Odour offensiveness of pig fed diets containing rock snail (*Thais coronata*) and the natural zeolite

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Abstract
Thirty six hybrid (Landrace × Large white) pigs, 26 to 28 weeks old with an average initial weight of 36.64 kg were assigned to diets containing (0.0, 0.2 and 0.3)g of Thais coronata and the natural zeolite respectively to determine the odour offensiveness of pig. The pigs were randomly allotted into six treatments of six pigs each, replicated three times with two pigs per replicate reared on a concrete-floored pen in a 2×3 factorial in a completely randomized design (CRD). Odour offensiveness was determined using 16 panelists in a five point scale. There were significant ($P<0.05$) additive (AD) × inclusion (IL) interactions in all the indices considered.Results showed that the odour offensiveness reduces as the inclusion level of the additives increases. It was concluded that the inclusion of Thais coronata can compare closely with the natural zeolite in mitigation of odour from the faeces of finisher pig.

Keywords: Odour offensiveness, pig, *Thais coronata*, the natural zeolite.

Introduction
Pig production is a lucrative venture in the southern region of Nigeria mostly because there are little or no religious restrictions on pork consumption. Most pig farmers in these areas are constrained to increase their production capacity by the community resentment due to the unpleasant odour released from the pig farms (Ki *et al.*, 2007). Intensive pig production is a source of environmental pollution because pigs produce large quantities of waste (Ogbuewu *et al.*, 2012). These relatively large quantities of excreta produced have increased environmental concerns over ammonia emission (Ritz *et al.*, 2004). This emission, aside from the unpleasant odour, affects the performance of the pig and is detrimental to human health (Lu *et al.*, 2008).

The rock snail *(Thais coronata)*, locally called *nkonko* is a mollusc with a humped or spined thick walled shell, mostly with short whorls with the shell closed by a honey operculum (Davis *et al.,* 2004). They are up to 5 cm in length and are dirty grey to brown in colour. It contains 67.20% calcium, 26.87% magnesium, 0.18% sodium 0.16% potassium, 0.04% iron, 2.74% zinc and 0.03% phosphorus.

The use of *Thais coronata* 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 reduce odour in the faeces of poultry (Ukachukwu *et al.,* 2013).This research therefore investigates the effectiveness of *Thais coronata*s hells on odour offensiveness of pig.

Materials and methods

The experiment was conducted in the Piggery Unit of the Teaching and Research Farm, AkwaIbom State University, ObioAkpa Campus, AkwaIbom State, Nigeria. ObioAkpa campus is in the humid tropical region, situated between latitudes 4^0 30′ N and 5^0 30′ N and longitudes 7^0 30′ E and 8^0 00′ E of the Greenwich Meridian (SLUS-AK, 1994).

Collection and preparation of Thais coronata shells

Thais coronate shells were collected from the market women in an urban market in Uyo, Akwa Ibom State of Nigeria. The samples were sorted, 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 (AOAC, 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 container for use in formulation of the experimental diets.

Experimental animals

Thirty six hybrid (Landrace × Large white) pigs, about 27 weeks old with an average initial weight of 36.64 kg were procured, weighed and allotted into six treatments of six pigs each, replicated three times with two pigs per replicate in a 2×3 factorial in a completely randomized design (CRD). The pigs were reared in well ventilated concrete floored pens, equipped with concrete feeding and watering troughs. Clean water and experimental diets were provided. Regular and routine cleaning of the pens was carried out and the experiment lasted for 56 days.

Experimental diets

Six experimental diets were formulated,the control dietswith no inclusions, diets 2 and 3 containing 0.2 g and 0.3 g of the natural zeolite and diets 5 and 6 containing 0.2 g and 0.3 g of rock snail (*Thais coronata)* shell power. This is presented in Table 1 below.

