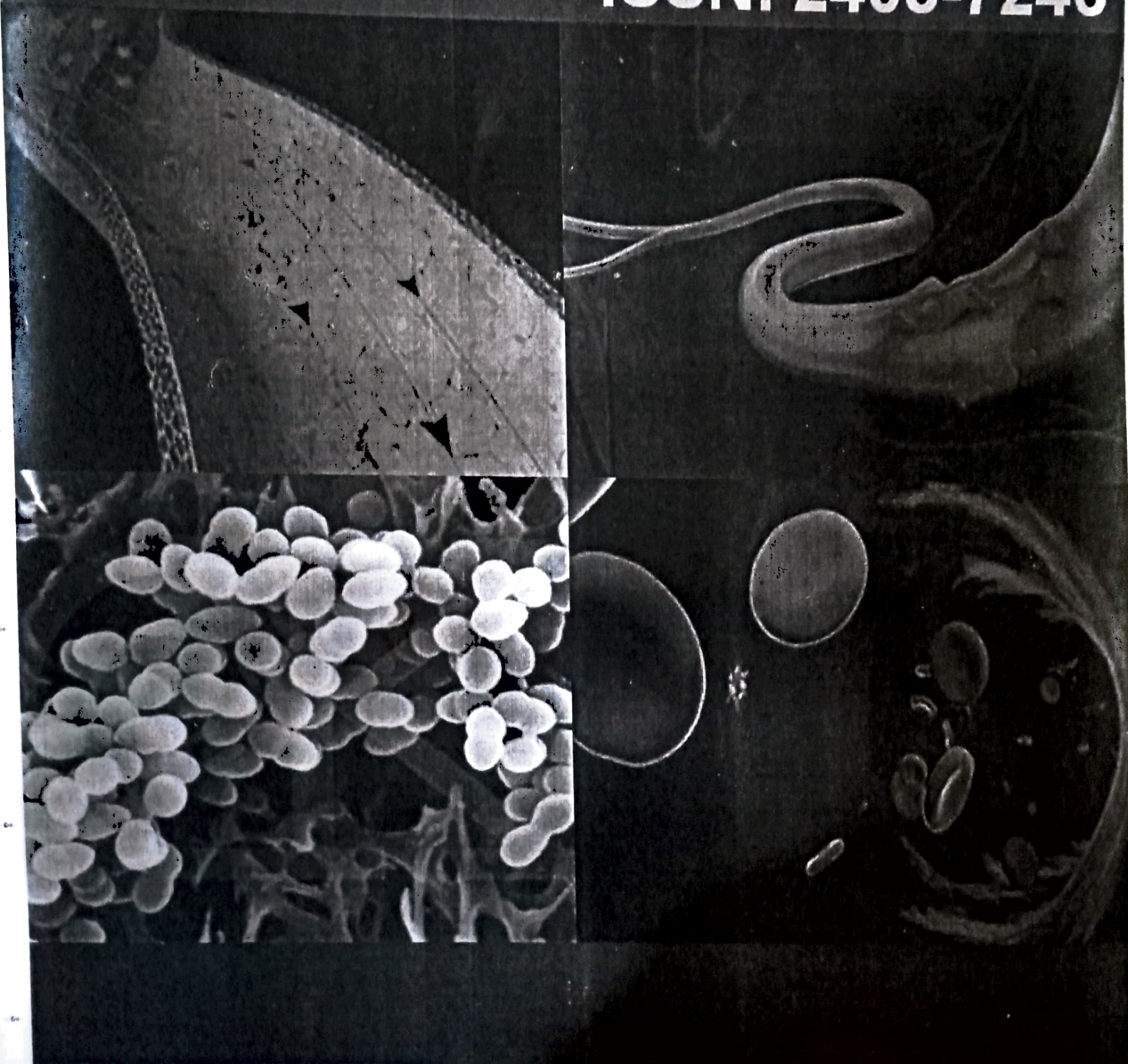


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Full Length Research Paper

# Haematological Values of Broilers Managed on Titanium Dioxide Treated Litter

<sup>1</sup>Adamu, Y. A.; <sup>2</sup>Usman A.; <sup>1</sup>Mera, U. M.; <sup>3</sup>Abubakar, M. B.; <sup>4</sup>Bello, A.; <sup>5</sup>Umaru, M.A.

<sup>1</sup>Department of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto

<sup>2</sup>Department of Animal Production, SAAT, Federal University of Technology, Minna

<sup>3</sup>Department of Veterinary Microbiology, Usmanu Danfodiyo University, Sokoto

<sup>4</sup>Department of Veterinary Anatomy, Usmanu Danfodiyo University, Sokoto, Nigeria.

