PERFORMANCE AND MORPHOMETRIC CHARACTERISTICS OF WEANER PIGS REARED ON DEEP LITTER SYSTEM INOCULATED WITH INDIGENOUS MICROORGANISMS

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ABSTRACT
Pigs are being produce mainly on cement-concrete floor. Such production system generates waste water (slurry) rich offensive odour, large population of houseflies and emission of polluting and greenhouse gases. In order to assess a production system that may ameliorate these challenges, a study was designed to compare performance and morphometric characteristics of pigs reared on deep litter without indigenous microorganisms, DL- IMOs (T_1) and those inoculated with indigenous microorganisms, DL+ IMOs (T_2). Forty (40) equal sex weaners pigs of average 126 days old were arranged in five animals x 4 replicate x 2 treatments (n=40; M=20, F=20). Data obtained from the two treatments for each of the parameter measured were subjected to a pair t-test analysis of STATA. Those reared on DL+ IMOs (n=20; M=10, F=10) produced better performance in IBW, FBW, AWG, AFI, FCR and morphometric results (not significant, p>0.05) over the untreated litter, DL- IMOs (n=20; M=10, F=10). Respective results from the two-litter system showed that FBW= 12.43 ± 2.00 and 11.62 ± 3.07 and FCR = 0.83± 0.27 and 0.78 ± 0.32. Sex performance did not differ significantly between entire male and female pigs irrespective of deep litter system. Results of the present study suggest the potential of DL+ IMOs for awareness creation and adoption among the pig producers in Nigeria.
Keywords: Pigs, Microorganisms, Morphometrics, Performance

INTRODUCTION

Pigs are one of the most commonly raised animals in the world. They are the primary protein source for millions of people across numerous different cultures and geographical regions. In 2023, there were over 778 million pigs worldwide, decreasing from around 784 million heads in the previous year (Shahbandeh, 2024). In the same year, FAOSTAT (2023) reported that Africa contributes about 1.67% of the global pork production. In respect to pigs' production in Africa, Nigeria ranks among the top countries within the region with about 40% growth (Shahbandeh, 2024). Nigeria had the largest domesticated pig population in Africa as of 2022, reaching over 9.5 million heads. Malawi and Angola followed with around 8.1 million and 3.6 million heads, respectively.

It has been reported (Brown *et al.,* 2018) that 90% of the Pigs' population raised in Nigeria are through extensive system. However, Pig production in Nigeria is rapidly moving from the traditional extensive system to semi-intensive and intensive systems of production (Adesehinwa *et al.*2024). Such intensive system is usually carried out on a firm cement concrete floor; characterized with washing out of wastewater that contains urine, excrement, food waste and various cleaning chemicals. Ottosen *et al*. (2021) affirmed the negative impact of the later system on our environment as it generates greenhouse gases, acidifies soils and causes eutrophication in natural water bodies.

Studies (AfrII, 2016 and Laishram *et al.,* 2018) showed that rearing pigs under deep litter system is a beneficial method in ameliorating these challenges and also minimizing disease occurrences through improvement on the pigs' immune systems. Linear body measurements accurately measured are closely related to live weights for pigs (Adedeji, 2012; Adeola *et al.,*2013) and in other farm animals. Such zoometrical measurements of body parts can predict live weight at relatively lower costs with a high relative accuracy and consistency. There is a dearth of information about the performance of pigs reared under deep litter system. This study was therefore conducted to assess the performance and morphometrics characteristics of weaner pigs reared o- deep litter system inoculated with Indigenous Microorganisms (IMO's).

MATERIALS AND METHODS

Location and experimental pens/design

This research will be carried out at proposed Piggery Research and Teaching Farm of Alex Ekwueme Federal University Ndufu-Alike, Ikwo Local Government Area of Ebonyi State. The State lies in the humid tropical agro ecological zone of Nigeria within Longitudes 70 30ˈE and 80 30ˈE and Latitudes 50 40ˈN and 60 45ˈN (Okereke, 2012). Four (4) pens (12 x 12 m^2) each were provided for "deep litter inoculated without Indigenous Microorganisms (IMO's)" [DL-IMO's] and "deep litter with IMO's" [DL+IMO's] respectively. A total number

of forty (40) weaned pigs (Large White X Landrace) were randomly allotted to two (2) treatments of twenty (M=10, F=10) pigs. Each treatment has four (4) replicates of five (5) weaners.

Cultivation of indigenous microorganisms (IMOs)
Materials used for cultivation of indigenous microorganisms (IMOs) include; a small wooden box, 30 x 30 x 15 cm deep, steamed white rice, white paper towels, enough to cover the wooden box, two to four large rubber bands, a sheet of clear plastic or thick white-water proof, large enough to completely cover the wooden box, 35 cm mesh wire screen large enough to completely cover the wooden box. These materials were assembled for cultivation and collection of microbes (IMOs) in line with the method (with little modification) described by Park and DuPonte (2008). The IMOs collected was formed into cultured solution and used to inoculate the litter according to the procedures outlined in AfrII (2016)

Sources of Deep Litter Materials
Required quantity of rice straw was gathered after rice paddy harvest from the selected farms within Ikwo Local Government Area (LGA). Rice husk and dried palm fronds were also freely obtained from Nwakpu rice mill cluster and Obuegu Ndufu Echara palm tree plantation, respectively. Other materials (loam soil, borehole water, table salt and glucose) were also sourced accordingly.

