PERFORMANCE CHARACTERISTICS OF BROILER CHICKENS FED DIETS SUPPLEMENTED WITH CALCIUM PHOSPHATE NANOPARTICLES COATED WITH WILD SUNFLOWER LEAF EXTRACT

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ABSTRACT

Nanotechnology is one of the approaching techniques with the ability to increase global nourishment while improving dietary esteem, quality and security. This experiment was carried out to study the effect of diets containing Calcium Phosphate Nanoparticles on growth performance and nutrient digestibility of broiler chickens. Two hundred (200) day old Abor Acre strain of broiler chicks were weighed and randomly divided into 5 treatments of four replicates each. There were 10 birds per replicate making a total of forty (40) birds per treatment in a completely randomized design experiment. The birds in Treatment 1 were fed diets without the test ingredients (control), birds in Treatment 2, 3, 4 and 5 had control diet + 0.01%, 0.03, 0.05 and 0.07% of Calcium Phosphate Nanoparticles respectively. The experiment lasted for seven weeks. Result shows that Treatments 3, 4 and 5 had the highest final weight gain of 2244.09, 2216.14, 2249.97g respectively and the daily weight gain of 44.74, 55.03 and 45.03g. Treatments 1 and 2 had the highest daily feed intake of 81.06g and 80.94g respectively while the lowest feed intake (77.00g) was obtained in Treatment 2. The feed cost/kg weight in Treatment 1 (670.17g) was the highest and the lowest (597.81g) was in Treatment 5. It was concluded that feeding Calcium Phosphate Nanoparticles coated with Wild Sunflower leaf extract up to 0.07% inclusion level has no adverse effect on the growth performance of broiler chickens with 0.03% as the most recommended dosage for growth performance.

Keywords: Calcium Phosphate Nanoparticles, Sunflower, Broiler, Performance.

INTRODUCTION

Nanotechnology is a new scientific approach that study about the control of matter on an atomic and molecular scale, generally structures in the nanometer (Huang *et al*., 2015). Nanotechnology have been implicated in veterinary medicine as a tool for improving animal nutrition, breeding and reproduction, for diseases diagnosis, prevention and therapy (Mukar *et al*., 2015) as well as food safety. It is a very promising new approach that has the potential to substitute antibiotics as feed additive.

Calcium Phosphate Nanoparticles is a family of nanominerals containing calcium ions together with inorganic phosphate anions (Mahmoud, 2012). The fast growing birds due to increased weight gain often have skeletal disorder leading to economic losses. The most commonly use inorganic sources such as calcium phosphate doses in feed generally are in the range of 6-6.5g/kg for Ca and 2-3.5g/kg for P, depending on the supplementation of phytase. However, the bioavailability of inorganic sources is poorer than the organic sources. The functionality or bioavailability of foods and nutrients may be improved by using nanoparticle-sized components, which would reduce the concentrations required in the food product (Weiss *et al*., 2006)

Wild Sunflower (*Tithonia diversifolia*) from the family Asteracae is a woody herb of succulent shrub, stoloniferous, annual or perennial (Gualberto *et al*., 2011). It is used for several purpose such as, ornamental, fuel, compost, land demarcation and also works as green manure, increasing crop productivity and acts as fodder for domestic animals (Mwango *et al*., 2014).

Feeding of Calcium and Phosphorus minerals as calcium phosphate nanoparticles instead of conventional di-calcium phosphate has increased the feed efficiency among broiler chickens (Victor and Kumar, 2008). The demand of phosphorus and calcium nutrients as nanoparticles has reduced the quantum of such nutrient requirement as conventional feed form (He *et al*., 2002).

MATERIALS AND METHODS

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State. The test ingredients used for experiment were calcium phosphate produced by Tianjin Kermel Reagent Co., Ltd. China and wild sunflower leaves. The Calcium Phosphate Nanoparticles was prepared as follows:

Wild Sunflower leaves plucked from uncultivated area of the University Teaching and Research Farm was air dried before grinding into powder. 10gram of the grinded sunflower leaf was added to 500mL of distilled water, boiled for one hour in a shaker water bath, the solution was filtered and the filtrate was centrifuged for 20mins at 4000rpm. The calcium phosphate nanoparticles were prepared using 15mL of wild sunflower leaf extract in addition to 150mL of 1mM calcium phosphate. The solution was boiled in a shaker water bath for another one hour after which it was cooled at room temperature, decanted and oven dried at 60^{o}C and stored in an air tight container for further use.