<sup>5</sup>Department of Theriogenology and Animal production, Usmanu Danfodiyo University, Sokoto, Nigeria

## Abstract

An experiment was conducted to study the effect of TiO<sub>2</sub> applied in 0g/m<sup>2</sup>, 30g/m<sup>2</sup>, 60g/m<sup>2</sup> and 120g/m<sup>2</sup> concentration, as a litter treatment agent on litter bacteriology, haematology, ammonia emission and ammonia lesions on broilers fed standard commercial diet and water *ad lib* on wood shavings based deep litter system at a depth of 6cm and 16birds/m<sup>2</sup>. Litter samples were collected weekly for ammonia while tissue samples were collected at the seventh week for histology and blood samples were also collected via cardiac venipuncture for haematology and blood chemistry. The result showed that RBC and WBC were significantly (P<0.05) elevated in 0g/m<sup>2</sup>TiO<sub>2</sub> treatment (3.86x10<sup>12</sup>, 2.93x10<sup>12</sup>, 3.01x10<sup>12</sup>, 2.34x10<sup>12</sup> and 27.16x10<sup>9</sup>, 26.41x10<sup>9</sup>, 21.47x10<sup>9</sup>, 21.84x10<sup>9</sup>) respectively. MCH and MCV were significantly (P<0.05) elevated (28.60pg, 34.26pg, 30.96pg, 44.71pg and 87.42fl, 103.41fl, 93.62fl, 134.52fl) in the 120g/m<sup>2</sup>TiO<sub>2</sub>litter treatments. There was a significant (P<0.05) elevation in serum sodium (132.27mEq/l, 135.07mEq/l, 135.33mEq/l, 138.67mEq/l); potassium (4.12mEq/l, 4.18mEq/l, 4.03mEq/l, 4.47mEq/l); globulin (1.23g/dl, 1.85g/dl, 1.35g/dl, 2.47g/dl) and conjugated bilirubin (5.11mg/dl, 5.52mg/dl, 5.55mg/dl, 6.07mg/dl) in 120g/m<sup>2</sup>TiO<sub>2</sub> litter treatment. There was no significant difference (P>0.05) in ammonia even though 60g/m<sup>2</sup>TiO<sub>2</sub> litter treatment retained more ammonia (29.77, 29.25, 33.16, 30.01). It was concluded that TiO<sub>2</sub> is beneficial as a litter treatment agent especially at 60g/m<sup>2</sup> rate.

**Keywords:** Ammonia, Titanium dioxide, Broiler, Litter, Haematology.

## INTRODUCTION

Poultry are kept with variable economic importance and their production in many countries has become increasingly specialized and integrated into a dynamic industry of major national and international significance (Jordan and Pattison, 1996). The importance of poultry to Nigeria's national economy cannot be overemphasized, where it has shown a significant effect on the national economy with about 10% of Nigerians engaged in poultry production, mostly on subsistence and small or medium-sized farms (Okonkwo and Akubuo, 2001). Investment in broiler enterprises has become attractive because of low production cost per

unit compared to other types of livestock and has a short production cycle (Nwajiuba and Nwoke, 2000, Sani *et al.*, 2000). However, high stocking density in modern poultry house may lead to reduced air quality with high concentrations of aerial pollutants such as ammonia (Curtis and Drummond, 1982; Maghirang *et al.*, 1991; Feddes and Licsko, 1993), whose concentrations sometimes exceed recommended occupational limits (Kristensen and Wathes, 2000) and may adversely affect poultry health and production. Poultry litter is considered one of the major sources of pollutants in poultry houses that needs to be addressed seriously especially because of its high nitrogen content; some of which is in ammonia form (Mitchell and Donald, 1995; Sloan *et al.*, 1996) and primarily in the form of uric acid that microorganisms can readily decompose to form ammonia which then escapes into the air under favorable environmental

**Table 1.** Distribution of Birds, Treatment and Quantity of Titanium Dioxide applied on the Litter

Treatment	Number of Birds	Concentration of Titanium dioxide (g/m <sup>2</sup> )
1.	3×20=60	0
2.	3×20=60	30
3.	3×20=60	60
4.	3×20=60	120

Number of Birds = (P × Q) = Z, where P= number of Replicates, Q= number of Birds per replicate and Z= number of birds per Treatment

**Table 2.** Ammonia and Nitrogen (means± S.D) Content of Titanium Dioxide Treated Broiler Litter

Parameter	0g/m <sup>2</sup>	30g/m <sup>2</sup>	60g/m <sup>2</sup>	120g/m <sup>2</sup>
Ammonia (ppm)	29.77±9.91	29.25±9.70	33.16±11.31	30.01±9.82
Nitrogen (%)	2.98±0.99	2.92±0.97	3.32±0.11	3.00±0.98

