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EFFECT OF MICROBIAL PHYTASE SUPPLEMENTATION ON GROWTH PERFORMANCE OF JAPANESE QUAILS

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ABSTRACT

A 28 days trial was conducted to evaluate efficacy of microbial phytase in diets for Japanese quails. For this purpose, 900 experimental birds were divided into six groups, each group containing 150 chicks and further sub-divided into10 replicates. Diet A (positive control) was formulated according to NRC (1994) requirements set for the Japanese quail (CP 24% and ME 2900 Kcal/Kg). Diet B differed from diet A in Ca (Calcium) and P (Phosphorus) i.e. 0.15% Ca and 0.20% P less to Diet A, respectively. Four different levels of phytase enzyme (250, 500, 750, 1000 FTU/kg of feed) were added to diet B to formulate diets C, D, E and F treatments respectively. Results revealed that body weight gain, feed consumption, FCR, keel /shank length, dressing percentage of birds in groups consuming 750 and 1000 FTU/kg phytase were significantly higher (P<0.05) than those of B, C and D. The growth performance of group E and F was comparable with those of group A (+ve control). Maximum leg weakness, swollen joints and crippled legs were observed in group B (39.30%) followed by C, D (21.33%,and 16.0%). Keeping in view, performance and mortality rate, it is recommended that microbial phytase may be used with greater confidence in Japanese quail ration.

Key words: Japanese quail, phytase, growth, dressing percentage.

INTRODUCTION

Phosphorus (P) being the most costly mineral among the macro-minerals is essentially required for skeletal development and other metabolic functions in animal body. Two third of P in poultry diets in bound form (Phytate P) is predominantly unavailable due to lack of sufficient endogenous phytase activity in mono gastric animals. Phytate molecules chelate with positively charged nutrients, thus lead to poor utilization of protein/amino acids, energy and minerals. This behavior of phytate has led it being categorized as anti-nutritional factor (Swick and Ivey., 1992). Exogenous phytase supplementation seems to be a solution to combat phytate issues, thus leads to bioavailability of P economically and reduces P load on environment (Shelton *et al.,* 2004 & Ravindran *et al.*, 1995).

A lot of research has been done to study the effects of phytase on performance of broiler and layers but no/little work has been conducted on Japanese quail particularly in our local conditions. The present experiment was planned to study the effect of phytase enzyme supplementation on growth performance and economics of the Japanese quail farming.

MATERIALS AND METHODS

A total of 900 day old Japanese quail chicks were randomly selected, weighed, and assigned to 6 dietary treatments. There were ten replicates in each treatment and each replicate consisted of 15 chicks (6 treatments × 10 replicate per treatment × 15 birds per replicate). Two isocaloric and iso-nitrogenous corn soybean based diets (A & B) were formulated (Table: I) under NRC (1994) recommendation with the difference that the diet B (negative control) was reduced by 0.20% in total P and by 0.15% in Ca relative to diet A (positive control). Diets C, D, E, and F were formulated by addition of phytase at the rate of 250, 500, 750, and 1000 FTU/kg in negative control ration, testrespectively. The birds were offered *ad lib* test feed and water during the experiment period under strict monitoring i.e. mortality, leg weakness, swollen joints and crippled legs.

Proximate analysis of the feed was done by using standard procedure prescribed by (AOAC 2000). At the end of the 4th week, 2 birds from each replicate were randomly selected and slaughtered.

Statistical Analysis: The recorded data thus obtained were subjected to statistical analysis using Completely Randomized Design (CRD) (Steel *et al*., 1997) and the differences among treatment means were tested by applying Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Feed Consumption: Significant influence of addition of phytase was observed on feed intake of experimental groups**.** The difference in feed intake (P<0.05) of the treatments containing 750 and 1000 FTU/Kg of feed (Table: II) resembles with Watson *et al.,*(2005), Wu *et* *l.*,(2006), Namkung and Leeson, (1999), Viveros *et al.*, (2002) and Francesch *et al.*, (2005) who found the positive effect of phytase on low Ca and P feed.

Body Weight: Improvement in the body weight of Japanese quails (Table II) with the increase in the phytase concentration may be due to the release of the chelated minerals from phytates and improved digestibility which matches with the findings of Catala-Gregori *et al*., (2006), Watson *et al*., (2005), Bahtiyarca and Parlat (1997), Pirgozliev *et al*., (2008), Sebastian *et al*., *(*1996), Francesch *et al*., (2005), Kwon *et al*., (1995), Denbow *et al*., (1995), Broz *et al*., (1994) and Perney *et al*., (1993) who reported that the growth rate of birds consuming low Ca and P diet was improved after supplementation with phytase.

