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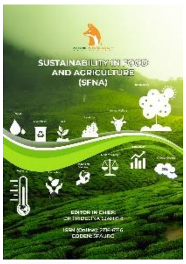

RESEARCH ARTICLE

EFFECT OF DIFFERENT LEVEL OF WHEAT WITH AND WITHOUT PHYTASE ON FEED INTAKE, GROWTH PERFORMANCE, FEED EFFICIENCY AND ECONOMICS IN COBB 500 BROILERS

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ABSTRACT

A study was conducted from 15th December 2019 to 25th January 2020 at Birendranagar Municipality- 12, Surkhet to determine the effect of phytase on the feed intake, growth performance and economics in cobb 500 broilers. Combined brooding was done for 10 days and then the chicks were separated into different treatments. A total of 288 broiler chicks were allocated to six different treatment groups. The experimental design was Completely Randomized Design (CRD), each treatment with four replications. And each replication had 12 birds in it. The birds in six treatments were fed with isoproteinous and isocaloric diet containing different level of phytase and wheat. T_0 was the control diet containing basal diet, T_1 consisted of basal diet and phytase (0.75gm/100 kg feed), T_2 consisted of basal diet containing wheat (13%), T_3 consisted of basal diet containing wheat (13%) and phytase (0.75gm/100 kg feed), T_4 consisted of basal diet containing wheat (26%), T_5 consisted of basal diet containing wheat (26%) and phytase (0.75gm/100 kg feed). Weekly average body weight, weight gain, feed consumption and feed efficiency were recorded for four weeks after the birds were allocated to different treatments. All the data recorded was statistically analyzed for Completely Randomized Design (CRD). The result showed that the overall weekly feed consumption was recorded higher (1.30 ± 0.0423 Kg) in the birds of treatment group T_5. On the other significantly ($P<0.01$) higher (2688.46 ± 7.99 gm) cumulative live weight was recorded for the birds of treatment group T_3. Likewise mean weekly weight gain was significantly ($P<0.01$) higher (293.53 ± 21.85 gm/week/bird) in treatment group T_3 in the 1st week, significantly ($P<0.05$) higher (548.57 ± 4.06 gm/week/bird) in T_1 in 2nd week, significantly ($P<0.01$) higher (649.23 ± 21.32 gm/week/bird) in T_3 in 3rd week and significantly ($P<0.01$) higher (1122.65 ± 30.90 gm/week/bird) in T_0 in 4th week. The overall FCR was significantly ($P<0.01$) better (1.94 ± 0.075) in the birds of treatment group T_3. The benefit cost ratio was found to be highest (1.3916) from the birds in the treatment group T_3. From the results of the experimental trial, it can be concluded that feed used in treatment group T_3 helped in better performance and higher benefit cost ratio. Thus, 75 gm phytase in 100 kg of feed (with 13% wheat) can be safely used in the feed of broiler.

KEYWORDS

poultry, phytase, poultry production, feed.

1. INTRODUCTION

Poultry industry is one of the fast-growing agricultural industries of Nepal. From past few decades it has become one of the major agricultural industries (Bhattarai, 2005). There are more than 20,000 commercial farms and more than 120 hatcheries with an investment of over NRs 20 billion (FAOSTAT, 2014). And broiler is the most produced commercial poultry in Nepal for the meat with 1.1 million of broiler per week (FOASTAT, 2014). The sole reason for the high demand of the poultry meat in Nepal is the cheap price and the ease of production along with the increasing awareness in the people about the importance of protein in our food. Poultry meat is cheap source for high quality protein. The fast-growing poultry industry requires nutrient as feed for the birds. The feeding of the commercial poultry covers about 80% of the total production cost (Barazjanizadeh et al., 2011). Providing the bulk amount of feed is not enough to achieve higher productivity. The mineral content is also important aspect of the poultry feed. Macro nutrition like calcium and phosphorous have direct role in the body weight and other productivity factors.