Data collection

Sixteen panelists were selected among the students and staff of Akwa Ibom State University, where the experiment was carried out, for evaluation of odour offensiveness. Zhang *et al*., 2002 opined that the most reliable way of measuring odour is using the human olfactory sense which is the nose. Pig faeces were placed in plastic vials capped with cotton wool. Odour offensiveness represented one of the four factors describing odour nuisance, namely FIDO (frequency, intensity, duration and offensiveness), as described by Otto *et al* (2003). Odour offensiveness was ranked on a scale of 1 to 5, where 5 was the score for extremely offensive, 4 for strongly offensive, 3 for moderately offensive, 2 for mildly offensive and 1 for not offensive. The panelists sniffed the samples in a temperature controlled room (20-23)^{0}C where there would be no detectable odour in the environment that would affect their evaluation (Otto *et al*., 2003). The scores obtained were weighted by the weight of the scale respectively and the percentage calculated. The accumulated weighted and percentage weighted scores were also computed. Data obtained were subjected to data analysis.

Data analysis

Data obtained from the experiments were subjected to analysis of variance (ANOVA) for a 2×3 factorial in completely randomized design (Steel and Torrie, 1980). Differences between treatment means were separated using Duncan's Multiple Range Test (Duncan, 1955).

The experimental design was a 2×3 factorial in completely randomized design with the model:

$$\gamma_{ijk} = \mu + L_i + A_j + (LA)_{ij} + e_{ijk}$$

Where:

γ_{ijk} = The kth observation on the i$_{th}$ treatment.

μ = Overall mean.

L_i = Effect of inclusion of *Thais coronata* and the natural zoelite.

A = Effect of level of inclusion of *Thais coronata* and the natural zoelite

$(AL)_{ij}$= The effect of the interaction between the additives and their level of inclusion.

e_{ijk} = Random error.

Results and discussion

The panelist score for offensiveness of finisher pigs' faeces on a 5 point scale (Otto *et al*., 2009) showed non-significant (P<0.05) additive type (AD) main effects in all the odour offensiveness indices considered(Table 2). The inclusion level (IL) main effect showed significant (P<0.05) differences in all the odour indices considered. There were also significant (P<0.05) AD × IL interactions in all the indices considered.

Pigs fed diet with 0.00 g IL (8.39) had scores for 'not offensive' lower (P>0.05) than that of 0.20 g IL (23.34) which was also lower (P>0.05) than that of 0.30 g IL (32.54). *T. coronata* and the natural zeolite at 0.00 g IL (8.39) had the same scores lower (P > 0.05) than those at 0.20% IL which were (P<0.05) themselves similar (P>0.05). *T. coronata* at 0.30 g IL (35.28) was significantly (P<0.05) higher than the natural zeolite at 0.30 g IL (29.38). It was obvious that as the inclusion level of the additives increases the score for not offensive also increases.

Scores for 'mildly offensive' showed that pigs fed diet with 0.00 g IL (10.44) were scored lower (P>0.05) than those of 0.20 g IL (28.58) which were also lower (P>0.05) than those of 0.30 g IL (31.31). *T. coronata* and the natural zeolite at 0.00 g IL (10.44) had the same scores. Zeolite at 0.20 g IL (35.42) had scores higher (P<0.05) than those of *T. coronata* at 0.20g IL (21.74) and 0.30 g IL (29.47) respectively. Results showed a trend of an increase in the score for 'mildly offensive' as the inclusion level of the additives increases.

Scores for 'strongly offensive' showed that pigs fed diet with 0.00g IL (37.50) were scored higher (P<0.05) than those of 0.20 g IL (12.46) which had scores (9.37), higher (P<0.05) than those of 0.30 g IL. The interaction between *Thais coronata* and the natural zeolite at 0.00 g IL had the same scores (37.50), but higher (P<0.05) than those of 0.20 g IL which were themselves similar (P>0.05). *Thais coronate* and the natural zeolite at 0.30 g IL had the lowest scores of 8.33 and 10.41, respectively.

Scores for 'extremely offensive' showed that pigs fed diet with 0.00 g IL (27.05) were scored higher (P<0.05) than those of 0.20 g IL (11.41) which had scores higher (P<0.05) than those of 0.30 g IL (9.29). The interaction between *Thais coronata* and the natural zeolite at 0.00 g IL had the same scores (27.05), but the natural zeolite at 0.20 g IL and 0.30 g IL (8.24 and 8.32) were significantly (P>0.05) lower than those of *Thais coronata*(14.58 and 10.27) at the same inclusion levels. *Thais* *coronate* at 20 g IL had scores higher ($P<0.05$) than those of 0.30 g IL.

