

MULTI-SPECIES PROBIOTICS/PREBIOTICS BLEND AND PHYTOGENE ON MITIGATION OF AMMONIA GAS AND ODOUR IN POULTRY HOUSES AND ENVIRONMENT

*Udeh, F.U., Iyoke, E.S., Onodugo, M.O., Okafor, P.C., Edeh, H.O., Obinna, A.L. and Nweke, F.C.

Department of Animal Science, University of Nigeria, Nsukka

*Corresponding author: fredrickudeh11@gmail.com; Tel: +2348062457193

ABSTRACT

The study was conducted to evaluate the effect of Multi-species Probiotics/Prebiotics blend and Phytogene on mitigation of Ammonia gas and Odour in Poultry houses and environment. A total of one hundred and thirty five (135) day old chicks of broiler chickens were used for the study. The chicks were randomly divided into 9 groups and assigned to 9 dietary treatments in a 3x3 factorial arrangement in completely randomized design (CRD). Each treatment contained 15 birds was replicated three times to contain 5 birds per replicate. The test materials were multi species probiotics/prebiotics blend (MSPB) incorporated in the feed and wild melon extract (WME) incorporated in the drinking water. Feed and water were provided to the birds ad-libitum throughout the study period. Litter materials were not changed during the experimental period, rather new litter materials were added to the old ones on bi-weekly basis. The experiment lasted for 8 weeks. At the end of the experiment, litter samples were randomly collected from different points according to the treatments for litter characteristics evaluation. The results indicated that the interaction of multi species probiotics/prebiotics blend and wild melon extract significantly ($p < 0.05$) improved the litter quality characteristics by reducing moisture content (11.25 to 8.63%), ammonia concentration (2.41 to 1.02ppm) and pH content (3.27 to 2.17) of the litter. It was concluded that MSPB and WME can be used to control odour in the poultry house and could be incorporated at 0.5 g/kg MSP+150 ml/litter WME. Thus T5 was recommended.

Keywords: Probiotics, Prebiotics, Phytogene, Ammonia gas, Odour, Poultry house

INTRODUCTION

Litter quality directly affects bird health and hygiene. Monitoring litter characteristics is integral to ensuring the well-being of broiler birds. Studies have shown that probiotics and use of nutritional supplements in poultry farms has numerous effects, such effects include the following; maintain proper litter moisture and balanced microbial population. It is documented in the literature that excessive moisture in the litter leads to footpad dermatitis, ammonia production, and increased bacterial growth (Oyeagu *et al.*, 2020). Increased microbial metabolism due to moisture in the litter results to increased ammonia build-up, leading to respiratory and ocular diseases in the birds (Muyiwa, *et al.*, 2020). Probiotics aids in moisture regulation by competitively excluding pathogenic microorganisms. Aguihe *et al.* (2020) found that adding probiotics to broiler feed aids in the reduction of ammonia emissions by encouraging the transformation of nitrogenous compounds in the litter into less volatile forms.

Prebiotics are non-digestible fibers and compounds, mainly carbohydrates that resist digestion in the upper gastrointestinal tract and reach the colon intact. Prebiotics are substances that promote the growth and activity of beneficial microorganisms, particularly bacteria, in the gastrointestinal tract. While probiotics are live bacteria that confer health benefits when consumed, prebiotics serve as a source of nourishment for these beneficial bacteria. By fostering the growth of these microorganisms, prebiotics contribute to the overall balance of the gut microbiota, which plays a crucial role in maintaining digestive health and supporting the immune system (Nwachukwu *et al.*, 2021). It supports the breakdown of organic matter in the litter (Onunkwo, 2017), and development of a more absorbent litter for maintaining a dry and comfortable environment for the birds (Ramlucken *et al.*, 2020). Provide the objective of your study here.

MATERIALS AND METHODS

Location of the study

The study was conducted at the poultry unit, Teaching and Research Farm, Department of Animal Science, University of Nigeria, Nsukka. Nsukka is in Enugu state Nigeria.