FCR: Birds consuming 500 and 1000FTU/kg phytase exhibited better performance in terms of FCR. The improvement in the FCR of phytase offered groups (Table: III) is in line with the findings of Pirgozliev *et al.*, (2008) who reported that birds given diets with higher levels of phytase weighed more and had better FCR due to more availability of Ca & P. Perney *et al.*, (1993) and Bahtiyarca and Parlat (1997), reported Phytase supplementation at 0.1% containing 0.45 and 0.35% available P (AP) significantly increased body weight gain and improved FCR in comparison to the control group fed on 0.45% AP without phytase. Broz *et al.*, (1994), Kwon *et al.*, (1995), Kies *et al.*, (1997), Waldroup *et al.*, (2000) and Wu *et al.*, (2006) also reported the similar findings.

Dressing Percentage: Non-significant effect of phytase on dressing percentage (Table: IV) were found in experimental groups except negative control having minimum value (62.63±1.33). same results were also recorded by Ahmad *et al.*, (2004) whereas Rutkowski *et al*, (1997) reported that phytase supplementation improved dressing percentage.

Keel and Shank Length: Non significant differences in keel and shank length were observed in control and experimental groups offered phytase but significantly lower values(4.97±0.087) were recorded in negative control .The findings (Table: IV) are in line with results reported by Lessen and Summers, (1984) and Lilburn *et al.*, (1989). Increase in measurements of these bones, is an indicator of improved skeletal development which is considered essential to support muscle development, better weight gain, improved FCR and dressing percentage.

Leg Weakness/Deformities: Highest incidence of leg deformities and mortality was observed in negative control group consuming diets set with low Ca and P with no supplementation of phytase (Table IV). The situation improved when this diet was supplemented with phytase and non phytate phosphorous in negative control group. Most birds developed leg weakness and deformities during pre starter phase of the experiment. No birds which had developed the leg abnormalities recovered except for birds consuming 1000 FTU/Kg. The results of this experiment are completely in agreement with Kornegay *et al*., (1996) who reported that Phytase additions linearly increased ($P < 0.01$) body-weight (BW) gain and feed intake. Denbow *et al.*, (1995) and Ravindran *et al*., (1995) also recorded a high mortality (35 to 45%) in the birds which were offered low P diets without phytase supplementation, but mortality became nominal with supplementation of 200 to 400 U phytase/kg diets. Kornegay *et al*., (1996) also observed above normal mortality in the group receiving 2.0 g nP/kg diet without phytase.

Mortality: Maximum mortality rate was observed in negative control group. Most birds which died had developed leg abnormalities (Table: IV). This was attributed due to calcium deficiency. Maximum casualties were observed during the 1st week of experiment.

Table 1. Ingredient composition and Nutrient profile of Experimental Diets

Ingredients	Diet A* (%)	Diet B** (%)	Nutrients	Diet A*	Diet B**
Maize	50.00	51.74	ME Kcal/kg	2900	2900
Rice Polish	6.00	6.00	CP %	24.00	24.00
Canola Meal	1.98	5.52	Ca%	0.80	0.65
Soybean Meal	30.54	28.23	Available P %	0.30	0.08
Corn Gluten 60%	6.00	6.00	Phytate P%	0.34	0.37
Lime stone	1.11	1.47	Total P%	0.65	0.45
DLL Methionine	0.11	0.10	Crude Fiber%	4.38	4.61
L-Lysine	0.22	0.22	Linoleic Acid %	1.42	1.41
Threonine	0.15	0.13	Methionine%	0.50	0.50
DCP	1.28	0.00	Lysine %	1.30	1.30
Vitamin Premix	1.30	0.30			
Salt	0.30	0.29			

Vitamin Premix contained all the required minerals except for phosphorus source *: Positive Control, **: Negative Control

Table II. Average feed consumption and weight gain During Different Weeks of Age in experimental groups