**Table 3.** Haematological (means± S.D) Parameters of Broiler Birds managed on Titanium Dioxide Treated Litter

Parameter	0g/m <sup>2</sup>	30g/m <sup>2</sup>	60g/m <sup>2</sup>	120g/m <sup>2</sup>
RBC(x10 <sup>12</sup> /l)	3.86±0.69 <sup>a</sup>	2.93±0.42 <sup>b</sup>	3.01±0.51 <sup>b</sup>	2.34±0.58 <sup>c</sup>
WBC(x10 <sup>9</sup> /l)	27.16±5.79 <sup>a</sup>	26.41±5.52 <sup>a</sup>	21.47±6.31 <sup>b</sup>	21.84±2.71 <sup>b</sup>
Hb (g/dl)	9.43±1.69	9.83±1.84	9.03±1.99	9.63±1.88
PCV (%)	28.87±5.63	29.67±5.59	27.27±5.93	29.07±5.73

Values in table are means± S.D of observations. Letters in superscripts represent significant differences in the mean

White blood cell count of broiler on titanium dioxide free litter (0g/m<sup>2</sup>) was 27.16±5.79×10<sup>9</sup>/l, it was 26.41±5.52×10<sup>9</sup>/l for broilers on litter treated with 30g/m<sup>2</sup> titanium dioxide, and 21.47±6.31×10<sup>9</sup>/l for broilers on 60g/m<sup>2</sup> titanium dioxide treated litter and it was 21.84±2.71×10<sup>9</sup>/l for broilers on 120g/m<sup>2</sup> titanium dioxide treated litter (Table 3). The white blood cell count of broilers raised on litter material treated with 30g/m<sup>2</sup> did not differ significantly (P>0.05) from that of those on untreated litter (P<0.05). However, the white blood cell count obtained from broilers raised on 60g/m<sup>2</sup> and 120g/m<sup>2</sup> titanium dioxide treated litters were lower respectively in white blood cell count obtained from broiler birds raised on 60g/m<sup>2</sup> there was no significant difference (P>0.05) from white blood cell count obtained from those raised on 120g/m<sup>2</sup> titanium dioxide treated litter respectively.

Haemoglobin concentration of broiler on litter not treated with titanium dioxide (0g/m<sup>2</sup>) was 9.43±1.69g/dl, it was 9.83±1.84g/dl for broilers on 30g/m<sup>2</sup> titanium dioxide treated litter, 9.03±1.99g/dl for those on 60g/m<sup>2</sup> treated litter, and was 9.63±1.88g/dl for broilers on 120g/m<sup>2</sup> titanium dioxide treated litter (Table 3). The haemoglobin concentration of broiler birds from both titanium dioxide treated litter groups and untreated group did not differ significantly (P>0.05). There was no much different in the PCV of broilers managed on titanium

dioxide free and those on litter treated groups (Table 3). The result shows that there was no significant difference (P>0.05) in both relative and absolute neutrophil count, absolute monocyte count, and absolute eosinophil count in the broilers across different concentrations of titanium dioxide litter treatments (g/m<sup>2</sup>) but the absolute lymphocyte count in birds raised on 60g/m<sup>2</sup> titanium dioxide treated litter was significantly (P<0.05) lower than absolute lymphocyte count obtained from broilers raised on 30g/m<sup>2</sup> titanium dioxide treated litter. The absolute lymphocyte counts obtained from broiler birds raised on 0g/m<sup>2</sup> titanium dioxide treated litter and broilers raised on 120g/m<sup>2</sup> titanium dioxide treated litter were not significantly (P>0.05) different but are comparable to absolute lymphocyte counts obtained from broilers raised on both 30g/m<sup>2</sup> titanium dioxide treated litter and 60g/m<sup>2</sup> Table 4.