Preparation of test materials

The multi-species probiotic/prebiotics blend was purchased as a whole product from the pharmacy. Wild melon fruits were sourced from nearby bush around the farm. 500g wild melon fruit was weighed, washed, crushed and soaked in 1 liter of water overnight. The extract was sieved and served to the birds *ad libitum*.

Experimental Animals and Management

A total of one hundred and thirty five (135) day old chicks of broiler chickens were used for the study. The chicks were randomly divided into 9 groups and assigned to 9 dietary treatments in a 3x3 factorial arrangement in completely randomized design (CRD). Each treatment contained 15 birds was replicated three times to contain

5 birds per replicate. The test materials were multi species probiotics/prebiotics blend (MSPB) incorporated in the feed and wild melon extract (WME) incorporated in the drinking water. The treatments were as follows: T1 + 0.0g/kg MSPB+0.0ml/litter WME, T2 = 0.5g/kg MSPB + 0.00ml/litter WME, T3 = 1.0g/kg MSPB+0.0ml/litter WME, T4 = 0.0g/kg MSPB+150 ml/litter WME, T5 = 0.5 g/kg MSP+150 ml/litter WME, T6 = 1.0 g/kg MSPB+150 ml/litter WME, T7 = 0.0 g/kg MSP+300 ml/litter WME, T8 = 0.5 g/kg MSPB+300 ml/litter WME and T9 = 1.0 g/kg MSPB+300 ml/litter WME. Feed and water were provided to the birds ad libitum throughout the study period. There were no removal and replacement of new litter materials during the experimental period, rather new litter material were added to the old ones on two weeks interval. The experiment lasted for 8 weeks. At the end of the experiment, litter samples were randomly collected from different points according to the treatments for litter characteristics evaluation.

RESULTS AND DISCUSSION

The results of the effect of multispecies probiotics/prebiotics blend and wild melon extract on control of ammonia gas and odour in the poultry litter is presented in Table 1. The results showed that multispecies probiotics/prebiotics blend significantly ($p < 0.05$) reduced ammonia concentration (1.42 to 1.32 ppm), moisture content (10.43 to 9.26%) and pH (3.01 to 2.61) of the litter. The results also indicated that wild melon extract had significant ($p < 0.05$) reduction on ammonia concentration (1.48 to 1.32ppm) and pH (3.11 to 2.28) of the litter at 150ml/Litter inclusion level, but had no significant ($p > 0.05$) effect on moisture content. Similarly, the interaction of multispecies probiotics/prebiotics blend and wild melon extract significantly reduced the ammonia concentration (2.41 to 1.02ppm), moisture content (11.25 to 8.63%) and pH value (3.27 to 2.17) of the litter at 0.5g/kg MSPB and 150ml/litter WME.

The reduction in ammonia concentration as observed in this study aligns with previous research by Houshmand *et al.* (2012) who demonstrated that certain dietary supplements, including prebiotics, can affect litter characteristics leading to decreased ammonia levels. Similarly, the finding is consistent with previous studies by Shokryazdan *et al.* (2017), which reported the reduction in litter moisture content and microbial activity in broiler production due to impact of dietary supplementation of probiotics. The findings are in line with earlier study by Siddhuraju and Becker (2007), who demonstrated the influence of dietary probiotics on litter pH and microbial activity in poultry production. The effect of wild melon extract in the reduction of ammonia concentration, moisture content and pH of the litter had been supported by previous studies by Abdalla *et al.* (2020).