Deep litter Preparation and Maintenance
7.5 kg each of the rice straws and dried palm fronds were laid firmly on non-cemented floor to a height of 30cm in a 12m x 12m size pen. Other bedding materials were also added to the height of 40cm given a total of 70 cm in all. The bedding materials consist of rice husk, (30 bags), 100kg or 3 wheelbarrows of loam soil, ash (10kg) and table salt (10kg). Hoes and garden forks were used to mixed the litter materials (down 30 cm from the top) thoroughly with borehole water and solution of IMO's (60 % moisture) respectively. Mixing of the bedding materials was continued for eight days before stocking the weaners. In order to maintain a healthy bedding and to encourage rootling, turning and mixing of the litter with borehole water and IMO's solution was respectively carried out for 3 times in a week till end of the experiment. All pigs were in the same rearing health and climatic conditions, in open sided pens with cement constructed feeders and nipple drinkers fixed within the wall of the pens.

Parameters measured
In order to assess the performance and morphometric characteristics of pigs under the two deep litters system [DL-IMO's (T_1) and DL+IMO's (T_2)], the following parameters were measured: Initial body weight, Final body weight and Feed intake. The Weight gain and Feed conversion ratio were calculated accordingly. The morphometric linear body measurements in centimeter (cm) were taken using a textile tape and graduated measuring stick (ruler). Selected linear body measurements taken includes; Snout circumference, Snout length, Head length, Ear length, Neck circumference, Body length, Heart girth, Shoulder width, Height of withers, Width of hook, Tail length.

Statistical analysis
Data obtained from the two deep litter systems [DL-IMO's (T_1) and DL+IMO's (T_2)] on each of the parameter measured and calculated were subjected to a pair t-test analysis of STATA version 17 software programme.

RESULTS AND DISCUSSION
The results on performance characteristics (Table 1) showed numerical variation (though not significant, $p>0.05$) between the two-treatment compared. Better performances of pigs reared on DL+IMO's were in agreement with the results of Kidega, *et al.* (2019). Such performance may be attributed to the potentiality of IMO's in fast-tracking decomposing of cellulose and lignin in the deep litter materials into simple organic compost and generates warmth suitable for prime pork production (AfrII, 2016). The welfare of pigs through rootling were also promoted and guaranteed. Non similarity performance in male and female weaner pigs observed in the present study (not-significant, $p>0.05$) revealed the manifestation of sex difference in the pigs reared on the two deep litter system. However, similarity report was observed in Okpeku *et al.* (2011) in all measured morphological parameters in indigenous pigs in Southern Nigeria.

The summary of the results for morphological parameters of pigs reared on the two deep litters system [DL-IMO's (T_1) and DL+IMO's (T_2)] are presented in the Table 2. The trend of better morphological values in pigs reared on DL+IMO's was in agreement with the reports of Solís-Tejeda *et al.* (2022) and Kidega, *et al.* (2019). [IM1]

Table 1: Mean value (mean ± S.D) for performance characteristics of weaner pigs reared under deep litter system inoculated with IMO's

Performance	Sex	Deep Litter System	
		DL- IMO's (n=20)	DL+ IMO's (n=20)
IBW (kg)	M	6.17 ± 1.19	6.19 ± 0.91
	F	5.13 ± 0.96	6.39 ± 1.15
FBW (kg)	M	11.62 ± 3.07	12.43 ± 2.00
	F	10.13 ± 2.11	12.45 ± 2.61
AWG (kg)	M	6.98 ± 0.15	7.44 ± 0.13
	F	6.08 ± 0.21	7.48 ± 0.21
AFI (kg)	M	5.46 ± 2.23	6.50 ± 1.55
	F	5.00 ± 1.96	6.11 ± 1.78
FCR	M	0.78 ± 0.32	0.83± 0.27
	F	0.82 ± 0.30	0.82± 0.23

IBW= Initial body weight; FBW= Final body weight; AWG= Average weight gain; AFI= Average feed intake; FCR = Feed conversion ratio; S. D= Standard deviation; n=Number of pigs/treatment. DL+ IMO's = Deep litter inoculated with IMO's; DL- IMO's = Deep litter without IMO's

Table 2: Mean value (mean ± S.D) for the morphometrics characteristics of weaner pigs reared on deep litter system inoculated with IMO's

Morphometric characteristics (cm)	Deep Litter System	
	DL - IMO's (n=20)	DL+ IMO's (n=20)
BW	10.87 ± 2.67	12.44 ± 2.27
SC	7.13 ± 0.58	7.83 ± 0.59
SL	5.48 ± 0.92	6.13 ± 0.48
HL	9.38 ± 1.35	10.65 ± 1.09
EL	4.36 ± 0.44	4.53 ± 0.50
NC	14.75 ± 1.20	15.30 ± 1.34
BL	19.83 ± 1.29	21.48 ± 2.13
HG	19.45 ± 1.39	21.00 ±1.80
SW	2.45 ± 0.43	2.40 ± 0.38
HW	14.12 ± 1.26	15.70 ± 1.80
WH	14.23 ± 1.45	15.88 ± 1.33
TL	5.79 ± 0.50	7.03 ± 0.94

BW= Body weight; SN= Snout circumference; SL=Snout length; HL=Head length; EL=Ear length; NC=Neck circumference; BL= Body length; HG= Heart girth; SW=Shoulder width; HW= Height of withers; WH=Width of hook; TL=Tail length; S.D= Standard deviation; n=Number of pigs/treatment. DL+ IMO's = Deep litter inoculated with IMO's; DL- IMO's = Deep litter without IMO's

CONCLUSION

This study may represent the first attempt to evaluate the effect of IMO's inclusion in Deep Litter System (DLS) of pigs' production in the study area. Non-significant better results observed in performance and morphological parameters for the pigs reared on DL+IMO's affirmed the efficient of this biotechnology over DL- IMO's and concrete floor system. Present findings show that DLS meets technical, financial, environmental and animal welfare characteristics, hence, our calls for future research in creation of awareness and adoption of deep litter system inoculated with IMO's (DL+IMO's) for pigs' producers in Nigeria.

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