The mean corpuscular haemoglobin of broilers on litter not treated with titanium dioxide (0g/m<sup>2</sup>) was 28.60±7.97pg; it was 34.26±8.47pg for broilers on litter treated with 30g/m<sup>2</sup> titanium dioxide, 30.96±9.62pg on litter treated with 60g/m<sup>2</sup> titanium dioxide and 44.71±17.65pg for broilers on litter treated with 120g/m<sup>2</sup> titanium dioxide (Table 5). The Mean corpuscular haemoglobin was significantly (P<0.05) higher in broiler birds raised on 120g/m<sup>2</sup> titanium dioxide treated litter compared to the values obtained from broiler birds

**Table 4.** Differential Leucocytes count of Broilers managed on Titanium Dioxide treated litter Concentration of titanium dioxide

Parameter	0gm <sup>-2</sup>	30gm <sup>-2</sup>	60gm <sup>-2</sup>	120gm <sup>-2</sup>
Neutrophils (%)	40.27±18.28	29.93±20.39	38.53±19.06	35.52±15.72
Neutrophils (X10 <sup>9</sup> /l)	11.57±7.34	8.60±7.42	8.89±6.53	7.21±3.40
Monocyte (%)	0.13±0.52	1.00±1.73	0.27±0.70	1.20±3.61
Monocyte (X10 <sup>9</sup> /l)	0.03±0.13	0.25±0.44	0.07±0.17	0.27±0.76
Eosinophil (%)	2.80±4.59	1.33±3.18	0.67±1.44	1.33±2.89
Eosinophil (X10 <sup>9</sup> /l)	0.74±1.25	0.38±0.92	0.18±0.39	0.30±0.63
Lymphocyte (%)	56.67±18.82	67.73±20.23	60.53±20.19	64.13±15.59
Lymphocyte (X10 <sup>9</sup> /l)	14.78±4.60 <sup>ab</sup>	17.17±4.23 <sup>a</sup>	12.34±4.58 <sup>b</sup>	14.07±4.20 <sup>ab</sup>
Basophil (x10 <sup>9</sup> /l)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

Values in table are means ± S.D of observations. Letters in superscripts represent significant differences in the mean

**Table 5.** Haematologic Indices of Broilers managed on Titanium Dioxide Treated litter Concentration of titanium dioxide

Parameter	0gm <sup>-2</sup>	30gm <sup>-2</sup>	60gm <sup>-2</sup>	120gm <sup>-2</sup>
MCH (pg)	28.60±7.97 <sup>b</sup>	34.26±8.47 <sup>b</sup>	30.96±9.62 <sup>b</sup>	44.71±17.65 <sup>a</sup>
MCHC (g/dl)	32.82±1.80	33.13±0.24	33.08±0.61	33.15±0.46
MCV (fl)	87.42±24.66 <sup>b</sup>	103.41±41.25 <sup>b</sup>	93.62±29.18 <sup>b</sup>	134.52±52.69 <sup>a</sup>

Values in table are means ± S.D of observations. Letters in superscripts represent significant differences in the mean

titanium dioxide free litter, 30gm<sup>-2</sup> and 60gm<sup>-2</sup> titanium dioxide treated litter respectively.

Mean corpuscular haemoglobin concentration of broilers on litter not treated with titanium dioxide (0g/m<sup>2</sup>) was 32.82±1.80g/dl, 33.13±0.24g/dl for broilers on litter treated with 30g/m<sup>2</sup> titanium dioxide, and it was 33.08±0.61g/dl for broilers on litter treated with 60g/m<sup>2</sup> titanium dioxide, while it was 33.15±0.46g/dl for broilers on litter treated with 120g/m<sup>2</sup> titanium dioxide. There was no significant difference (P>0.05) in their mean corpuscular haemoglobin concentration.

The mean corpuscular volume of broilers on litter not treated with titanium dioxide (0g/m<sup>2</sup>) was 87.42±24.66fl, it was 103.41±41.25fl for broilers on litter treated with 30g/m<sup>2</sup> titanium dioxide, and it was 93.62±29.18fl for broilers on litter treated with 60g/m<sup>2</sup> titanium dioxide, while it was 134.52±52.69fl for broilers on litter treated with 120g/m<sup>2</sup> titanium dioxide. The mean corpuscular volume in broiler birds raised on 0gm<sup>-2</sup> titanium dioxide treated litter did not differ significantly (P>0.05) from mean corpuscular volume obtained in broiler birds raised on both 30gm<sup>-2</sup> titanium dioxide treated litter and 60gm<sup>-2</sup> titanium dioxide treated litter. These values were however significantly (P<0.05) lower than mean corpuscular volume obtained from broiler birds raised on 120gm<sup>-2</sup> titanium dioxide treated litter.

## CONCLUSION

Based on the findings of this research, it could be concluded that titanium dioxide as a litter treatment agent, improved litter nitrogen retention hence has a

potential of reducing ammonia volatilization and improves moisture loss from litter. Titanium dioxide has proved to decrease total bacteria population of treated litter and could be used as means of reducing bacterial contamination of poultry litter so as to improve performance. Titanium dioxide as a litter treatment agent, significantly reduced ammonia associated lesions in bird and can be used at 60g/m<sup>2</sup> of litter.

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