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The number of micronutrients like calcium and phosphorus are provided in quantitative reference rather than qualitative (Li et al., 2016). Thus, the value of phosphorus liberated in the digestive tract do not match the phosphorus level provided in the feed (Li et al., 2016). The bioavailability of the phosphorus is based on the available phytate (NRC, 1977, 1994). Poultry diet ingredients like grain and oil seed have the phytate in the form of phytate phosphorus, which is about 75% of the total phosphorus (Ravindranet et al., 1995). In wheat 55% of the total phosphorus is in the form of phytate while it is 73% in the maize (Godoy et al., 2015). Non-ruminants can't produce enzyme for the hydrolysis of phytate. Thus, require supplementation of the inorganic phosphorus (Viveroset et al., 2002). The phytase enzyme assist in increasing the bioavailability of the phosphorus by the hydrolysis of phytate. The hydrolysis of the phytate generates a series of lower myo-inositol phosphate (IP) esters which are IP6, IP5, IP4, IP3, IP2 and IP1. Thus, giving inositol and six organic phosphorus (Kebreab et al., 2012). The use of phytase can promote and increase the bioavailability of the phosphorus in the feed and resulting in the overall increase in the productivity.

2. MATERIAL AND METHODS

2.1 Site selection

The experiment was conducted from 15th December 2019 to 25th January 2020 at Birendranagar Municipality- 12, Surkhet. The site is located at $28^0 35'$ North latitude and $81^0 38'$ East longitude.

2.2 Experimental birds

A total of 288, day old Cobb500 broiler chicks were in the experimental trial and was brought from Deuti Hatchery (private hatchery). The chicks were grouped brooded in deep litter for 10 days and were fed commercial broiler starter ration. From the 11th day the birds were kept separately in the different treatments.

2.3 Experimental design

From the 11th day all 288 broiler were randomly divided into six treatment groups with four replicates in each having 12 chicks with similar body weight in a Completely Randomized Design (CRD).

2.4 Procurement of test materials

The feed ingredients were purchased from Sara Poultry Feeds, Birendranagar-12, Surkhet. Requirement for all nutrients, were met using primarily maize, soya bean meal, rice polish, vegetable oil and smaller amount of minerals and vitamins. Firstly, two basal diets for the starter and finisher were prepared. Afterwards different concentrations of wheat and phytase were mixed to basal diet according to the treatment. The starter ration was feed up to 25th day and finisher ration was fed up to 39th day. Commercial phytase (Phytase -5000 Granules) was used in the feed. The commercial phytase had 5000 units of phytase in every gram.

2.5 Formulation and mixing of the diet

The starter and the finisher basal diets were prepared. And different concentration of wheat and phytase were added according to the treatment.

Different dietary treatments used in experiment were as follows:

T_0 : Control diet (Basal diet)
T_1 : Basal diet (99.925 Kg) + Phytase (0.75 gm)
T_2 : Basal diet (87 Kg) + Wheat (13 Kg)
T_3 : Basal diet (86.925 Kg) + Wheat (13 Kg) + Phytase (0.75 gm)
T_4 : Basal diet (74 Kg) + Wheat (26 Kg)
T_5 : Basal diet (73.925 Kg) + Wheat (26 Kg) + Phytase (0.75 gm)

Table 1: Ingredients compositions of experimental starter feeds and finisher basal diets.

Ingredients	Starter	Finisher
Maize	48.0	52.0
Rice polish	4.50	7.00
De-oiled cake	1.25	2.50
Soyabean meal	39.0	30.33
Bone meal	2.50	2.00
Soya oil	1.00	1.50
Sunflower cake	2.00	3.00
Lysine	0.05	0.05
Methionine	0.20	0.12
Vitamin premix	0.20	0.20
Limestone	1.00	1.00
Salt	0.25	0.25
Coccidiostat	0.05	0.05

2.6 Data collection

2.6.1 Feed intake

The feed was measured and offered daily in the morning at 8 AM in block of experimental group. Feed left over in a week was recorded weekly at 8 AM in the morning. The feed intake was calculated weekly by subtracting the feed residue over from each feed offered. The weekly records of feed offered and feed residue in each block were measured to calculate the weekly feed consumption per bird. Cumulative feed consumption for experimental period was also recorded.

