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Effect of graded level of sweet orange peel (Citrus sinensis) and phytasure® on performance of heat stressed-broiler chickens

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ABSTRACT

A total of three hundred and sixty day old broiler chicks were used for this study. The research was carried out over a period of twenty eight days during hot dry season. The experiment was complete randomized in nature having two phases. The birds were randomly divided into four treatment, T1–T4 with each treatment having three replicates of fifteen chicks per replicate. Phase I having graded level of sweet orange peel (SOP), shows significant increase (P<0.05) in final body weight, body weight gain, daily feed intake, protein efficiency ratio and lowest feed conversion ratio, with outstanding result in T3. Phase II having a combination of SOP and phytasure® shows similar but superior result to phase I. The test materials in both phases was able to reduce mortality in the supplemented group. It was therefore concluded that SOP either singly or in combination with phytasure® affects feed utilization and growth performance in heat-stressed broiler chickens

Keywords: Hot dry season, Sweet orange peel, Heat-stressed, Phytasure®

INTRODUCTION

Phytate is a mixture of salts of phytic acid (Myoinositol 1,2,3,4,5-hexakis dihydrogen phosphate), it is ubiquitous component of plant-sourced feed ingredients which accounts for approximately two-thirds of the total phosphorus found in plant-based diets [1] . The phosphorus that is associated with phytate in feed is poorly utilized by monogastric animals due to low level of phytase activity in their digestive tracts [2]. The use of phytate-phosphorus by simple stomach animals had been reported to vary from less than 10 to over 50 % [3]. It is well recognized that phytate reduces the availability of phosphorus and other minerals such as calcium, zinc, and copper. Microbial phytase supplementation has the ability to significantly improve phytate - phosphorus utilization in poultry diets and the results have been well documented by several researchers [4]. Dietary phytase supplementation also has the ability to influence protein and amino acid digestibility in broiler chickens and laying hens [4]. Previous research indicates that phytase improves protein and amino acid digestibility and availability in poultry diets [5]. Improvements in protein and amino acid digestibility due to phytase supplementation would also be expected to result in improved energy utilization in poultry. Studies have shown that citrus peels are rich in minerals [6], bioactive chemical compounds [7] and phytochemicals [8]. In Nigeria, orange peel is generally discarded as waste and it is regarded as environmental pollutant, it therefore available at no cost in most seasons. Beneficial effect of orange peel supplementation in poultry diets has been reported on growth performance ([9]; [10]). Therefore, the objective of this study is to explore the synergistic effect of phytase and sweet orange peel powder on growth performance and feed utilization of heat stressed-broiler chicken during hot dry season.

MATERIALS AND METHOD

Experimental location

This study was carried out in poultry unit of Veterinary Teaching Hospital research farm, University of Abuja, Gwagwalada which is located at latitude 8°55' and 9°00'N and longitudinal 7°00' and 7° 05'E. The temperature of the area ranges between 30 and 37°C annually, with the highest temperature experienced in the month of March while the mean rainfall is approximately 1,650 mm per annum. About 60% of this rainfall is concentrated between the months of July and September [11].

Experimental material's collection and preparation

Fresh yellow part of orange peels were collected from orange retailers in Gwagwalada central market, the peel was sorted out to remove dirt and immediately air-dried in the shade for 21 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

The experiment was carried out in April 2022 which coincide with the peak of hot dry season. A total of three hundred and sixty day old broiler chicks were purchased from commercial hatchery. They were randomly assigned on weight equalization basis to four treatment with each treatment having three replicates of fifteen chicks in a completely randomized design for 28 days. The experiment was divided into two phases; Phase I comprise of four treatments administered graded level of OPP dissolved in 1 liter of warm water at 0, 5, 10, 15g. Phase II also comprise of four treatments administered graded levels of OPP dissolved in 1 liter of warm water at 0, 5, 10, 15g with equal dose of phytasure® for the supplemented groups T2 – T4 respectively. Feed was given twice daily and water provided *ad libitum*, while medication was done as outlined by [12].

Data collection

Mineral analysis

The minerals in the orange peel was analysed using the protocols developed by [12].

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 of the birds. Feed conversion ratio was determined as feed intake divided by weight gain while mortality was calculated as number of dead birds divided by number of birds used multiply by 100. The same calculation was carried out for both phases of the experiment. This was done for the two phases of the experiment.

Data Analysis

All data collected were subjected to analysis of variance, using Statistical Package for Social Science (version 23.0). Means were separated using Duncan multiple range tests of the same software and significance was declared if $P<0.05$.

RESULTS

Mineral composition of sweet orange peel

Mineral composition of sweet orange peel extract is presented in Table I. the result reveals the following minerals with decrease in their abundance concentrations: calcium > potassium > sodium > chromium > zinc > magnesium > manganese > copper > nickel > cadmium. The striking thing about the analysis as showed in the result was the highest concentration of calcium relative to the rest of the minerals in the sweet orange peel.

