use in non ruminant feed is limited by its high contents of anti-nutritional factors. Thermal and chemical processing methods are known to reduce the levels of anti- nutrients in crops. Thirty-eight weeks experiment was conducted to determine the effect of differently processed velvet beans on the growth and reproductive performance of gilts. The velvet beans were boiled, toasted and soaked in Potassium Carbonate (K_2CO_3) and thereafter subjected to proximate analysis. The raw and the processed velvet bean seeds were included at 20% levels of inclusion representing 80% replacement value of the protein contribution of soya bean meal. Thirty growing gilts of average initial weight 28.08±0.06 Kg were randomly allotted to five dietary treatment with each treatment replicated three times in a randomized complete block experiment. Diet 1 contained soya bean meal included at 25% (Control), while diets 2, 3, 4, 5 contained raw, cooked, toasted, and K_2CO_3 treated velvet beans respectively. Data collected included average feed intake (AFI), average weight gain (AWG), feed conversion ratio (FCR), Average conception rate (ACR), average gestation period (AGP), average litter size (ALS), average weaning rate (AWR), average birth weight (ABW) and average weaning weight (AWW). All data collected were subjected to analysis of variance and means were separated using Duncan Multiple Range Test. Result revealed that the different processing methods significantly ($P < 0.05$) increase the percentage Crude Protein (C.P) and Gross energy (G.E) of velvet beans while L-3,4-dihydroxyphenylalanine (L-DOPA) was significantly depressed. The C.P and G.E ranges from 30.02 – 34.36 % and 3666.95 – 3838.80 Kcal/Kg respectively. The different processing methods significantly ($P < 0.05$) improve the AWG, FCR, ALS, AWR and AWW of the pigs. Thus the growth and reproductive performance of pigs fed with the differently processed velvet beans were significantly ($P < 0.05$) higher than those fed with the raw seeds and were comparable to the soya bean control. Pigs fed with toasted velvet beans had the best performance. Hence processed velvet beans can be used to replace 80% of soya bean meal in the diets of pigs without any deleterious effect.

Keywords: Growth; Pigs; Processing; Reproductive; Velvet beans.

INTRODUCTION

Food security is a condition in which all people have access at all times to enough food of an adequate nutritional quality for a healthy and active life (World Bank 1986). The existence of food

insecurity and nutritional problems in Nigeria has been reported by many workers (Olayide 1982; Famoriyo, 1998; Okuneye 2002*)*. Protein-energy malnutrition has been identify as most common challenge in the nutrition of people in the highly populated developing countries of the world where most people depends on starch based diet for survival (FAO, 1994; Michaelsen and Henrik, 1998). There is therefore the need to increase production of accessible protein sources so as to improve the nutritional status of people living in this part of the world.

Pig production as an important aspect of livestock sub-sector of Nigerian agricultural sector could be considered in this aspect as pigs' posses' high fecundity, high feed conversion efficiency, short generation intervals and early maturity. However, the growth of intensive pig production in developing nations such as Nigeria has been adversely affected by high cost of feed and feed ingredients especially the protein feed ingredients like groundnut cake, soya cake and fishmeal whose price continue to escalate due to human consumption and other uses.

Therefore, there is need to identify and exploit other protein sources especially in the wild which are in abundance so as to bridge the gap in protein availability to animals and man. *Mucuna pruriens* known as velvet beans is an annual leguminous weed which grows abundantly in the tropics. The moderate crude protein (20-35%) and high carbohydrates (55.2-64.88%) content (Siddhuraju Vijayakumari and Janardhanan 1996; Vedivet and Janardhan, 2000; Ezeagu *et al* 2003) is suggestive of a high nutritional potential. The presence of anti-nutritional factors such as trypisin inhibitors, phytate, cyanogenic glycoside, tannins and 1-3-4 dihydroxyphenyalanine (L-Dopa) has limited its use in monogastrics (Ravindran and Ravindran; 1988, Olaboro *et al* 1991; Houghton and Skari, 1994; Carew *et al*, 2002; Grant 1991).

The use of different processing methods to reduce the level of anti-nutrient to make it safe for human and livestock consumption has been reported.(Del Carmen *et al,*1999; Emenalon *et al*,2004; Ani,2008; Toleba *et al* 2009).

This study was geared towards determining the effect of including differently processed *Mucuna pruriens* in the diets of growing pigs on their growth and reproduction performance.

