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GROWTH PERFORMANCE AND NUTRIENTS DIGESTIBILITY OF ARBOR ACRE BROILER CHICKENS FED DIET SUPPLEMENTED WITH NANO ZINC

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Abstract

The research was carried out to determine the effect of dietary supplementation of nano zinc on growth performance and nutrient digestibility of broiler chickens aged 1 to 28 days. Two hundred Arbor Acre broiler chicks of a day old were randomly allocated four dietary nano zinc treatments, each consisting five replicates with ten birds per replicates using a completely randomized design. Treatments 1, 2, 3 and 4 containing 20, 30, 40 and 50 mg of nano Zn/kg and were tagged **NZn**20, **NZn3**0, **NZn**40 and **NZn**50, respectively. The Birds were reared on deep litter and fed basal diets containing 20 % CP and energy level of 3000 kcal/Kg DM supplemented with varying levels of nano zinc for 28 days. Data generated were subjected to Statistical Package for Social Science (SPSS version 16.0). The supplementation of nano zinc enhanced ($P<0.05$) final and daily body weight gain, reduced feed consumed and mortality. The dietary treatments also improved CP, CFand ash digestibility. Chickens on diet supplemented with 30 and 50 mg/kg zinc had better result than those on 20 mg/Kg.

Key words: Nano Zinc, growth, nutrient digestibility and broiler chickens

Introduction

Feed supplements are used in poultry ration to boost productivity efficiency and improving health of the birds (Alagawany *et al*., 2020). Zinc (Zn) is an essential trace element needed for the normal functioning of the animal body. The biological roles of zinc include; catalytic roles in the functioning of more than 300 enzymes, structural and regulatory functions on the antioxidant and immune system, nucleic acid synthesis, cell proliferation, protein synthesis, protein and carbohydrate metabolism, and enzymatic activities in the living system (Fayiz *et al*., 2021). National Research Council (1994) recommended 30 mg of Zn/kg for broiler chickens which may not be adequate to support maximum performance (Du *et al*., 2007). Recently, the indiscriminate used of zinc in the diets to obtain optimal productivity, causing public concern due to excessive environmental pollution exerted by minerals excretion. With the emergence of nanotechnology, nano zinc can be incorporated as a feed supplement to improve the efficiency of trace minerals in broiler chickens (Geetha *et al*., 2020).The nano-sized particles have higher potential than the conventional because of its high surface area to volume ratio which enables nanoparticles to be effective in very small amounts and absorbable more quickly than inorganic and organic minerals (Sawosz *et al*., 2009). The aim of this study was to evaluate the effect of dietary nano zinc supplementation on growth performance and nutrients digestibility of Arbo Acre broiler chickens.

Materials and Methods

Experimental Location

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Production, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State, Nigeria.

Source of feed ingredients

The feed ingredients maize and soybean were procured from GidanMatasa and step by step Agro store, Western bypass, Minna. Zinc nitrate $Zn(NO_3)_2$, Sodium hydroxide (NaOH), were purchased from Pan lac laboratory equipment and chemicals store, Keterengwari, along Mobile road, Minna. The Africa scent leave (*Ocimungratissimum*) was sourced from olericulture garden FUT, Minna. All other reagents and equipment used were obtained from the Step 'B' Drug and Vaccine Discovery Laboratory, Bosso Campus, Federal University of Technology, Minna. The green synthesis of nano zinc was done at the aforementioned laboratory in line with the protocols described by Jay and Shafkat (2018). Experimental diet was formulated in line with nutrients requirement recommended for broiler chickens (NRC, 1994).

Experimental animals, management and Design

The chicks were procured from Yammfy Farm hatchery, Ilemona, Kwara state. . Two hundred Arbor Acre broiler chicks of a dayold were randomly allocated four dietary nano zinc treatments, each consisting five replicates with ten birds per replicates using a completely randomized design. Treatments 1, 2, 3 and 4 contain 20, 30, 40 and 50 mg of nano Zn/kg and were tagged **NZn**20, **NZn3**0, **NZn**50 and **NZn**20, respectively. The Birds were reared on deep litter and fed basal diets containing 20 % CP and energy level of 3000 kcal/Kg DM supplemented with varying levels of nano zinc for 28 days.