Feed Intake = Total feed offered in a week – Total feed residue in a week

2.6.2 Live body weight and weight gain

The average weekly body weight and body weight gain of birds in each replication for each treatment was recorded. The average weekly body weight gain was calculated by subtracting previous live weight of the birds from their corresponding body weight. The birds were weighed in the same sequence for each replicate as it was done at the beginning of the experiment.

2.6.3 Feed consumption ratio (FCR)

The weekly cumulative feed conversion ratio of the birds in each replication was determined by dividing the weekly cumulative feed intake by their respective average total body weight.

$$\text{Feed conversion ratio} = \frac{\text{Total feed consumed (g)}}{\text{Total weight gain (g)}}$$

2.6.4 Statistical analysis

The data collected were analyzed statistically using MSTAT. The data were subjected to analysis of variance. Differences between the treatments were tested for significance by Least Significance difference (LSD) by using MSTAT. Where needed descriptive analysis was done by using MS Excel.

2.6.5 Layout of experiment

288 chicks were equally and randomly divided and distributed in six dietary treatment groups T0, T1, T3, T4, T5 having four replications in each. Each dietary treatment group consists of 48 chicks distributed in four replicated pens (R_1, R_2, R_3 and R_4) with 12 chicks in each.

3. RESULT

3.1 Feed intake

Table 2: Mean weekly feed intake (kg/bird/week) of cobb 500 broilers fed with diet having different level of phytase, wheat and maize.

Treatment	Week					
	1st	2nd	3rd	4th	Total feed	Overall, per week
T_0	0.55 ± 0.0340 a	1.07 ± 0.0340	1.27 ± 0.0340 b	2.02 ± 0.0340 c	4.89 ± 0.1358	1.22 ± 0.0340
T_1	0.45 ± 0.0400 a	1.04 ± 0.0400	1.42 ± 0.0400 a	2.11 ± 0.0400 bc	5.03 ± 0.1602	1.26 ± 0.0400
T_2	0.50 ± 0.0535 a	0.99 ± 0.0535	1.43 ± 0.0535 a	2.22 ± 0.0535 a	5.09 ± 0.2140	1.27 ± 0.0535
T_3	0.53 ± 0.0458 a	0.97 ± 0.0458	1.30 ± 0.0458 b	2.02 ± 0.0458 c	4.81 ± 0.1832	1.20 ± 0.0458
T_4	0.49 ± 0.0583 a	1.01 ± 0.0583	1.41 ± 0.0583 a	2.19 ± 0.0583 ab	5.10 ± 0.2332	1.28 ± 0.0583
T_5	0.53 ± 0.0423 a	1.00 ± 0.0423	1.42 ± 0.0423 a	2.26 ± 0.0423 a	5.22 ± 0.1694	1.30 ± 0.0423
Grand mean	0.49	1.01	1.38	2.14	5.02	1.26
F-value	3.44	2.39	9.61	20.53	2.53	2.50
Probability	0.023*	0.079*	0.0001**	0.000**	0.0667	0.069
SEM	0.033	0.0328	0.0328	0.0328	0.1312	0.0328
LSD	0.0689	0.0689	0.0689	0.0689	0.2612	0.0689
CV %	9.31	4.58	3.37	2.17	3.69	3.69

Means in the column with different superscript differ significantly by LSD (P<0.05), where CV = Coefficient of variation, SEM = Standard error of mean, LSD = Least significant difference, *,** = significant at 0.05 and 0.01 probable levels respectively, ± = Standard deviation of mean.

Table 3: Mean daily feed intake (kg/bird/day) of cobb 500 broilers fed with diet having different level of phytase, wheat and maize.

