GROWTH PERFORMANCE AND ECONOMIC BENEFITS OF BROILER STARTER CHICKS FED VARYING LEVELS OF ORANGE PEEL EXTRACT AS MINERAL SUPPLEMENT

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ABSTRACT
The study was conducted to investigate the effect of the administration of orange peel extracts on growth and economic benefits of starter broiler birds in drinking water as mineral supplement. A total of one hundred and thirty five (135) broiler starter birds were randomly allotted into five treatments groups namely: T0 (OPP 0g), T1 (OPP 5g), T2 (OPP 10g), T3 (OPP 15g) and T4 (OPP 20g). Each treatment was replicated thrice with nine (9) birds per replicate in a completely randomized design (CRD). Growth parameters measured were body weight gain, feed intake, feed conversion ratio (FCR) and mortality. The cost per kilogram, cost of feed consumed, cost of feed per Kg weight gain and total revenue were evaluated. Results showed that final body weight, body weight gain and daily feed intake were significantly (P<0.05) higher in birds on OPP 10g followed by birds fed OPP 15g then than those of on OPP 20g which were not significantly different from the control. The feed conversion ratio was improved in birds fed OPP 15g. In conclusion, administering of OPP in drinking water improved performance of broiler starter at 15, 10, and 5g than birds fed without peel extracts. Economy of production indicated that cost of feed consumed and cost per kilogram weight gain reduced for broiler starter birds fed OPP compared to those fed control diet.
KEYWORDS: Growth performance, broiler starter, orange peels, mineral, economic benefits

INTRODUCTION

Minerals are essential elements in the diets of poultry, which regulate metabolic processes and provide cellular structure. Inadequate provision of minerals may result in wide ranging symptoms including poor weight gain, fragile bones, joint problems, heart disease and anaemia disorders (Gupta *et al.,* 2008). These effects may be sub-clinical in some cases or suboptimal livestock health and performance, the causes of which are difficult to diagnose (Fisher, 2008). However, the minerals are usually supplied in the diet of chickens as mineral premix. Mineral premix is a convectional source of mineral supplements usually added in water or feed to complement the deficiency of micro-minerals in the formulated diets. Despite its important in poultry nutrition, mineral premixes are not readily available and affordable due to cost. Studies have shown that citrus peels are rich in minerals (Feumba *et al*., 2016), bioactive chemical compounds (Erhan and Bolukbasi, 2017) and phytochemicals (Dias *et al*., 2020). In Nigeria, orange peel is generally discarded as waste and it therefore available at little or no cost in most seasons. Beneficial effect of orange peel supplementation in poultry diets has been reported on growth performance (Sunmola *et al*., 2018; Abdulameer, 2019, Vlaicu *et al*., 2020; Majekodunmi *et al.*, 2021) but there scanty information on the use of orange peel as alternative mineral premix. This study therefore investigated the effect of water supplementation with dry orange peel powder on the performance and economic benefits of starter broiler chicks as mineral supplement.

Materials and methods

Experimental location

The study was conducted at the poultry house of the Department of Animal Science, Kebbi State University of Science and Technology, (KSUST) Aliero, Kebbi State. The poultry house is located within the campus of the University behind Molecular Laboratory. Aliero lies at latitude 12°16′44″N and Longitude 4°27′6E.

Experimental material's collection and preparation

Fresh yellow part of orange peels were collected from orange retailers within KSUST, Aliero Mini market, sorted out to remove dirt and immediately air-dried for 3 days. After drying, the peels were

ground and sieved to obtain a fine powder. The orange peel powder (OPP) was kept in an air tight container at room temperature till when needed.

Experimental birds and management

A total of 135 1-day old broiler chicks were purchased from Amo hatchery. They were randomly assigned on weight equalization basis to five treatment groups of 27 chicks. Each treatment group had three (3) replicates with 9 chicks per replicate in a completely randomized design for 28 days. The five treatments contained varying levels of OPP mixed in 1 litre of warm water at 0, 5, 10, 15 and 20% for treatments T0, T1, T2, T3 and T4 respectively. Feed and water were provided *ad libitum*, while medication was done as outlined by Oluyemi and Roberts (2000).

Data Collection

Mineral analysis

The minerals in orange peels were analyzed using Atomic Absorption Spectrophotometer.

Growth performance

The initial body weight was taken at the beginning of the experiment and weekly thereafter. Feed intake and left over was recorded on daily basis. Body weight gain was calculated as final weight minus initial weight by number of birds. Feed conversion ratio was determined as feed intake divided by weight gain while mortality was calculated as number of birds remain divided by number of birds used multiply by 100.

Feed cost analysis

Feed cost (FC) was calculated as number of bag used divided by cost of bag while, cost of feed consumed was calculated as FC by the total feed intake.

Data Analysis

Data were subjected to analysis of variance (ANOVA) using SPSS Software package and means were separated using Turkey at 5% level of significance as outlined by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Mineral constituent of the orange peel

The result of the mineral analysis of orange peel is shown in Table 1. The six minerals analyzed affirms the report of Feumba *et al*. (2016) that orange peel is a good source of minerals particularly Ca, Zn, Fe and Cu. These minerals are crucial to normal growth and development of chicks (Mohammed *et al*., 2013).

