

Blood indices of weaner pigs reared on different bedding materials

A. A. Ogunbode^{1*}, T. O. Adamolekun², O. A. Adebisi³ and T. O. Bankole⁴

¹Department of Animal Production Technology, Oyo State College of Agriculture and Technology, Igboora, Nigeria.

²Department of Animal Science, University of Ibadan, Nigeria.

*Corresponding author. Email: aaogunbode@gmail.com; Tel: +2348062455318.

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ABSTRACT: Attempts made to improve pig production have focused more on feed with little or no consideration of the impact of bedding materials, which is a major concern in pig production, not only because it affects pig health and productivity, but also because it may act as a potential reservoir and transmission vehicle for pathogens and potential pathogens. Since blood is considered an important material for the evaluation of health status in animals, there is a need, therefore, to investigate the impact of different bedding materials on the haematological and serum indices of crossbred weaned pigs, reared on concrete, woodshaving and clay floors. Twenty-seven (27) crossbred weaned pigs were used for the study. The treatments were replicated three times each with nine pigs in each treatment. The blood samples were collected at the end of the experiment for haematological and serum indices analysis. Three different bedding materials were used for the experiment, viz, concrete, woodshaving and clay floors. The concrete floor was made from gravel, sand, granite and water, while wood shavings were obtained in dried form from sawmills within Ibadan metropolis and pebbles, dirt, iron metals and broken bottles were removed and spread on the cemented floor to make the woodshaving floor. The clay floor was obtained from a termite hill within the university premises and spread on a cemented floor to make clay floor. The results revealed that there was no significant ($p>0.05$) difference in the mean value obtained for haematological parameters except white blood cells. Packed cell volume, haemoglobin, red blood cell and platelet compared favourably with that of the control. The lymphocytes, neutrophils, monocytes and eosinophils were not affected by the bedding materials, showing that the bedding materials did not adversely affect the health and welfare of the pigs. There was no significant ($p>0.05$) difference in the total protein, albumin, globulin and albumin/globulin ratio. Serum protein, serum albumin, serum globulin and serum albumin/globulin ratio were not affected by treatments ($p>0.05$), resulting in a better protein efficiency ratio recorded in all the treatments. The haematological and serum indices recorded in this study showed no notable health challenges in the pigs.

Keywords: Floor types, haematology, serum, weaned pigs.

INTRODUCTION

Blood biochemical parameters are routinely used to assess the health of the animals (Pal *et al.*, 2009). The best indicator of animals' wellbeing and their production potential is their health status, which can be assessed through their haematological profile (Abonyi *et al.*, 2016). Ozkan *et al.* (2011) posited that blood is an important material for the determination of health conditions in animals. Diagnosis of illness in animals is usually done through blood testing (Vetstreet, 2011). It acts as a

pathological reflector of the status of exposed animals to toxicants and other conditions (Olafadehan *et al.*, 2010). Bedding material is an important component of the livestock production system. It is an important issue in the wellness and comfort, but also for biosecurity measures applied for disease control and prevention programmes. Livestock production uses many types of bedding materials such as wood shavings, corn cobs, rice husk, newspaper and sand, depending on the availability, price,

hygroscopicity, animal comfort and environmental concerns. The choice of material is generally based on comfort, cleanliness and moisture absorbance (Breen *et al.*, 2009). There are different types of bedding materials such as straw, wood shavings, sawdust, soybean residue, feathers, sand, dried compost hay, corn cob and newspaper (Meng *et al.*, 2015). Bedding also prevents bruised knees, elbows, hocks and hips and keeps the animals clean (Randall *et al.*, 2016). The bedding materials harbour many microbes (Munir *et al.*, 2014), salts, nutrients (Miller *et al.*, 2003) and other contaminants. Merck Manual (2012) reported that haematology includes the study of the numbers and morphology of the cellular elements of the blood- the red cells (erythrocytes), white cells (leucocytes) and the platelets (thrombocytes) and the use of these results in the diagnosis and monitoring of diseases. Zhou *et al.* (1999) opined that it is very useful in the transport of nutrients, metabolic waste products and gases within the body of livestock, while Olorode and Longe (2000) reported that blood can also be useful in assessing the clinical and nutritional health status of the animals. Serum is the yellow watery part of the blood that is left after blood has been removed (Burtis *et al.*, 2006). Serum is extracted from blood samples by centrifuging the sample to separate cellular components and coagulation factors of blood from the liquid part (Hannu and Hanna, 2014). Therefore, this study was carried out to determine the effects of concrete and bedded floors on the blood indices of weaned pigs.

MATERIALS AND METHODS

Experimental location

The experiment was carried out at the piggery unit of the Teaching and Research Farm of the University of Ibadan, Nigeria. (GPS Coordinates: 7.4432° N 3.9003° E). The temperature ranges from 21 to 32°C, the humidity 71.53 to 76.00% and the annual rainfall of about 1250 to 1500 mm.