Treatment	week				
	1st	2nd	3rd	4th	Average per day
T_0	0.078 ± 0.0048	0.153 ± 0.0049 a	0.181 ± 0.0048 b	0.288 ± 0.0048 b	0.175 ± 0.0048
T_1	0.066 ± 0.0094	0.149 ± 0.0059 ab	0.197 ± 0.0121 ab	0.298 ± 0.0088 ab	0.178 ± 0.0057
T_2	0.062 ± 0.0057	0.142 ± 0.0074 ab	0.202 ± 0.0056 a	0.311 ± 0.0083 ab	0.179 ± 0.0056
T_3	0.072 ± 0.0076	0.138 ± 0.0066 b	0.189 ± 0.0114 ab	0.295 ± 0.0161 b	0.174 ± 0.0083
T_4	0.069 ± 0.0075	0.141 ± 0.0069 ab	0.195 ± 0.0087 ab	0.305 ± 0.0128 ab	0.176 ± 0.0072
T_5	0.073 ± 0.0062	0.143 ± 0.0059 ab	0.202 ± 0.0058 b	0.320 ± 0.0074 a	0.185 ± 0.0060
Grand mean	0.0701	0.144	0.195	0.303	0.178
F-value	2.48	2.98	3.53	5.07	1.46
Probability	0.0708	0.0391	0.0213	0.0045	0.2504
SEM	0.005	0.0004	0.0061	0.0073	0.0045
LSD	0.0094	0.0094	0.0127	0.0143	0.0912
CV %	10.03	4.37	4.41	3.43	3.58

Means in the column with different superscript differ significantly by LSD (P<0.05), where CV = Coefficient of variation, SEM = Standard error of mean, LSD = Least significant difference, *,** = significant at 0.05 and 0.01 probable levels respectively, ± = Standard deviation of mean.

3.2 Growth performance

3.2.1 Body weight

Table 4: Mean weekly cumulative live body weight (g/bird/week) of cobb 500 broilers fed with diet having different level of phytase, wheat and maize.

Treatment	Week				
	Initial (day 11)	1st	2nd	3rd	4th
T_0	256.57 ± 5.36	508.43 ± 5.96 C	1056.99 ± 7.37 b	1158.74 ± 15.75 e	2281.39 ± 17.64 d
T_1	271.88 ± 6.84	511.21 ± 11.02 C	1119.76 ± 52.18 ab	1542.52 ± 6.50 d	2374.30 ± 23.33 c
T_2	269.24 ± 17.60	537.66 ± 7.45 b	1055.31 ± 18.87 b	1600.07 ± 43.74 c	2356.40 ± 20.37 c
T_3	275.19 ± 7.63	568.72 ± 17.32 a	1158.54 ± 15.10 a	1807.19 ± 11.70 a	2688.46 ± 7.99 a
T_4	274.53 ±10.54	535.21 ± 6.03 b	1121.29 ± 51.94 ab	1636.19 ± 30.21 c	2538.03 ± 40.07 b
T_5	261.69 ± 10.10	549.29 ± 10.29 ab	1116.51 ± 14.54 ab	1696.76 ± 9.82 b	2578.94 ± 90.02 b
Grand mean	268.18	535.09	1104.73	1573.67	2469.59
F-value	2.06	19.20	6.32	354.90	193.63
Probability	0.1189	0.000**	0.0015**	0.000**	0.000**
SEM	7.40	7.39	22.86	16.71	15.87
LSD	NS	15.522	48.024	35.1032	32.144
CV %	3.90	1.95	2.93	1.50	0.91

Means in the column with different superscript differ significantly by LSD (P<0.05), where CV = Coefficient of variation, SEM = Standard error of mean, LSD = Least significant difference, *,** = significant at 0.05 and 0.01 probable levels respectively, ± = Standard deviation of mean.

3.2.2 Body weight gain

Table 5: Mean weekly weight gain (g/bird/day) of cobb 500 broilers fed with diet having different level of phytase, wheat and maize.