Five experimental diets were formulated from conventional feed ingredients for starter and finisher phases;

Diet 1- Basal diet (control, with 0% CaPNps), Diet 2,3,4 and 5 - Basal diet supplemented with 0.01, 0.03, 0.05 and 0.07% CaPNps respectively.

The gross composition of the experimental starter and finisher diets are presented in Table 1 and 2

Two hundred (200) day-old Arbor acre strain of broiler chicks was used for the experiment. The birds were weighed at the commencement of the experiment and randomly divided into 5 treatments of four replicates each after weight balancing. Each replicate had Ten (10) birds to make a total of forty (40) birds per treatment. Each replicate was housed in pen measuring 130cm×97cm×186cm. The birds were managed intensively and all necessary vaccinations and medications were used appropriately. The birds were offered feed and water on *ad-libitum* basis throughout the experiment that lasted for 49 days.

Table 1: Gross composition of Experimental diets for broiler starter phase

Ingredients (kg)	Diet 1	Diet 2	Diet 3	Diet 4	Diet5
Fixed Ingredients	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
CaPNPs	-	0.001kg	0.003kg	0.005kg	0.007kg
Calculated Analysis					
Dry matter (%)	82.70	82.70	82.70	82.70	82.70
Crude Protein (%)	22.07	22.07	22.07	22.07	22.07
Ether Extract (%)	3.66	3.66	3.66	3.66	3.66
Crude Fibre (%)	3.03	3.03	3.03	3.03	3.03
ME(Kcal/kg)	3018.20	3018.20	3018.20	3018.20	3018.20
Phosphorus (%)	1.20	1.20	1.20	1.20	1.20
Calcium (%)	0.93	0.93	0.93	0.93	0.93
Lysine (%)	1.60	1.60	1.60	1.60	1.60
Methionine (%)	0.60	0.60	0.60	0.60	0.60
Threonine (%)	0.72	0.72	0.72	0.72	0.72

Fixed Ingredients: Maize 54.00kg, Soy bean meal 33.00kg, Soybean oil 2.00kg, Wheat offals 4.00kg, Bone meal 3.00kg, Salt 0.25kg, Premix 0.25kg, Methionine o.25kg and Lysine 0.25kg

The following data were collected;

Growth Performance: The performance of broiler chicken was measure by using the following parameters:

Total Feed intake: $\frac{\text{Feed offered-Leftover food}}{\text{Number of Birds}}$

Total weight gain: Final Weight- Initial Weight

Daily weight gain: $\frac{\text{Total weight gain in a week}}{\text{7 days}}$

Feed to gain ratio: $\frac{\text{Total feed intake}}{\text{Total weight gain}}$

Feed cost per kg (₦): $\frac{\text{Total Feed Cost}}{\text{Quantity of Feed}}$

Feed Cost per Kg Weight Gain: Feed Cost × Feed to Gain Ratio
Daily Feed Intake: Total feed intake / Number of Days

Table 2: Gross composition of Experimental diets for broiler finisher phase

Ingredients (kg)	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Fixed Ingredients	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
CaPNPs	-	0.001kg	0.003kg	0.005kg	0.007kg
Calculated Analysis					
Dry matter	81.42	81.42	81.42	81.42	81.42
Crude Protein (%)	18.97	18.97	18.97	18.97	18.97
Ether Extract (%)	3.42	3.42	3.42	3.42	3.42
Crude Fibre (%)	3.01	3.01	3.01	3.01	3.01
ME(Kcal/kg)	2910.72	2910.72	2910.72	2910.72	2910.72
Phosphorus (%)	1.05	1.05	1.05	1.05	1.05
Calcium (%)	1.88	1.88	1.88	1.88	1.88
Lysine (%)	1.34	1.34	1.34	1.34	1.34
Threonine (%)	0.72	0.72	0.72	0.72	0.72
Methionine (%)	0.57	0.57	0.57	0.57	0.57