Collection of experimental material

The different bedding materials used were sourced locally. The concrete floor was made of gravel, sand, granite and water, while wood shavings were collected in dried form and pebbles, dirt, stone, broken bottles and metals were removed. Clay floor material was obtained from a termite hill within the University campus with the assistance of a soil scientist and spread on the cemented floor to make a clay floor.

Blood collection and evaluation

At the end of the experiment, blood samples were collected from experimental animals through the anterior vena cava vein into a set of well-labelled sterile bottles

containing EDTA (Ethylene Diamine Tetra Acetic) bottle for haematological examinations. Haemoglobin concentration was evaluated using the cyanmethaemoglobin method (Cannan, 1958), packed cell volume (PCV), red blood cell (RBC), and white blood cell (WBC) count of the blood samples were determined in a Wintrobe haematocrit tube according to the method of Schalm *et al.* (1975). Another set of tubes without EDTA was also used to collect blood, immediately covered and centrifuged. Serum was separated out, decanted, and deep-frozen for serum biochemical analysis as referenced by Ewuola and Egbunike (2008).

Data analysis

The data collected on haematology and serum biochemical indices of the experimental animals were subjected to statistical analysis using the analysis of variance procedure of SAS Institute Inc. (SAS, 2018). The treatment means were compared using Duncan's procedure in the same software.

RESULTS

The results of haematology and serum indices of weaned pigs reared on concrete, wood shaving and clay floors are presented in Tables 1 and 2. The packed cell volume (PCV) values across the three treatments (T1, T2, T3) were 34.25, 30.75 and 40.50% respectively, with T3 showing the highest value. Haemoglobin (Hb) level followed a similar trend, with T3 having the highest value (13.35g/dL) compared to (11.28g/dL) and T2 (10.05g/dL). The red blood cell (RBC) counts also followed this pattern, where T3 (6.75×10^6 /UL) had the highest count, followed by T1 (5.72×10^6 /UL) and T2 (5.01×10^6 /UL). White blood cell (WBC) counts showed significant differences ($P < 0.05$) between the treatments, with T1 (12063.00×10^3 /UL) and T3 (12513.00×10^3 /UL) having significantly higher WBC counts compared to T2 (8463.00×10^3 /UL). Platelet counts were fairly consistent across the treatments, with T1 having 127750.00/ul, T2 having 115500.00/ul and T3 showing 114750.00/ul. Lymphocyte percentages were highest in T3 (66.50%), followed by T1 (60.75%) and T2 (59.00%). This is an indication that the weaned pigs' immune system might have been challenged by toxic substances, probably the anti-nutritional factors in the wood shavings and clay floors, respectively (Gilaneh, 2016). Neutrophil percentages, however, were higher in T2 (34.75%) and T1 (33.50%) compared to T3 (26.25%). Monocyte counts showed little variation across the treatments, with values of 3.00% for T1, 3.50% for T2, and 4.00% for T3. Eosinophil counts remained relatively similar across all groups, with T1 and T2 both recording 2.75% and T3 having 3.25%. The serum indices of the weaned pigs reared on concrete, wood shavings and clay floors are shown in Table 2. Total protein ranged from 7.00 g/dL in

Table 1. Haematological indices of weaned pigs on concrete, woodshaving and clay floors.

Parameters	T1 (Concrete floor)	T2 (Wood shaving floor)	T3 (Clay floor)	SEM
Packed Cell Volume (%)	34.25	30.75	40.50	0.52
Haemoglobin(g/dl)	11.28	10.05	13.35	0.17
Red Blood Cell (iu/l)	5.72	5.01	6.75	0.09
White Blood Cell (iu/l)	12063.00 ^a	8463.00 ^b	12513.00 ^a	12.16
Platelet	127750.00	115500.00	114750.00	0.01
Lymphocyte(iu/l)	60.75	59.00	66.50	0.63
Neutrophil(iu/l)	33.50	34.75	26.25	0.49
Monocyte(iu/l)	3.00	3.50	4.00	0.16
Eosinophil(iu/l)	2.75	2.75	3.25	0.13

^{a,b} within the same row with different superscripts declare significantly differences ($p < 0.05$) SEM: Standard Error of Means.

Table 2. Serum parameters of weaned pigs reared on concrete, wood shaving and clay floors.

Parameters	T1 (Concrete floor)	T2 (Wood shaving floor)	T3 (Clay floor)	SEM
Total protein(g/dl)	7.67	7.00	7.33	0.03
Albumin(g/dl)	3.13	2.87	3.00	0.02
Globulin(g/dl)	4.53	4.13	4.33	0.02
Albumin/Globulin	0.69	0.69	0.69	0.00

pigs reared on wood shavings to 7.67g/dL in pigs maintained on a concrete floor. Albumin values were from 2.87 to 3.13g/dL, respectively, in pigs reared on wood shavings and a concrete floor. Globulin values were 4.53, 4.13 and 4.33 g/dL in T1, T2 and T3, respectively.

