Journal of Agriculture, Environmental Resource and Management
ISSN2245-1800(paper) ISSN 2245-2943(online)
4(1)137-144

www.saerem.com

Growth performance and haematology of weaner pig fed diets containing different mollusc shells

[1]Ukpanah, U. A., [2]K. U. Amaefule, [1]I. M. Sam,.
[1]Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State, Nigeria.
[2]Michael Opara University of Agriculture, Umudike, Abia State Nigeria.
unwanaukpanah@yahoo.com;

Abstract

A study was conducted to determine the performance and haematological indices of weaner pigs fed diets containing different mollusc shells (Thais coronata, Egeria radiata, Achatina achatina,Pachymelania aurita) with 30 hybrid (Landrace × Large white) weaner (8 – 10 weeks old) pigs whose initial live weight ranged from 9.00 to 12.20 kg. The pigs were randomly assigned to five dietary treatments (the control and 4 different mollusc shells) with each treatment having six pigs and two pigs per replicate. The supplementation of diets with each mollusc shell was 100 g per 100 kg diet. The experimental design was completely randomized design (CRD). Performance parameters measured were weight gain, feed intake, feed conversion ratio (FCR), protein intake, and protein efficiency ratio and feed cost of weight gain while haematological indices were pack cell volume (PCV), haemoglobin (Hb), white blood cell (WBC), Red Blood Cell (RBC), Platelets, mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). Results showed that there were no significant (P>0.05) differences in the performance of weaner pigs fed diets supplemented with different mollusc shells. The haematological indices showed significant (P<0.05) differences among the treatments in PCV, the control diet had value (35.65) which was significantly (P<0.05) higher than those with the mollusc shell inclusions (34.50, 34.33, 32.50 and 33.50) respectively). These values all fall within the tolerable range for weaner pigs. The inclusion of mollusc shells in the diets of weaner pigs improved performance in terms of body weight gain.

Keywords: Weaner pig, Performance, Haematology, Mollusc shells.

INTRODUCTION

Like other developing countries, Nigeria is faced with the challenge of scarcity of animal protein, which is increasing with the increase in population. It has been reported that only 8.4 g of the 53.8 g of protein consumption of Nigerians is gotten from animal source, which imply less than 16% contribution of animal products to protein consumption of Nigerians (Ajala *et al.,* 2007). There is therefore need to increase pig production. Pigs are highly prolific, good converters of feed to flesh, have faster growth rate when compared with the cattle, sheep and goat (Ikani *et al.,* 1995). Pig production is a lucrative venture in the southern region of Nigeria mostly because there are little or no religious restrictions on pork consumption. The use of mollusc shell powder has been found efficient as an adsorbent, based on its adsorption capacity, available surface area, distribution

ratio and percentage sorption (Asia *et al*., 2007). It has high thermal capacity, distinct macrospore structure which enables fast transport of gaseous vapors, it does not swell or disintegrate in ordinary water (Osu, 2010). It is less expensive, easy to use and non toxic to the livestock or the farmer. It has the potential to improve performance and reduce odour in the faeces of poultry (Ukachukwu *et al.*, 2013).

Molluscs make their shells from the calcium derived from their environment, either the food they eat or the water they dwell in and are classified into major groupings according to the characteristics of their shells (Marin *et al.*, 2004). Mollusc shells litter the environments around the coastal plans and the riverine regions of Nigeria and constitute pollutants and health hazard to the people leaving in such areas. Although they have been used as calcium source in livestock feed, their potential to improve performance has not been widely investigated. This research will therefore investigate the effectiveness of selected mollusc shells on the performances and haematology of pigs

MATERIALS AND METHODS

Collection and preparation experimental materials

Four mollusc *(Thais coronata, Egeria radiata, Achatina achatina* and *Pachymelania aurita)* shells were collected from the market women in an urban market in Uyo, Akwa Ibom State of Nigeria.

The samples were sorted according to their species, thoroughly washed and rinsed in clean water, air-dried for one week and further dried in an oven at 110^0C for six hours, according to pre-treatment recommendations of the Association of Official Analytical Chemists (A.O.A.C, 1990) After drying, the samples were homogenized by crushing into fine grains using a crusher (Megan Model BB 200). The crushed particles were sieved using a 120 mm mesh and poured into cleaned, dried, sample containers and sealed with labels A, B, C and D to distinguish one from each other (table 1).

Table 1: Four mollusc shells used in the experiments

Sample code	Common name	Biological name	Local name
A	Rock snail	*Thais coronate*	Nkonko
B	West African clam	*Egeria radiate*	Nkop
C	Land snail	*Achatina achatina*	Ekwong
D	Periwinkle	*Pachymelania aurita*	Mfi

A
Rock snail (*Thais coronata)*

B
West African clam (*Egeria radiata)*

C
Land snail (*Achatina achatina)*

D
Periwinkle (*Pachymelania aurita*

The shells were analysed to determine the Ca^{2+}, Fe^{2+}, Zn^{2+}, Mg^{2+}, Na^{+}, K^{+} and P compositions using spectrophotometry method, this method measures how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength.