The interaction effect of probiotics/prebiotics blend and wild melon extract in ammonia reduction was in agreement with studies of Ullah *et al.* (2022) which reported the ability of wild melon to modulate the gut microbiota and enhance nutrient utilization, consequent reduction of ammonia production. Furthermore, the combination of probiotics and wild melon provided additional benefits in terms of ammonia reduction, which may be due to the synergic effect of the individual components or the specific strains and levels of inclusion used. Moisture content reduction in the litter was in agreement with Houshmand *et al.*, (2012) which suggested that certain dietary components and their interactions can influence water intake, excretion, and litter moisture levels. The increased moisture content observed in 1.0 g/kg MSPB+300 ml/litter WME inclusion level may be attributed to the potential effects of wild melon and probiotics on water balance and gut health, leading to altered excretion patterns. The litter pH value reduction by the interaction of wild melon extract and probiotics/prebiotics blend was supported by the findings of Ullah *et al.* (2022) who reported ability of wild melon and prebiotics to modulate gut microbiota and influence nutrient metabolism, which directly affects ammonia and moisture content of the litter. Probiotics are known to modulate the gut microbiota, enhance nutrient absorption, and improve overall gut health Shokryazdan *et al.*, (2017), which can influence litter characteristics. Wild melon, on the other hand, contains various bioactive compounds, including antioxidants and phytochemicals that can exert beneficial effects on gut health and nutrient utilization (Ullah *et al.*, 2022), thereby affecting litter quality. It is important to note that reduced moisture content and pH value of the litter discourages microbial proliferation, hence, reduced ammonia production and odour in the poultry house and environment (Udeh *et al.*, 2024).

CONCLUSION

The results showed that multispecies probiotics/prebiotics blend and wild melon extract had significant reduction effect on ammonia concentration, moisture content and pH value of the litter in the poultry house. It was therefore recommended that multispecies probiotics/prebiotics blend and wild melon extract should be used at 0.5g/kg MSPB+150ml/litter WME inclusion level for ammonia gas and odour control in the poultry house and environment.

Table 1: The effect of multispecies probiotics/prebiotics blend and wild melon extract on control of ammonia gas and odour in the poultry litter

Treatments/Parameters	NH ₃ (%)	Moisture (%)	pH
Effect of MSPB			
0.00g/kg	1.40 ^a	10.42 ^a	3.01 ^a
0.50g/kg	1.32 ^b	9.26 ^b	2.61 ^b
1.00g/kg	1.42 ^a	9.68 ^{ab}	2.68 ^b
SEM	0.02	0.27	0.08
P-Value	0.03	0.03	0.03
Effect of WME			
0.00ml/litter	1.48 ^a	9.67	3.11 ^a
150ml/litter	1.32 ^b	9.43	2.28 ^b
300ml/litter	1.34 ^b	10.25	2.50 ^b
SEM	0.02	0.27	0.08
P-Value	0.02	NS	0.02
Interaction of MSPB+WME			
0.0g/kg MSPB+0.0ml/litter WME	2.41 ^a	10.17 ^{ab}	3.27 ^a
0.5g/kg MSPB+0.0ml/litter WME	1.50 ^{ab}	9.17 ^{ab}	3.13 ^{ab}
1.0g/kg MSPB+0.0ml/litter WME	1.50 ^{ab}	9.67 ^{ab}	2.93 ^{ab}
0.0g/kg MSPB+150 ml/litter WME	1.30 ^b	9.33 ^{ab}	2.40 ^b
0.5 g/kg MSPB+150 ml/litter WME	1.02 ^c	8.63 ^b	2.17 ^c
1.0 g/kg MSPB+150 ml/litter WME	1.31 ^b	10.33 ^{ab}	3.10 ^{ab}
0.0 g/kg MSPB+300 ml/litter WME	1.27 ^b	10.17 ^{ab}	2.37 ^b
0.5 g/kg MSPB+300 ml/litter WME	1.40 ^{ab}	9.33 ^{ab}	2.77 ^{abc}
1.0 g/kg MSPB+300 ml/litter WME	1.37 ^{ab}	11.25 ^a	2.37 ^b
SEM	0.03	0.47	0.13
P-Value	0.02	0.04	0.01

a, b, c = means on the row is significant at (p<0.05), NS = Non significant, MSPB = Multi-species probiotics/prebiotics blend, WME = Wild melon extract, SEM = Standard error of the mean.

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