Treatment	Week			
	1st	2nd	3rd	4th
T_0	251.86 ± 8.26 ^{bc}	548.57 ± 4.06 ^{ab}	301.75 ± 20.84 ^{d}	1122.65 ± 30.90 ^{a}
T_1	239.33 ± 4.97 ^{c}	608.55 ± 54.66 ^{a}	422.76 ± 52.40 ^{c}	831.78 ± 25.05 ^{c}
T_2	268.42 ± 23.01 ^{abc}	517.65 ± 20.66 ^{b}	544.76 ± 54.09 ^{b}	756.33 ± 47.37 ^{d}
T_3	293.53 ± 21.85 ^{a}	589.82 ± 22.91 ^{a}	649.23 ± 21.32 ^{a}	880.69 ± 9.29 ^{bc}
T_4	260.68 ± 5.92 ^{abc}	586.08 ± 46.15 ^{ab}	514.90 ± 62.10 ^{bc}	901.84 ± 34.90 ^{b}
T_5	287.60 ± 20.17 ^{ab}	567.22 ± 7.26 ^{ab}	580.25 ± 17.18 ^{ab}	882.18 ± 13.09 ^{bc}
Grand mean	266.90	569.65	502.27	895.91
F-value	6.74	4.18	34.13	68.32
Probability	0.0011**	0.0107*	0.000**	0.000**
SEM	11.34	22.62	29.88	21.02
LSD	23.816	47.5161	62.772	44.161
CV %	6.01	5.61	8.41	3.32

Means in the column with different superscript differ significantly by LSD (P<0.05), where CV = Coefficient of variation, SEM = Standard error of mean, LSD = Least significant difference, *,** = significant at 0.05 and 0.01 probable levels respectively, ± = Standard deviation of mean.

Table 6: Mean daily weight gain (g/bird/day) of cobb 500 broilers fed with diet having different level of phytase, wheat and maize.

Treatment	**Week**			
	1st	**2nd**	**3rd**	**4th**
T_0	35.98 ± 1.18 ^{bc}	78.36 ± 0.58 ^{ab}	14.54 ± 2.98 ^{e}	160.38 ± 4.41 ^{a}
T_1	34.19 ± 0.71 ^{c}	86.94 ± 7.81 ^{a}	60.39 ± 7.49 ^{d}	118.83 ± 3.58 ^{c}
T_2	38.35 ± 3.29 ^{abc}	73.95 ± 2.95 ^{b}	77.83 ± 7.72 ^{bc}	108.05 ± 6.77 ^{d}
T_3	41.94 ± 3.12 ^{a}	84.26 ± 3.27 ^{a}	92.75 ± 3.04 ^{a}	125.81 ± 1.33 ^{b}
T_4	37.24 ± 0.84 ^{abc}	83.73 ± 6.59 ^{ab}	73.56 ± 8.87 ^{c}	128.84 ± 4.98 ^{b}
T_5	41.09 ± 2.88 ^{ab}	81.03 ± 1.04 ^{ab}	82.89 ± 2.45 ^{b}	126.03 ± 1.87 ^{b}
Grand mean	38.13	81.38	66.99	127.99
F-value	6.75	4.18	34.13	68.32
Probability	0.001**	0.011*	0.020*	0.000**
SEM	1.62	3.23	11.36	7.16
LSD	3.400	6.788	8.967	6.307
CV %	6.00	5.61	8.41	3.32

Means in the column with different superscript differ significantly by LSD (P<0.05), where CV = Coefficient of variation, SEM = Standard error of mean, LSD = Least significant difference, *,** = significant at 0.05 and 0.01 probable levels respectively, ± = Standard deviation of mean.

3.2.3 Feed Conversion Ratio

Table 7: Mean weekly FCR of cobb 500 broilers fed with diet having different level of phytase, wheat and maize.