It was generally observed that odour offensiveness were reduced with the inclusion of additives and that the potential of *Thais coronate* shell in this study to reduced odour emission in the faeces of finisher pig was close to that of the natural zeolite. This agrees with the report of Ukachukwu *et al.* (2013) in his work with broiler birds, that *Thais coronate* shell powder has the potential to reduce odour in the faeces of poultry. The potential of natural zeolite to mitigate odour in this research is in agreement with the work of Portejoie *et al.* (2003), who reported that addition of zeolite to feed rations as treatment of effluent reduced malodour, in particular that of ammonia and other nitrogen containing compounds. In another experiment, Milan *et al*. (2001) reported that the addition of zeolites to the supplemental rations of ruminants could reduce methane emissions. This is based on the fact that odours are the result of incomplete fermentation of protein and fibers in the gut and in the manure. Exogenous enzymes such as xylanase have been shown to reduce the indigestible portion of a feed (Wolford *et al*., 2001).

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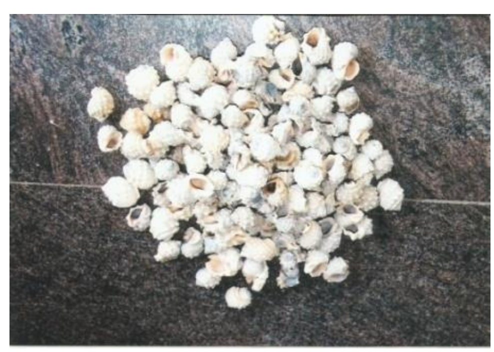

Rock snail (*Thais coronata*) shells

Table 1. Composition of finisher pigs diets containing *Thais coronata* and natural zoelite

Parameters	**Control**	**Zeolite**	**Zeolite**	**Control**	***T.coronata***	***T.coronata***
Maize	16.00	16.00	16.00	16.00	16.00	16.00
Wheat offal	28.00	28.00	28.00	28.00	28.00	28.00
Palm Kernel Meal	50.00	50.00	50.00	50.00	50.00	50.00
Soybean meal	2.20	2.20	2.20	2.20	2.20	2.20
Bone meal	3.00	2.80	2.70	3.00	2.80	2.70
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin premix*	0.25	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.20	0.20	0.20	0.20	0.20	0.20
DL-Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Natural zeolite (g)	-	0.2	0.3	-	-	-
Thais coronata (g)	-	-	-	-	0.2	0.3
Total	**100**	**100**	**100**	**100**	**100**	**100**

*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.

Table 2. Effect of level of inclusion *of Thais coronata* and the natural zeolite on odour offensiveness of finisher pig

Parameters		0g	0.2g	0.3g	Mean
Not offensive %	*T. coronata*	8.39^{d}	28.68^{b}	35.28^{a}	20.78
	zeolite	8.39^{d}	29.12^{b}	29.38^{b}	29.38
	Mean	8.39^{c}	23.34^{b}	32.54^{a}	
	SEM=0.83	Ad=0.14	IL =0.10	Ad×IL=0.14	
Mildly offensive %	*T. coronata*	10.44^{e}	21.74^{d}	29.47^{c}	20.55
	zeolite	10.44^{e}	35.42^{a}	33.14^{b}	26.33
	Mean	10.44^{c}	28.58^{b}	31.31^{a}	
	SEM	Ad =0.08	IL =0.69	Ad×IL=0.14	
Strongly offensive %	*T. coronata*	37.50^{a}	12.42^{b}	8.33^{d}	19.41
	Zeolite	37.50^{a}	12.51^{b}	10.41^{c}	20.14
	Mean	37.50^{a}	12.46^{b}	9.37^{c}	
	SEM	Ad=0.26	IL =0.32	Ad×IL=0.04	
Extremely offensive %	*T. coronata*	27.05^{a}	14.58^{b}	10.27^{c}	17.30
	zeolite	27.05^{a}	8.24^{d}	8.32^{d}	14.54
	Mean	27.05^{a}	11.41^{b}	9.29^{c}	
	SEM	Ad =0.01	IL =0.01	Ad×IL=0.17	

^{mabc}; means of the same row with different superscripts are significantly different (P<0.05); SEM=standard error of mean.Ad= additive; IL= inclusion level, Ad×IL = interaction between the additive and inclusion level.