Premix composition: Vitamin A-12500000.00I.U, Vitamin D3-2500000.00, Vitamin E-40000.00mg, Vitamin K3-200.00mg, Vitamin B1-3000.00mg, Vitamin B2-5500.00mg,Niacin-55000.00mg, Calcium Pantothenate-11500.00mg, Vitamin B6-500.00mg, Vitamin B12-25.00mg, Choline Chloride-500000.00mg, Folic acid-100.00mg, Biotin-80.00mg, Manganese-120000.00mg, Iron-100000.00mg, Zinc-80000.00mg, Copper-8500.00mg, Iodine1500.00mg, Cobalt-300.00mg, Selenium-120.00mg, Anti-Oxidant-12000.00mg.

ME– Metabolizable Energy, CaPNPs- Calcium Phosphate Nanoparticles

Fixed Ingredients: Maize 54.20kg, Soy bean meal 28.00kg, Soybean oil 2.00kg, Wheat offals 6.00kg, Bone meal 6.80kg, Salt 0.25kg, Premix 0.25kg, Methionine o.25kg and Lysine 0.25kg

The proximate composition of the starter, grower and finisher feeds was determined using the method of A.O.A.C (2005) and data collected were analyzed using one-way analysis of variance (ANOVA) of the GLM of SAS (2003). Means were separated using Duncan Multiple Range Test of the same statistical package.

RESULTS AND DISCUSSION

Results obtained from tables 3 showed that dietary treatment had significant effects on final weight gain, total feed intake and feed cost per kg.

The improvement in the final weight observed in treatment 5 correlates with the result reported by Doha *et al*., (2022), but contradicts the result reported by Vijayakumar and Balakhishran (2014). Also Ahamdi (2009) reported the significant increase in the final weight compared to the control group. This result might be due to the antibacterial properties of Calcium Phosphate nanoparticles affecting microbial population without inducing resistance and increasing anabolic activity that may lead to the stimulation of development and growth of animals. The daily feed intake reported in this study contradicts the findings of Eskandani *et al.,* (2021) who reported higher daily feed intake for broiler chickens fed Zinc nanoparticles, although excess calcium intake reduce feed intake as reported by

Table 3: Performance Characteristics of Broiler Birds Fed Diet Supplemented with Calcium Phosphate Nanoparticles Coated with Sunflower Leaf Extract at 7 weeks of age

Parameters	T1	T2	T3	T4	T5	SEM	P-value
Initial Weight (g)	48.63	49.69	49.18	44.97	47.64	0.27	0.00
Final Weight (g)	2110.43^{b}	2198.74^{ab}	2244.09^{a}	2216.14^{a}	2249.97^{a}	15.34	0.32
Daily Weight Gain (g)	42.09	43.44	44.74	55.03	45.03	2.23	0.36
Daily Feed Intake (g)	81.06^{a}	77.00^{b}	80.94^{a}	77.76^{b}	77.44^{b}	0.39	0.01
Feed Cost/KG (₦)	344.00	351.89^{c}	367.66^{bc}	383.44^{b}	399.21^{a}	0.00	0.01
Feed to Gain ratio	2.00^{a}	1.92^{b}	1.94^{b}	2.00^{a}	1.94^{b}	0.01	0.02
Feed Cost/Kg	670.17^{a}	609.51^{b}	627.38^{b}	606.76^{b}	597.81^{b}	4.84	0.01

^{ab} Means along the same row with different superscripts are significantly different ($p<0.05$)
T1= Control Diet, T2= Control Diet + 0.01% Calcium Phosphate Nanoparticles

T3= Control Diet + 0.03% Calcium Phosphate Nanoparticles, T4= Control Diet + 0.05% Calcium Phosphate Nanoparticles,
T5= Control Diet + 0.07% Calcium Phosphate Nanoparticles

Hassan *et al.,* (2016). The daily weight gain reported in the study falls below the daily weight gain reported by Eskandani *et al.,* (2021).

CONCLUSION AND RECOMMENDATION

It could be concluded from the study that feeding Calcium Phosphate Nanoparticles coated with Wild Sunflower Leaf Extract up to 0.07% inclusion level has no adverse effect on the growth performance of Broiler Chickens with 0.03% as the most recommended dosage.

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