

MICRO-MINERAL COMPOSITION AND SKIN HEALTH OF WEANED PIGS REARED ON CONCRETE AND BEDDED FLOORS

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Abstract

To explore the impact of different bedding materials on micro-minerals and skin health, eighteen (18) crossbred weaned pigs were assigned randomly into three treatment groups of nine (9) pigs per treatment and three (3) pigs per replicate. The bedding material used were T1 (Concrete floor), T2 (Wood shaving floor) and T3 (Clay floor). Concrete floor were made of gravel, granite, sand and water while wood shaving were obtained from the sawmill within Igboora metropolis in its dried form and pebbles, dirt and broken bottles were removed and spread on cemented floor to make wood shaving floor. Clay floor were gotten from termite hills within the Oyo State College of Agriculture and Technology, Igboora campus as certified by the soil scientist and spread on the cemented floor to make clay floor. Feed were offered according to the nutrient requirement of the animals while water were offered *ad libitum*. For the determination of micro-mineral analysis, blood were collected from the anterior vena cava vein of the pigs very early in the morning before feeding into plain bottle for the determination of iron, zinc and copper. The method of Bjourklund (2005) were adopted for the purpose of skin lesion score. Results revealed significant ($P < 0.05$) difference in the mean value obtained for micro-minerals as pigs reared on concrete floor recorded the highest mean value for Iron (23.67), Zinc (24.00) and Copper (26.33) respectively. Pigs kept on clay floor recorded the highest (0.55) occurrence of skin lesion as compared to pigs reared on concrete floor (0.40) and wood shaving floor (0.10) respectively. It could be concluded that rearing pigs on concrete floor improve the iron concentration of pigs and wood shaving floor caused less damaged to the skin.

Keywords: Bedding, blood, micro-minerals, skin, weaned pigs

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Introduction

An important key factor in livestock production is the design of production systems that meet the needs of animals thus improving livestock productivity, animal activity and welfare (Singh *et al.*, 2020). Rearing and

management techniques employed during pig pre-weaning stage are more crucial to reduce stress and illness risk. Flooring is one of such factors related to animal housing which influences the growth, production, health and welfare of the animals. The type of beddings

used in piggery affects the pig skin surface temperature (Sutherland *et al.*, 2013) in addition to providing warmth and comfort. Micro-minerals constitute a small percentage of pig diets, but their importance to growth, health and productivity of the pig cannot be over emphasized. They play very important role in digestion, metabolism of protein, fats and carbohydrates, enzymes, blood, skeleton, hair and milk (Fakler *et al.*, 2004). Iron is an important component of many enzymes and is essential for synthesis of haemoglobin. Iron is low in grains and thereby commonly supplemented from inorganic sources in a trace mineral premix. Zinc is an important component of many enzymes and participates in the metabolism of carbohydrates, proteins and lipids. Zinc is found in grains and oilseeds at low concentration and mostly associated with phytate, which makes zinc unavailable to the pig (Walk *et al.*, 2015) Zinc deficiency is characterized by a skin condition called parakeratosis, low growth rate and impaired reproductive performance (Sheikh *et al.*, 2010). Zinc toxicity depends upon source, dietary level and duration of feeding, but generally the maximum tolerable dietary level for swine is set at 1,000 ppm with the exception of zinc oxide, which may be included at higher levels (NRC, 2012). Copper is an important component of many enzymes and participates in iron absorption and synthesis of haemoglobin (Bikker *et al.*, 2016). Copper is found in grains and oilseeds probably at adequate quantities to meet the requirements (Coble *et al.*, 2017). Copper deficiency signs include anaemia and low growth rate. Copper toxicity occurs at levels above 250 ppm when fed for a long period of time (NRC, 2012). The skin of pigs serves as a multifunctional organ crucial for protection, thermoregulation, sensory perception and immune defense, playing a pivotal role in overall pig health and welfare (Schoonhoven *et al.*, 2016). Comprising layers such as epidermis, dermis and subcutaneous tissue, the pig skin provides a barrier against