Treatment	Phytase Addition FTU/kg diet	Average Feed Consumption (g)					Average Weight Gain (g)			
		1st Week	2nd Week	3rd Week	4th Week	1-4th Week	1st Week	2nd Week	3rd Week	4th Week
A	0	36.5±0.58^{b}	78.37±1.02^{b}	121.1±0.89^{b}	187.98±1.67^{b}	423.98±3.13^{b}	20.8±1.43^{b}	37.0±1.69^{b}	55.0±1.05^{b}	59.0±1.76^{b}
B	0	33.0±1.06^{a}	74.5±0.56^{a}	118.5±1.03^{a}	177.0±1.46^{a}	402.9±2.21^{a}	14.7±1.87^{a}	22.0±1.76^{a}	43.0±0.67^{a}	49.0±1.69^{a}
C	250	33.0±1.35^{a}	75.0±1.17^{a}	120.0±1.32^{a}	177.0±1.49^{a}	405.0±4.10^{a}	15.7±1.51^{a}	24.2±1.93^{a}	43.0±1.56^{a}	52.0±3.09^{a}
D	500	34.5±1.39^{ab}	76.5±1.29^{ab}	119.0±1.22^{ab}	182.0±2.15^{ab}	411.9±5.03^{ab}	17.8±1.76^{ab}	32.0±2.21^{ab}	45.0±2.26^{ab}	55.0±2.67^{ab}
E	750	35.0±1.26^{b}	77.0±1.58^{b}	120.9±2.20^{b}	188.0±1.25^{b}	420.9±5.37^{b}	19.8±1.85^{b}	40.0±2.45^{b}	50.0±3.19^{b}	55.0±1.76^{b}
F	1000	36.0±1.25^{b}	79.0±1.27^{b}	122.0±1.14^{b}	189.0±1.464^{b}	425.9±4.23^{b}	19.7±1.42^{ab}	43.0±1.33^{ab}	57.0±3.05^{ab}	58.0±2.71^{ab}

*: Positive Control, **: Negative ControlMeans with different superscripts in a column differ significantly (P<0.05)

Table III. Average Body Weight (gm) and Average Feed Conversion Ratio (FCR) at Different weeks of Age in experimental groups

Treatment	Phytase Addition FTU/kg diet	Body Weight					FCR			
		0	1st	2nd	3rd	4th	1st	2nd	3rd	4th
A	0	10.16±0.26	31.0±1.49^{b}	68.0±2.83^{b}	123.0±2.26^{b}	182.0±3.80^{b}	1.179±0.044^{b}	1.69±0.052^{b}	1.9±0.027^{b}	2.33±0.04^{b}
B	0	10.30±0.10	25.0±1.83^{a}	47.0±3.27^{a}	90.0±3.71^{a}	139.0±4.74^{a}	1.326±0.074^{b}	2.29±0.152^{a}	2.51±0.10^{a}	2.90±0.09^{a}
C	250	10.27±0.18	26.0±1.41^{a}	50.0±3.09^{a}	93.0±3.74^{a}	145.0±6.31^{a}	1.27±0.045^{ab}	2.19±0.15^{ab}	2.44±0.09^{ab}	2.79±0.12^{ab}
D	500	10.19±0.15	28.0±1.76^{ab}	60.0±3.83^{ab}	105.0±5.0^{ab}	160.0±6.9^{ab}	1.23±0.037^{ab}	1.856±0.09^{ab}	2.22±0.20^{ab}	2.58±0.10^{ab}
E	750	10.19±0.18	30.0±1.89^{b}	70.0±3.94^{b}	120.0±6.53^{b}	175.0±7.17^{b}	1.169±0.03^{b}	1.70±0.24^{b}	1.96±0.08^{b}	2.41±0.08^{b}
F	1000	10.25±0.14	30.0±1.33^{b}	73.0±2.54^{b}	130.0±5.42^{b}	188.0±7.45^{b}	1.20±0.036^{b}	1.578±0.047^{b}	1.82±0.07^{b}	2.27±0.09^{b}

Values with different superscripts in a column differ significantly (P<0.05)

Table IV. Average dressing percentage and Average keel / shank lengths in experimental groups

Treatments	Phytase (FTU/kg)	Dressing Percentage	Keel Length (cm)	Shank Length (cm)	Leg weakness (%)	Mortality (%)
A	0	64.93±1.34^{b}	5.61±0.036^{b}	3.37±0.04^{b}	0	1.33
B	0	62.63±1.33^{a}	4.97±0.087^{a}	2.94±0.05	39.30	4.67
C	250	64.74±1.07^{b}	5.06±0.11^{a}	3.01±0.09^{b}	21.33	3.33
D	500	64.40±1.81^{b}	5.29±0.1^{b}	3.19±0. 05^{b}	16.00	2.67
E	750	64.94±1.82^{b}	5.47±0.12^{b}	3.28±0.06^{b}	8.67	2.67
F	1000	65.62±1.06^{b}	5.68±0.16^{b}	3.40±0.09^{b}	3.33	2.0

Values with different superscripts in a column differ significantly (P<0.05)

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