The experiment was conducted in the Piggery Unit of the Teaching and Research Farm, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State, Nigeria. Obio Akpa campus is in the humid tropical region, situated between latitudes 5^0 17′ N and 7^0 27′ N and longitudes 7^0 30′ E and 7^0 58′ E of the Greenwich Meridian. The annual rainfall ranging from 3500mm – 5000mm and average monthly temperature of 25^0C in the tropical rainforest zone of Southeast Nigeria. (SLUS-AK, 1994).

Experimental animals

Thirty hybrid (Landrace x Large white) weaner pigs, 8-10 weeks old with initial live weight ranging between 9.00-12.20 kg were procured from pig dealers/farmers in Oruk Anam Local Government Area, Akwa Ibom State . They were quarantined for two weeks, weighed and allotted into five treatments of six pigs each, replicated three times with two pigs per replicate in a completely randomized design. The pigs were housed in a well ventilated concrete floor pens, equipped with concrete feeding and watering troughs. Routine and regular cleaning of the pens was carried out. Feed and clean water were provided and the experiment lasted for 56 days.

Experimental diets

Table 2: Composition (Kg) of weaner diets containing different mollusc shells

Ingredients (kg)					
Maize	18.20	18.20	18.20	18.20	18.20
Wheat offal	24.00	24.00	24.00	24.00	24.00
Palm Kernel Meal	40.00	40.00	40.00	40.00	40.00
Soybean meal	14.00	14.00	14.00	14.00	14.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
Vitamin premix*	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.20	0.20	0.20	0.20	0.20
DL-Methionine	0.10	0.10	0.10	0.10	0.10
Thais coronata		0.10			
Egeria radiata			0.10		
Achatina achatina				0.10	
Pachymelania aurita					0.10
Total (kg)	**100**	**100**	**100**	**100**	**100**
Calculated Composition					

Crude protein	19.75	19.75	19.75	19.75	19.75
ME(kcal/kg)	2308	2308	2308	2308	2308
Fibre (%)	8.31	8.31	8.31	8.31	8.31
Calcium (%)	1.25	1.25	1.25	1.25	1.25
Lysine	1.11	1.11	1.11	1.11	1.11
Methionine	0.69	0.69	0.69	0.69	0.69

*Each 1.25kg contains Vit A 12,000,0000I.U,VitD 33,000,000I.U, Vit E 30,000mg, Vit K3 2,500mg, Folic Acid 1,000mg, Niacin 40,000mg Calpan 10,000mg, Vit B2 5,000mg, VitB12 20mg, VitB1 20mg, Vit B6 3,500mg, Biolin 80mg, Antioxidant 125,000mg.

Data collection

The experimental animals were weighed weekly to obtain the weekly weight. The daily weight gain (DWG) was calculated by dividing the total weight gain by the number of days the experiment lasted. Feed intake was obtained as the difference between the quantity offered the previous day and the quantity left over while feed conversion ratio (FCR) was calculated by dividing the feed intake by weight gain. The experiment lasted 56 days. The protein intake was calculated as feed intake multiplied by protein in feed and protein efficiency ratio was calculated as daily protein intake divided by daily weight gain. Feed cost of weight gain was calculated as feed conversion ratio multiplied by cost per kg of diet.

At the end of the experiment, two mls of blood sample were collected via a vein behind the ears, using 10 mls syringe into sample bottles containing Ethylene diamine-tetra-acetate (EDTA) as anticoagulant for haematological analysis according to the methods of Schalm *et al.* (1975). Data obtained from the experiment were subjected to analysis of variance (ANOVA) for completely randomized design (Steel and Torrie, 1980). Differences between treatment means were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The mineral composition of mollusc shells used in the study is presented in Table 3. The mineral composition showed low sodium (Na^+) concentration. Similar variations were obtained in a study by Ademolu *et al.* (2004) with shells from Abeokuta. The low sodium concentration is an indication that its inclusion in livestock diet is safe and without complications arising from high Na^+ intake (Ademolu *et al.*, 2004).

Table 3: Mineral composition of the respective mollusc shells used in the experiments

Parameters	*T. coronata*	*E. radiata*	*A. achatina*	*P. aurita*	SEM
Calcium (%)	67.20^a	48.72^b	43.68^c	38.64^d	3.25
Magnesium (%)	26.87^a	17.48^b	17.47^b	15.45^c	1.30
Sodium (%)	0.18^c	0.33^b	0.41^a	0.42^a	0.09
Potassium (%)	0.16^b	0.12^c	0.11^c	0.20^a	0.05
Iron (%)	0.04^b	0.03^b	0.03^b	0.07^a	0.02
Zinc (%)	2.74^a	2.37^b	1.12^c	0.55^d	0.26
Phosphorus (%)	0.03^d	0.85^a	0.47^c	0.50^b	0.08

^{abcd}; means of the same row with different superscripts are significantly different (P<0.05) SEM=standard error of mean.