environmental pathogens and physical injuries while also housing a diverse microbial community that influences skin health (Lozupone *et al.*, 2012). The skin is the largest organ of the body accounting for about 10-12% of body weight in piglets at birth and up to 7% in adult pigs (Cameron, 2012). It serves as the first line of defense against external, physical, chemical and biological attackers which makes it prone to a number of diseases. Understanding the structure, function and factors influencing the skin of pigs is essential for optimizing husbandry practices and promoting the well-being of pigs in various production system. Lima *et al.*, (2018) reported that intense genetic improvement aiming at producing pigs with high growth potential is currently being engaged in swine farming worldwide. Pigs are reared for food (pork, bacon and gammon) and their skin and apart from poultry, it is the livestock species commonly reared in the society (Adetunji and Adeyemo, 2012). FAO, (2018) opined that 33% of the meat output produced in the world were from pork and ranked second in terms of volume after poultry. Inherent traits like high fecundity, better feed conversion efficiency, early maturity and relatively shorter generation intervals compared to sheep and goat are great potentials in pigs that allowed comparison with other livestock species (Pluhar, 2010). However, religious taboos and cultural beliefs served as hindrances to the popularity and uneven distribution of pigs globally (Nwachukwu and Udegbonam, 2020).

Materials and Methods

Experimental site:

The experiment was carried out at the piggery unit of the Teaching and Research Farm of Oyo State College of Agriculture and Technology, Igboora, Nigeria. The area is in the savannah forest vegetation located on latitude 7° 43'N, longitude 3° 28'E and altitude of 140m above sea level, The average

minimum temperature is above 21.5⁰c and maximum average temperature is about 32.5⁰c (Google Earth, 2023)

Experimental animals and management:

Eighteen (18) crossbred weaned (Large white X Landrace) pigs with an average weight of 20.0kg were obtained from a reputable commercial farm in Ibadan, Nigeria. The pigs were kept and monitored for one week for acclimatization before the commencement of the experiment for proper adaptability. Water and feed were offered *ad libitum* for the eight weeks experimental period. The feeds were formulated to meet the nutrient requirements of the growing pigs and made available twice a day based on body weight as shown in table 1.

Animal housing and management:

Concrete floor: The concrete floor was constructed using cement, gravel, sand and water. The floor is subjected to chemical attack by cleaners, feed acids, manure and gases and to mechanical impact from animals and high pressure cleaning.

Wood shaving floor: The wood shavings were collected from sawmills within Igboora metropolis and after the debris, dirt, iron metals, broken bottles were removed, the wood shavings were spread on the cemented floor to make wood shaving floor.

Clay floor: The clay floor was gotten from termite hill within the College premises and spread on the cemented floor to make clay floor.

Data collection

At the end of the experiment, 3ml of blood was collected from three pigs per treatment using syringe and needle from the anterior vena cava

vein of the pigs very early in the morning before feeding into sample bottle vials without Ethylene Diamine Tetra Acetic (EDTA) using spectrophotometric method for the determination of micro minerals. For the purpose of skin lesion assessment, the body of the pigs was divided into three parts. Each part received a score based on the number of lesions on it. The parts of the body assessed were: (1) front (head, shoulders and front legs), (2) middle (flanks and back) and (3) rear (hind legs and tail). To keep the scores consistent throughout the experiment direct observation of the skin following the checklist of Bjorklund (2005) in table 2 was used. All lesions were assessed by the same observer throughout the study and percentage of observation of each part assessed across the treatments was then calculated using:

$\% \text{ of observation} = \frac{\text{number of observations in a treatment} \times 100}{\text{Total number observed in all treatments}}$

Table 1: Gross Composition of experimental diet

Ingredients	Percentage (kg)
Maize	40.00
Corn bran	30.00
Soya bean meal	20.00
Fish meal	5.00
Bone meal	4.0
Salt	0.50
Premix	0.50
Total	100.00
Calculated analysis	
Metabolizable energy (kcal/kg)	3000.00
Crude protein	20.00

Table 2. Micro-mineral composition of weaned pigs reared on concrete and bedded floors

Parameters	T1(Concrete floor)	T2 (Wood shaving floor)	T3 (Clay floor)	SEM
Iron (Fe)	23.67 ^a	20.00 ^b	18.67 ^b	0.10
Zinc (Zn)	24.00 ^a	19.00 ^b	21.67 ^{ab}	0.15
Copper (Cu)	26.33 ^a	23.67 ^b	26.33 ^a	0.06