Table 1: Mineral composition of sweet orange peel extract

Minerals	Composition (mg/100 g)
Calcium	125.00
Sodium	50.18
Potassium	60.00
Manganese	0.14
Copper	0.11
Nickel	0.03
Cadmium	0.02
Chromium	0.60
Zinc	0.50
Magnesium	0.17

Feed utilization and growth performance of broiler chicken administered graded level of Orange Peel Powder

The effect of varying levels of OPP on the growth performance of broiler chicken is shown in Table 2. Results showed that final body weight, body weight gain and daily feed intake were significantly higher for birds in T3, followed by T4 and T2 as compared with the control ($P<0.05$). The feed conversion ratio was different in the supplemented group as compared with the control ($P<0.05$). There was increase weight gain with increased level of OPP up to 10g and decrease weight seen when 15g of OPP administered.

Table 2: Feed utilization and growth performance of broiler chicken administered graded level of OPP (0 – 28 days)

Parameter	Treatment				SEM
	T1	T2	T3	T4	
Initial body weight (g/bird)	41.00	40.72	40.24	40.86	0.17
Final body weight (g/bird)	759.17^{c}	912.23^{b}	993.60^{a}	920.04^{b}	48.24
Body weight gain (g/bird)	718.17^{c}	871.51^{b}	953.36^{a}	915.18^{b}	51.58
Daily weight gain (g/bird)	25.64^{c}	31.13^{b}	34.05^{a}	32.69^{b}	1.84
Daily feed intake (g/bird)	80.19^{c}	90.28^{b}	100.04^{a}	95.09^{b}	4.23
Feed conversion ratio	3.13^{a}	2.90^{c}	2.93^{c}	2.89^{b}	0.05

Protein efficiency ratio	1.62[c]	2.07[b]	2.15[a]	2.04[b]	0.12
Mortality (%)	5.00[a]	2.00[b]	1.00[c]	1.00[c]	0.95

Means within same row with different superscripts are significantly different (P<0.05)

OPP= Orange Peel Powder; T1= control; T2 = 5g OPP; T3= 10g OPP; T4= 15g OPP

Feed utilization and growth performance of broiler chicken administered combination of OPP and phytasure®

The positive synergy between graded level of OPP and phytasure® was evident in the in Table 3 of the result. Final body weight, body weight gain, daily feed intake and protein efficiency ratio were significantly higher for birds in T3 followed by T4 and T2 as compared with the control (P<0.05). Feed conversion ratio was lower in T4, similar in T2 and T3 as compared with the control (P<0.05).

Table 3: Feed utilization and growth performance of broiler chicken administered combination of OPP and phytasure® (0 – 28 days)

Parameter	Treatment				SEM
	T1	T2	T3	T4	
Initial body weight (g/bird)	40.00	40.12	40.20	40.14	0.04
Final body weight (g/bird)	1000.31[c]	1415.32[b]	1578.40[a]	1401.17[b]	122.93
Body weight gain (g/bird)	960.31[c]	1375.2[b]	1538.2[a]	1361.0[b]	122.9
Daily weight gain (g/bird)	34.30[c]	49.11[b]	54.94[a]	48.61[b]	4.39
Daily feed intake (g/bird)	81.33[c]	104.15[b]	112.41[a]	101.28[b]	6.59
Feed conversion ratio	2.37[a]	2.12[b]	2.04[d]	2.08[c]	0.07
Protein efficiency ratio	1.81[c]	2.19[b]	2.28[a]	2.21[b]	0.11
Mortality (%)	3.00[a]	1.00[c]	0.00[d]	2.00[b]	0.65

Means with abc superscripts on same row are significantly (P<0.05) different.
OPP = Orange peel Powder; T1= control; T2= 5g OPP + 500 FTU/g; T3= 10g OPP + 500 FTU/g; T4= 15g OPP + 500 FTU/g.

DISCUSSION

The concentrations of minerals screening of sweet orange peel is shown in Table 1. From the result, calcium The values obtained were similar to that of [13], but in contrast with the findings of [14], The differences in results may be due to variation in the variety of sweet orange, processing methods of the orange peels, location and environmental conditions where the oranges were grown [15]. 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 [16].

The administration of peel powder at moderate level to the experimental birds showed bet-

ter feed utilization and growth performance. Similar findings was observed by [17] who reported declined of weight gain of birds at highest levels of 20 and 25g *Gongronema latifolia* extract in drinking water. It is also similar to the results obtained by [18], who discovered increase in weight gain and final live weight of broiler chickens diet supplemented with mixtures of garlic and ginger. [19] observed that the dietary inclusion of 0.8 % *Daniellia oliveri* extract, as a phytogenic feed additive, in broiler diets improved the performance and lowered mortality. It disagrees with the work of [20], who find no significant effect of dietary ascorbic acid and citric flavonoids (quercetin and rutin) mixtures on broiler chickens growth performance and carcass. However, the superior growth of the birds on OPP in T2, T3 and T4 over the control may indicate that the inclusion of orange peels in the broiler diet was quite beneficial at moderate levels.

Also, positive synergy between OPP and phytasure® leads to better feed utilisation and growth performance as compared with the effect of OPP supplementation alone. This supports the findings of [20], who reported improved body weight of broiler chicken administered mixture of genistein and hesperidin but in contrast with the work of [19], who found no significant effect of dietary ascorbic acid and citric flavonoids (quercetin and rutin) mixtures on broiler chickens growth performance and carcass characteristics. There was decrease in mortality rate for both phases of the experiment showing that administration of OPP either singly or in combination with phytase significantly reduced mortality across treatment groups.

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