Growth performance

The growth performance of weaner pigs fed diets containing 100g of the respective mollusc shells/100 kg is presented in Table 3. The weaner pigs fed diets containing *Thais coronata* shells powder had an average daily weight gain

of 0.21 kg/pig, *Egeria radiata* had 0.20 kg/pig, *Achatina achatina* had 0.18 kg/pig, *Pachymelania aurita* had 0.19 kg/pig while the control had 0.18 kg/pig.

There were no significant (P>0.05) differences among the weaner pigs fed the control diet and those fed diets containing 100g of the different mollusc shells powder in final live weight and FCR. However, results showed numerical differences in the final life weight and daily weight gain. Weaner pigs fed diets containing *Thais coronata* shells powder had the highest numerical daily weight gain. The result gotten in this experiment could be the effect of the isocaloric and isonitrogenous diets fed to the weaner pigs.

The daily weight gain in this experiment (0.18-0.22) kg was slightly higher than those reported by Amaefule *et al.,* 2006 (0.13- 0.14) kg who fed diets containing different proportions of palm kernel meal (PKM) and brewers dried grain (BDG) to weaner pigs. In that experiment, the diet containing 40% PKM had 0.13 kg daily body weight gain. McDonald *et al.,* (1995), noted that PKM is a good source of protein, energy, methionine and cysteine though limited in lysine. The inclusion of 40% PKM in the weaner pigs' diet in this experiment did not depress growth.

Table 3 Performance of weaner pigs fed diets containing different mollusc shells

Parameters	Control	*T. coronata*	*E. radiata*	*A. achatina*	*P. aurita*	SEM
Initial live weight (kg)	9.23	9.35	9.38	9. 52	9.79	0.38
Final live weight (kg)	19.39	21.33	20.93	20.00	20.53	0.56
Daily weight gain (kg)	0.18	0.21	0.20	0.18	0.19	0.05
Daily feed intake (kg)	0.66	0.72	0.69	0.66	0.68	0.02
Feed conversion ratio	3.67	3.43	3.45	3.67	3.58	0.06
Daily protein intake (kg)	0.18	0.18	0.18	0.18	0.18	0.03
Protein efficiency ratio	0.94	0.85	0.85	0.95	0.58	0.01

[abc]; means of the same row with different superscripts are significantly different (p<0.05)
SEM=standard error of mean.

Haematological indices

The haematological indices of weaner pigs were studied to assess the effect of dietary mollusc shells powder on the health status and welfare of weaner pigs. Results (Table 4) showed no significant (P>0.05) differences between the weaner pigs fed the control diet and those fed dietary mollusc shells in white blood cell (WBC), red blood cell (RBC), haemoglobin (Hb) and mean corpuscular volume (MCV). There were significant (P<0.05) differences among the weaner pigs fed mollusc shell inclusions in pack cell volume (PCV) and platelets. However all the values obtained fell within the normal range for pigs in this class (National Research Council 2012). The RBC fell within the normal range which implies that there were no cases of dehydration. The Platelets fell between (525.00- 636.67), This result is an indication that the diets were not toxic to the pigs and that they were no cases of anemia, excess body fluid or blood loss (Togun *et al.,* 2007).

Table 4: Haematological indices of weaner pigs fed diets containing different mollusc shells

Parameters	Control	*T. coronata*	*E. radiata*	*A. achatina*	*P. aurita*	SEM
Pack Cell Volume	35.65^{a}	34.50^{ab}	34.33^{b}	32.50^{c}	33.50^{b}	1.25

Haemoglobin (g/dl)	13.67	12.33	12.00	12.33	13.67	0.43
White Blood Cell (%)	12.50	12.00	12.10	12.83	13.00	0.43
Red Blood Cell (%)	6.67	7.67	8.00	8.33	7.33	0.33
MCV	53.44	44.98	42.91	39.01	52.92	1.98
MCH (Pg)	20.49	16.07	15.00	14.80	21.59	0.01
MCHC (%)	38.34	35.74	34.95	37.93	40.80	0.09
Platelets	525.00^{c}	613.67^{a}	613.67^{a}	628.33^{b}	636.67^{b}	21.7

[abc;] means of the same row with different superscripts are significantly different (P<0.05) MCH= Mean Corpuscular Haemoglobin; MCHC= Mean Corpuscular Haemoglobin Concentration, SEM=standard error of mean.

CONCLUSION

The growth performance of the weaner pigs fed diets containing the various mollusc shells in this study was not affected or altered. However, weaner pigs fed *Thias coronata* shells were numerically higher in total body weight gain and feed conversion ratio. The haematological analysis all fell within the normal range for weaner pigs therefore implying that the mollusc shells were not toxic to the weaner pig.

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