MATERIALS AND METHODS

Production of Raw and Processed Mucuna Seed Meals

Seeds of *Mucuna pruriens* used in this study were harvested from the pasture of the ruminant unit of the Department of Animal Production and Fisheries of Lagos State Polytechnic (LASPOTECH), Ikorodu, Lagos, Nigeria. The seeds were de-hulled sundried and subjected to different processing methods. The boiled Mucuna seed meal (BMSM) was processed by lowering the *Mucuna pruriens* packed in a Jute bag into a large pot of boiling water and allowing it to cook for 60 minutes, the timing was taken from the boiling point of water (100^{o}C).The seeds were then drained and sundried. Toasted Mucuna seeds meal (TMSM) were obtained by frying in a hot Gari fryer with continuous stirring until a popping sound was heard. The chemical treated Mucuna seed meal (CMSM) were processed with of K_2Co_3 using the method of Ani (2008). The chemical compositions of the raw (RMSM) as well as the processed Mucuna seed meals (MSM) sample were determined by the methods of AOAC (2005). The Gross Energy (GE) was determined using Sanyo bomb calorimeter.

Experimental Diets

The composition of the control diet (Commercial pig ration) and others containing the raw and processed mucuna seed meal are shown in table 2. The experimental diets were formulated to contain approximately 18% crude protein. Each diet constituted a treatment. All experimental diets were milled at the feed mill of LASPOTECH Commercial Farms using 1mm mesh size sieve.

Experimental Animals and Management

Thirty healthy gilts of average weight of 28.08±0.06 obtained from the breeding unit of LASPOTECH Commercial Farms were used. The pigs were housed in pens with adequate feeders, drinkers and wallowing through. Prior to the arrival of the pigs, the experimental pens were washed and disinfected using Lysol solution. The pens were properly labeled to indicate the dietary treatment to be fed to animal housed in it. The pigs were randomly allotted to the five dietary treatments with each treatment replicated three times in a completely randomized design (CRD) Experiment. There were two gilts per replicate. At puberty one matured proven boar was deployed per treatment. Feed and water were provided *ad libitum* and all traditional management practices were strictly observed throughout the two hundred and sixty six days of the study.

Data Collection and Analysis

Data collected includes feed intake, weight gain, weight at maturity, age at maturity, gestation period (in days), litter size, number of healthy piglets, weight of piglets at farrows, survivals in terms of numeral weaned, and weaning weight. The following performance indices were calculated from the primary above primary data.

i. Feed Conversion ratio = $\frac{\text{Feed intake}}{\text{Weight gain}}$

ii. Protein efficiency ratio = $\frac{\text{Weight gain}}{\text{Protein intake}}$

iii. Piglets weaned/sow/treatment = $\frac{\text{Total number of piglet weaned per treatment}}{\text{Total number of sow}}$

All data collected were subjected to analysis of variance and treatment means were separated with Duncan Multiple range test using Assistat 7.6 beta software developed by Silva and Alzevedo,(2006).

Table 1: Composition of Experimental Diets (G/100g)

Ingredients	T1	T2	T3	T4	T5
Maize	58.9	53.20	55.31	56.30	55.75
Maize offal	8.00	8.00	8.00	8.00	8.00
Soya bean cake	25	10.70	8.59	7.60	8.15
Mucuna	0	20.00	20.00	20.00	20.00
Blood meal	2.35	2.35	2.35	2.35	2.35
Bone meal	2	2	2	2	2
Oyster shell	3	3	3	3	3
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50	0.50
Calculated Analysis					
Crude Protein	18.10	18.10	18.10	18.10	18.10
M.E(KCal/Kg)	3136.25	3202.11	3223.82	3240.58	3223.99

Table 2: Proximate Composition of Differently Processed Mucuna Seed (G/Kg Dm)

Variables	RMSM	BMSM	TMSM	CMSM	SEM
Dry Matter	93.78	94.35	94.72	93.66	0.25
Ash	6.57^{a}	4.33^{b}	4.60^{b}	4.29^{b}	0.55
Crude Protein	30.02^{b}	32.98^{ab}	34.36^{a}	33.59^{a}	0.95
Crude Fibre	9.60^{a}	9.50^{a}	8.77^{b}	8.45^{b}	0.28
Ether Extract	4.5	3.43	4.50	3.45	0.31
NFE*	43.09	44.61	42.49	43.88	0.46
L.Dopa	3.48	1.59	1.60	1.62	0.47
GE**	3666.95^{c}	3761.57^{b}	3838.80^{a}	3759.49^{b}	34.73

*NFE→ Nitrogen Free Extract. **GE→ Gross Energy KCal/Kg

Table 3: Effect of Different Processing Methods of *Mucuna Pruriens* on Growth Performance of Pigs

	T1	T2	T3	T4	T5	SEM
Initial weight (Kg)	27.90	28.20	28.00	28.20	28.10	0.06
Weight at Puberty (Kg)	76.38[a]	73.78[c]	74.44[b]	78.08[a]	74.82[b]	1.22
Weight gain (kg/day)	0.56	0.53	0.54	0.58	0.55	0.01
Feed intake	1.60	1.58	1.60	1.62	1.59	0.01
Feed conversion ratio	2.86[b]	2.98[a]	2.96[a]	2.79[b]	2.89[b]	0.05