Treatment	**Week**	**Overall FCR**			
	1st	**2nd**	**3rd**	**4th**	
T_0	2.17 ± 0.178 ^{a}	1.94 ± 0.049 ^{a}	4.22 ± 0.395 ^{a}	1.80 ± 0.033 ^{d}	2.53 ± 0.147 ^{a}
T_1	1.86 ± 0.143 ^{ab}	1.72 ± 0.168 ^{ab}	3.41 ± 0.404 ^{b}	2.54 ± 0.112 ^{b}	2.38 ± 0.116 ^{ab}
T_2	1.68 ± 0.214 ^{b}	1.92 ± 0.122 ^{a}	2.64 ± 0.296 ^{cd}	2.94 ± 0.153 ^{a}	2.29 ± 0.116 ^{ab}
T_3	1.81 ± 0.139 ^{ab}	1.64 ± 0.091 ^{b}	2.00 ± 0.119 ^{d}	2.29 ± 0.061 ^{c}	1.94 ± 0.075 ^{c}
T_4	1.89 ± 0.195 ^{ab}	1.73 ± 0.181 ^{ab}	2.76 ± 0.288 ^{bc}	2.43 ± 0.145 ^{bc}	2.20 ± 0.105 ^{b}
T_5	1.84 ± 0.151 ^{ab}	1.77 ± 0.069 ^{ab}	2.46 ± 0.132 ^{cd}	2.57 ± 0.076 ^{b}	2.15 ± 0.087 ^{bc}
Grand mean	1.87	1.79	2.91	2.43	2.25
F-value	3.62	3.75	28.39	50.64	13.95
Probability	0.0193*	0.0167*	0.000**	0.000**	0.000**
SEM	0.1218	0.0871	0.2083	0.0751	0.0777
LSD					
CV %	9.2	6.89	10.11	4.37	4.88

Means in the column with different superscript differ significantly by LSD (P<0.05), where CV = Coefficient of variation, SEM = Standard error of mean, LSD = Least significant difference, *,** = significant at 0.05 and 0.01 probable levels respectively, ± = Standard deviation of mean.

During 1st week of experimental period, significantly (P<0.05) better feed conversion ratio (1.68±0.214) was observed in the treatment T_2. Similarly, significantly (P<0.05) poor feed conversion ratio (2.17±0.178) was recorded in control group (T_0). The mean weekly feed conversion ratio of the birds in the treatment T1, T3, T4 and T5 was in between the value recorded in the treatment groups T2 and T0.

During 2nd week of experimental period, significantly (P<0.05) better feed conversion ratio (1.64±0.091) was observed in the treatment T_3. Similarly, significantly (P<0.05) poor feed conversion ratio (1.94±0.049) was recorded in the control group (T_0) which was statistically similar to the treatment group T2. The mean weekly feed conversion ratio of the birds in the treatment T1, T4 and T5 was in between the value recorded in the treatment groups T3 and T0.

During 3rd week of experimental period, significantly (P<0.01) better feed conversion ratio (2.00±0.119) was observed in the treatment T_3. Similarly, significantly (P<0.01) poor feed conversion ratio (4.22±0.0.395) was recorded in control group (T_0). The mean weekly feed conversion ratio of the birds in the treatment T1, T2, T4 and T5 was in between the value recorded in the treatment groups T3 and T0.

During 4th week of experimental period, significantly (P<0.01) better feed conversion ratio (1.80±0.033) was observed in the treatment T_0. Similarly, significantly (P<0.01) poor feed conversion ratio (2.94±0.153) was recorded in the treatment T_2. The mean weekly feed conversion ratio of the birds in the treatment T1, T3, T4 and T5 was in between the value recorded in the treatment group T0 and T2.

The overall feed conversion ratio was significantly (P<0.01) better (1.94±0.075) in the birds of treatment group T3. Similarly, the overall feed conversion ratio was significantly (P<0.01) poorer (2.53±0.147) in the birds of treatment group T0. The overall feed conversion ratio of the birds in the treatment groups T1, T2, T4 and T5 was in between the overall feed conversion ratio recorded for the treatment groups T3 and T5.

The findings reported by Guanghou et al., 2010 was in close agreement with the result in which the feed efficiency was significantly (P<0.05) better in the birds with 0.02% supplementation of phytase in their feed. Similar result was reported by Pintas et al., 2004 which revealed improvement in the FCR, however the result was statistically not significant.