Data collection and statistical Analysis

Data obtained on growth performance and nutrients digestibility were subjected to one way analysis of variance. Significant means variations were separated using Duncan multiple range test. StatisticalPackage for Social Science (SPSS, 2018 version 16.0) was used for the data analysis.

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Results and Discussion

The effect of nano zinc supplementation on growth performance of broiler chickens is presented in Table 1. The results revealed that all parameters measured were significantly ($P<0.05$) affected except initial body weight and feed conversion ratio. Results showed that birds fed higher level of Nano Zn did better ($P<0.05$) than those on NZn40 which was similar ($P>0.05$) to those on NZn20. This might be related to the role of Zn as an integral part of more than 300 enzyme systems involved in energy and protein metabolism (2).These are in line with reports of (Geetha *et al*., 2020) and (Zhao *et al*., 2014) who found improvement in the body weight gain and feed efficiency from broiler chickens fed diets supplemented with zinc oxide nanoparticles. Table 2: Demonstrated that crude fibre, crude protein and ash digestibility contents were significantly ($P<0.05$) influenced by dietary treatments of the test ingredients except dry matter, ether extract and nitrogen free extract. The findings indicated that birds fed 30 mg/kg NZn supplemented diets had highest nutrients digestibility across the treatments. This may be attributed to the enzymatic activities of zinc in the living system. The current data agree with (Saleh *et al*., 2012) who conducted study to investigate the effects of dietary supplementation ofZn (0, 20, 40, 60 and 90 mg/kg) diets on growth performance, nutrient digestibility and meat quality of broiler chickens. They found improvement in dry matter, crude fibre, crude protein, ash and nitrogen free extract across the treatment.

Conclusions and Recommendations

Based on the results obtained from the present study, it was observed that dietary supplementation of nano zinc at 30 mg/kg NZn improved body weight gain, CF, CP and ashdigestibilityand are recommendedfor higher productive performance for Arbor acre broiler chickens.

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Table 1: Effect of nano zinc supplementation on growth performance of Arbor acre broiler chickens (0 – 28 d)

Main effect nano zinc (mg/kg)	Initial body weight (g/b)	Final body weight (g/b)	Body weight gain (g/b)	Total feed consumed (g/b)	Daily feed consumed (g/b)	Daily body weight gain (g/b)	FCR	Mortality (%)
NZn20	61.47	930.67^{b}	889.17^{b}	1881.15^{b}	38.38^{b}	17.73^{b}	2.22	6.50^{a}
NZn30	61.59	1011.42^{a}	949.84^{a}	1932.93^{a}	39.44^{a}	19.38^{a}	2.08	0.68^{c}
NZn40	61.76	976.96^{ab}	915.25^{ab}	1905.64^{ab}	38.89^{ab}	18.67^{ab}	2.14	5.37^{ab}
NZn50	61.56	984.41^{a}	936.35^{a}	1948.52^{a}	39.77^{a}	19.10^{a}	2.08	3.81^{b}
SEM	0.25	18.85	16.56	18.91	0.03	0.02	0.05	0.75
P-value	0.87	0.02	0.03	0.02	0.33	0.38	0.23	0.00

ab = means in the same column with vary superscript differs significantly ($p<0.05$).

Table 3: Effect of nano zinc supplementation on nutrients digestibility of Arbor acre broiler chickens (0 – 28 d)

Main effect of nano zinc (mg/kg)	DM (%)	CP (%)	CF (%)	EE (%)	ASH (%)	NFE (%)
NZn20	83.09	78.02^{b}	75.28^{b}	79.74	77.12^{ab}	77.49
NZn30	84.60	84.04^{a}	81.27^{a}	81.17	79.16^{a}	80.15
NZn40	85.55	80.25^{ab}	79.17^{ab}	79.97	74.56^{b}	82.53
NZn50	87.47	82.68^{a}	77.22^{b}	81.18	80.16^{a}	82.91
SEM	1.71	1.40	1.30	1.91	1.36	1.87
P-value	0.34	0.01	0.02	0.92	0.03	0.16

ab = means in the same column with vary superscript differs significantly ($p<0.05$).
DM = dry matter, CF = crude fibre, CP = crude protein, EE = ether extract and NFE = Nitrogen Free Extract.
SEM = standard error of mean
P –value = probability levels
mg = milligram and Kg = kilogram % = percentage