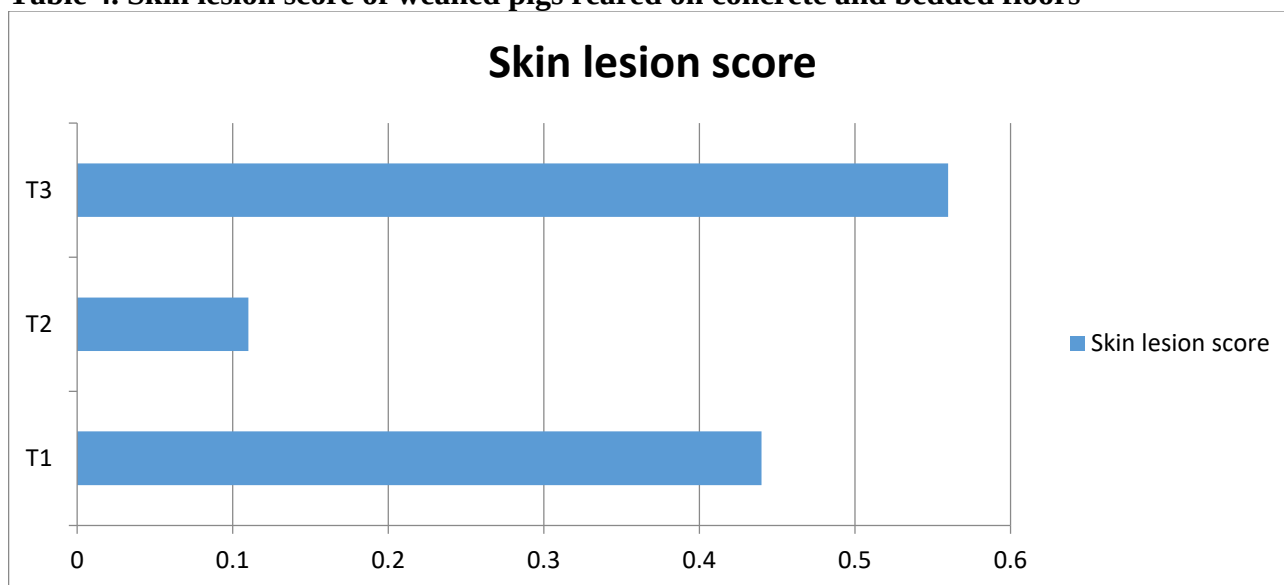
a, b means on the same row with different superscript differed significantly

Table 3: Skin lesions scoring system

Score	Description
0	No injuries
1	One small (>3mm) pale red lesion
2	More than one small
3	One or several large (>7mm)
4	One very large
5	Many very large

Source: Bjourklund, (2005)

Table 4. Skin lesion score of weaned pigs reared on concrete and bedded floors



Results and Discussion

The results of micro-minerals and skin health of weaned pigs reared on concrete, wood shaving and clay floors are presented in table 2. Pigs reared on concrete floor had the highest (23.67mg/kg) iron concentration while the lowest value (18.67mg/kg) were obtained in pigs kept on clay floor. Zinc value ranged from (19.00mg/kg) in pigs kept on wood shaving floor to (24.00mg/kg) in pigs reared on

concrete floor. Pigs reared on concrete and clay floors recorded the highest (26.33mg/kg) of copper concentration while the lowest copper mean value(23.67mg/kg) were obtained in pigs reared on wood shaving floor. The skin lesion scores (Table 4) across the three treatment groups (T1, T2 and T3) indicating varying levels of skin lesion severity or incidence. T3 recorded the highest skin lesion score with a value of approximately

0.55, indicating a higher degree of skin lesions in this treatment group. T1 had a score of approximately 0.40, showing a lower but still relatively high occurrence or severity of skin lesions compared to T3. In contrast, T2 exhibited the lowest skin lesion score, slightly above 0.10, suggesting a marked reduction in skin lesions relative to the other treatments. There were significant ($P < 0.05$) difference in the selected micro-minerals examined. Pigs kept in concrete floor recorded the highest micro-minerals this might be as a result of more comfortable and softer surfaces for pigs potentially reducing the occurrence of lameness. The decrease in the mean value of iron and zinc observed in the study might be as a result of nature and composition of bedding materials. There were significant ($P < 0.05$) difference in the skin health condition of crossbred weaned pigs reared on concrete, woodshaving and clay floors. The pigs maintained on the concrete floor and woodshaving floor were found to be less prone to lesions or any kind of skin related abrasions unlike the pigs maintained on clay floor which were having more health scores indicating more abrasions or lesions than other treatment groups. The findings of this study were in consonance with the report of Graunke *et al.*, (2011) who reported that skin lesions score were prevalent in bulls reared on bedded floor which might be due to several factors like weather, region and management conditions. The present findings were in contrast with the reports of Elmore *et al.*, (2015), Islam *et al.*, (2020) and Shakaya *et al.*, (2021).

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