Table 1: Mineral analysis of orange peels

Minerals	Quantity (ppm)
Calcium (Ca)	5.73±1.71
Magnesium (Mg)	4.73±1.26
Potassium (K)	1.43±0.95
Copper (Cu)	4.0±1.41
Iron (Fe)	4.0±1.41
Zinc (Zn)	4.0±1.41

Value are means ± standard deviations of three replicate measurements

Growth performance of experimental birds

The effect of varying levels of OPP on the growth performance of starter chicks is shown in Table 2. Results showed that final body weight, body weight gain and daily feed intake were significantly ($P>0.05$) higher for birds on OPP 10g followed by OPP 15g and OPP 5g, while the control was not significantly ($P>0.05$) different from OPE 15g and 20g.

Table 2: Growth performance of broiler starter chickens served varying levels of OPP in drinking water

Parameters	Treatments					
	T0 (0g)	T1 (5g)	T2 (10g)	T3 (15g)	T4 (20g)	SEM
Initial body weight (g/b)	39.00	39.01	38.63	38.93	39.25	3.37
Final body weight (g/b)	308.64^{d}	382.72^{c}	419.75^{a}	395.06^{b}	382.72^{c}	25.25
Body weight gain (g/b)	441.92^{b}	441.91^{b}	490.02^{a}	457.89^{b}	339.30^{c}	5.12
Daily feed intake (g/b)	47.67^{c}	49.10^{b}	52.35^{a}	50.52^{b}	51.66^{c}	12.23
Total feed intake (g/b)	11584.40^{c}	12206.13^{b}	12721.40^{a}	12278.63^{b}	11622.60^{c}	76.70
FCR (g feed g^{-1} gain)	1.64^{a}	1.33^{b}	1.24^{c}	1.28^{b}	1.25^{c}	0.01
Mortality (%)	7.64	6.00	5.30	6.00	6.00	0.02

^{abcd}= Row means with different superscripts are significantly different (P<0.05)

The FCR of birds on OPP 10g (1.24), OPP 20g (1.25) were similar (P>0.05) but better than birds on OPP 5g (1.33) and birds on control (1.64). The increasing weight gain with increasing level up to OPP 10g and thereafter decreasing weight gain on OPP 20g. Similar findings have been stated by Nworgu et al. (2020) who reported declined of weight gain of birds at highest levels of 20 and 25g *Gongronema latifolia* extract in drinking water. However, the superior growth of the birds on OPP 5g, 10g and 15g over the control and OPP 20g may indicate that the inclusion of orange peels in the broiler diet was quite beneficial at moderate levels. Birds on OPP at low levels (5, 10 and 15g) had the highest feed intake though consumed less at higher level of OPP (Table 2). The different responses of birds to levels of OPE with respect to feed intake may be as a result of the availability of useful minerals in the extract. Oluyemi and Roberts (2000) reported that incorporation of both macro and micronutrients in poultry diets enhances feed intake and utilization. It also supports the assertion of Olomu (2011) that minerals are involved in feed utilization, growth and maintenance of body weight. The lower feed intake observed in control may be attributed to none inclusion of OPP in their drinking water. There was mortality across the treatments. Birds served levels OPE had the lowest mortality rate though was not significantly different (P>0.05) from control.

Feed cost analysis

The result of economic benefit of broiler starter birds is presented in Table 3.

Table 3: Cost analysis of broiler starter fed varying levels orange peels powder in drinking water.

Parameters	Treatments					
	0 (0g)	1 (5g)	2 (10g)	3 (15g)	4 (20g)	SEM
Feed cost/ kg (₦/kg)	4278.1^{a}	1121.2^{b}	1272.3^{b}	1158.0^{b}	1162^{b}	15.5
Total weight gain (kg)	2574.0^{a}	1818.0^{ab}	3200.0^{b}	2077.0^{ab}	1596.0^{b}	264.7
Total feed intake (₦)	4901.26^{a}	1265.53^{b}	1318.95^{b}	1115.90^{b}	1024.17^{b}	160.9
Total income (₦)	2273.3^{b}	2273.3^{b}	2493.3^{a}	2346.6^{b}	1833.3^{c}	10.9

abc= Row means with different superscripts are significantly different (P<0.05)

There was significant (P<0.05) difference on all the parameters evaluated. Feed cost declined with inclusion of the orange peels. This is explained by the cheap cost of orange peel. Ani *et al.* (2015) reported a similar trend. Birds served feed with non-inclusion of OPE consumed higher feed worth ₦4901.26, while those fed varying levels of OPE had the lowest cost of feed. Onu *et al.* (2016) reported that the inclusion of unconventional feed stuffs in starter broiler diets minimizes cost of production. The result of feed cost per kilogram weight gain was higher in control and low for birds on 20g OPE. Feed cost per kg weight gain increased with increase in FCR. The result is in tandem with the report of Nworgu (2007) who reported significance difference in feed cost per kilogram weight gain in starter broilers fed pumpkin (*Telfaria occidentalis)* leaf extract supplement.

Conclusion and recommendation

It was concluded that broiler starter birds served OPP in drinking water showed improved growth performance and reduced cost of feed consumed. However, 10% OPE should be used as mineral supplement in broiler starter diet.

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