DISCUSSION

The haematological indices of weaned pigs reared on different bedding materials are presented in Table 1. Haematological components are those parameters that are related to the blood and blood-forming organs. Similar haematological values (except white blood cell values) obtained from pigs reared on different bedding materials is an indicative of the bedding materials used (Olafadehan *et al.*, 2010) There was no significant difference in packed cell volume level ($p > 0.05$) between the pigs reared on different bedding materials and this was in agreement with the findings of Earley *et al.*, 2015 and Keane *et al.*, 2017 who reported that there was no effect of different floor types on packed cell volume values in beef heifers. The values obtained in this study were within the normal range (30-50%) reported by Etim *et al.* (2014) and Sandhu *et al.* (2018). No significant ($p > 0.05$) effect was found among the three floor types on haemoglobin values in weaned pigs. The haemoglobin values obtained in this study were within the normal range (10-16%) reported by Jezek *et al.* (2018). Edozien and Switzer (1977) opined that haemoglobin and packed cell volume are very sensitive to levels of protein intake, as the value increases with an increase in dietary protein concentration, suggesting that the pigs received

normal diets throughout the experiment. There were also no significant ($p > 0.05$) differences among the floor types in red blood cells, showing that there was no form of red blood cell damage in the pigs (Jain, 1986). Red blood cells are responsible for oxygen and carbon dioxide transportation in the blood and synthesis of haemoglobin, and thus the values obtained in this study indicated a greater potential for this function and a better state of health for weaned pigs. There was a significant differences significant difference ($p < 0.05$) in the mean values obtained for white blood cells in pigs reared on different bedding materials, and this was in agreement with the findings of Eze *et al.* (2010) and Palova *et al.* (2019 who reported higher white blood cell. A high value of white blood cells in pigs reared on clay floor might have been associated with the consumption of clay floor by the pigs, which led to the highest (12513.00) value of white blood cells, suggesting that pigs kept on clay floors had immunity to fight infections. However, a low value (8463.00) of white blood cells recorded for pigs maintained on a wood shaving floor suggests susceptibility to infection (Nwakolor, 2001). No significant ($p > 0.05$) effect was found among the three bedding material types on platelets, and this was in contrast with the findings of Ogunbode and Adepoju (2024), who reported a significant ($p < 0.05$) difference in the mean value of crossbred weaned pigs reared on concrete and straw floors. The non-significance in the mean value of platelets was an indication that the process of clot-formation (blood clotting) will not be prolonged in the case of injury (Baker *et al.*, 2000). The Neutrophil, Monocyte and Eosinophil were not affected by the bedding materials, showing that the litter conditions did not

adversely affect the health and welfare of the pigs (Lister, 2009). The slightly higher values recorded for lymphocyte above the normal range in pigs (40-60%) as reported by Etim *et al.* (2013) showed that the pigs could be susceptible to lympho-proliferative neoplasm, notably occurring in viral and bacterial infections, often seen in infectious mononucleosis and whooping cough (Mania *et al.*, 2018). Serum indices are always a reflection of animal responsiveness to their internal and external environment (Akinduro, 2016). The serum indices result showed no significant differences ($p>0.05$) in the serum protein among the treatments, supporting the work of Earley *et al.* (2015) and Bakari *et al.* (2018), who reported that the bedding materials had no effect on the serum total protein of pigs. The findings of this study were also in consonance with the report of Isaac *et al.* (2013) which states that animals with good blood composition are likely to show good performances and this can also be attributed to the high protein efficiency ratios and better feed conversion recorded in all the treatments indicating that the bedding materials did not pose any threat to the pigs. Serum proteins are involved in the formation of immunoglobins responsible for the development of antibodies. Serum albumin and globulin also indicated no significant differences ($p>0.05$) in all the treatments, indicating the availability of protein (Hoffenberg *et al.*, 1966). No significant ($p>0.05$) effect was found among the three floor types on albumin values in weaned pigs. Earley *et al.* (2015) reported that there was no effect of different floors on serum albumin values in beef heifers, thus in tandem with the present findings. Mayengbam *et al.* (2012) opined that the housing system does not have influenced influence on serum albumin levels in pigs.

Conclusion

From the findings of the research, wood shavings floor and clay floor can be effectively used as alternative bedding materials to a concrete floor without detrimental effects on the blood indices of weaned pigs, which play a crucial role in pigs' health.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest, reasons being that research results were not influenced by external factors or any scientific misconduct and were free of bias.

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