Table 4: Effect of Different Processing Methods on Reproductive Performance of Pigs

	T1	T2	T3	T4	T5	SEM
Age at Puberty (days)	170	168	169.67	172	167.33	1.20
Gestation length (days)	114.0	115.0	116.0	116.0	116.0	0.40
Litter size	9.0[bc]	8.0[c]	10.0[ab]	11.0[a]	9.0[bc]	0.58
Litter birth weight (kg)	1.40	1.38	1.41	1.45	1.40	0.01
Survival rate %	100[a]	75[c]	89[b]	90[b]	88[b]	5.15
No of piglet weaned	8.0	6.0	9.0	10.0	8.0	0.66
Weaning Weight (kg)	7.03[a]	5.02[c]	5.73[b]	6.63[a]	5.90[b]	0.36

RESULTS AND DISCUSSION

The proximate composition of differently processed seeds of *Mucuna pruriens* are shown on table 2. The result revealed that the lowest crude protein (CP) value was recorded in the RMSM while the highest CP was observed in TMSM. Generally the CP of the processed seeds were significantly (P<0.05) higher than the raw seeds, hence the different processing methods were effective in increasing the level of CP in mucuna seeds. The CP obtain in this report is higher than those reported by Nyirenda *et al*(2003), Ani (2008), Mugandi and Njogi,(2010)). The difference in the CP of Mucuna seeds used in this study and those reported in literature could be attributed to varietal and geographical differences. Okorie and Anugwa, (1987); Amaefule and Obioha,(1998) reported that geographical and varietal difference influences the nutrient composition of certain legume & oil seed. The crude fibre and L-dopa content of the processed seeds was significantly (P<0.05) reduced by the different processing methods thus processing reduces the antinutritional factors (ANFS) inherent in plant (Fasuyi 2005).Thermal processing methods appears to be more effective in reducing ANFS in mucuna seeds.

Table 3 shows the growth performance of swine fed with diets containing raw and differently processed *Mucuna pruriens* seeds. The initial body weight of swine was similar in all treatment groups. The average feed intake during the experiment varied from 1.58 to 1.65kg/pig/day and did not significantly difference (P>0.05) between treatment groups. The experimental diets were well consumed except for diets 5 (CMSM) whose consumption level was lowest.

The daily weight gain ranges between 0.51kg/day to 0.59kg/day. The significantly(P<0.05) lowest daily weight gain was observed in pigs fed on diet 2 (RMSM), this may not be unconnected with high amount of ANFS in RMSM, depression in weight gain has been associated with ANFS in mucuna seeds (D'Mello and Devendra 1995; Carew *et al* 2002) this is reflected in the weight of pigs at puberty which also differs significantly (P<0.05) among the treatment groups with the pigs fed on diet 4 having the highest weight gain which is comparable to the soya bean control diet. The FCR of the pigs fed with the experimental diets also varied significantly (P<0.05) the gilts on diet 2 (RMSM) having the highest and worst FCR while the lowest and best FCR was observed among gilts on in diets 4 (TMSM based diet). The better performance observed in pigs fed with the processed MSM compared to RMSM might be attributed to detoxifying effect of the processing methods on the ANFS in the raw seeds (Ani 2008).

The effects of raw and differently processed Mucuna seeds on the reproductive performance of pigs are shown on Table 4. The age at average litter size differ significantly (P<0.05) among pigs fed with the

experimental diet. The significantly highest litter size of 11 piglets observed in pigs fed with diet containing TMSM in this study was higher than the value reported by Orheurata (2000) but within the range of 8-12 reported by Iheukwumere *et al* (2008). Generally the litter sizes of the pigs fed with diets containing the processed seeds was higher than those fed with RMSM and are comparable to those on soya bean control diets.

The survival rate and of pigs whose sow were fed with the soya bean control diets was significantly ($P<0.05$) higher than that of those fed with the processed MSM which did not differ significantly ($P<0.05$) among each other but were significantly different from the piglets of sow fed with RMSM. The average weaning weight follow similar trend as the survival rate, however, the weaning weight of piglets whose dam was fed with TMSM was similar to the soya bean diets.

The average birth weight was similar ($P>0.05$) for all sow fed with the experimental diet and is within the range of value reported by Iheukwumere *et al* (2008).

CONCLUSION

This study indicated that the different processing method improves the feeding value of MSM and that TMSM can replace 80% of soya bean meal in the diets of growing pigs without any deleterious effect.

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