4. Discussion

The overall weekly feed consumption was recorded highest (1.30 ± 0.0423 kg) in the treatment group T_5. Minimum overall weekly feed consumption (1.20 ± 0.0458 kg) was recorded in treatment group T_3. The overall feed intake between the treatment with different treatments with different level of maize, wheat and phytase was statistically insignificant (P<0.05) (Lelis et al., 2011; Guangzhouet al., 2010; Wang et al., 2013). The experimental trail performed by Junqueira et al., 2011 also reported higher feed intake in the birds of the treatment supplemented with 500 FTU per kg of feed compared to the control group with the basal diet only. The results were in close agreement with the findings of which concluded that the addition of 250 to 1000 units of phytase per kg of the feed significantly (P<0.05) increased the feed intake of the broilers (Kinkinen et al., 1994; Wastson et al., 2006).

In this experimental trail the palatability of the feed was highest in the treatment group with 75 gm of phytase per 100 kg of the feed. This higher palatability can be due to the positive response for the feed with higher digestibility and nutrient utilization by the autonomic nervous system of the poultry. The addition of the phytase enables the improved digestion and absorption of the plant source-based phosphorus in the gut of the birds. Also, the introduction of the phytase improve the digestion and absorption of protein from the feed. This can be the possible reason for the improved growth performance of the birds supplemented with phytase in their feed. Similar results in the growth performance were reported (Balsubramanian et al., 2002; Singh et al., 2003; Karnegay et al., 1994; Mitchell and Edward, 1992; Sohail and Roland, 2001). The results were in close agreement with the findings of the schooner et al., 1992 which reported significantly (P<0.05) higher weight and weight gain in the birds fed with 1500 units of phytase per kg of feed. Similar results were reported by the findings of Mohamed et al., 2015 which concluded that the addition of 500 FTU of phytase per kg of the feed significantly (P<0.05) improved the growth performance.

The overall feed conversion ratio was significantly (P<0.01) better (1.94±0.075) in the birds of treatment group T3. Similarly, the overall feed conversion ratio was significantly (P<0.01) poorer (2.53±0.147) in the birds of treatment group T0. The overall feed conversion ratio of the birds in the treatment groups T1, T2, T4 and T5 was in between the overall feed conversion ratio recorded for the treatment groups T3 and T5. The findings reported by was in close agreement with the result in which the feed efficiency was significantly (P<0.05) better in the birds with 0.02% supplementation of phytase in their feed (Guanghou et al., 2010). Similar result was reported by which revealed improvement in the FCR, however the result was statistically not significant (Pintas et al., 2004). The sole reason for the improved feed conversion ratio must be the effective utilization of the feed in terms of the phosphorus availability and improved digestion of protein. The results of FCR revealed from this experimental trail showed poorer value than the standard FCR value for the cobb 500 broilers. The possible reason for this can be the age of birds during the experimental period. The FCR of the cobb 500 broiler is better in the early age and continues to the poorer side as the age of bird increases. The age of the birds was 11 days in the beginning of the experimental trail. Thus, the FCR was reported poorer than the standard value provided by Cobb Vantress.

The sole reason for the improved feed conversion ratio must be the effective utilization of the feed in terms of the phosphorus availability and improved digestion of protein. The results of FCR revealed from this experimental trail showed poorer value than the standard FCR value for the cobb 500 broilers. The possible reason for this can be the age of birds during the experimental period. The FCR of the cobb 500 broiler is better in the early age and continues to the poorer side as the age of bird increases. The age of the birds was 11 days in the beginning of the experimental trail. Thus, the FCR was reported poorer than the standard value provided by Cobb Vantress.

5. Conclusion

With the obtained results from the experimental trial, it can be concluded that use of phytase in the poultry feed compensate the supplementation of inorganic phosphorus. However, these results need to be verified in farmer's management conditions before making any recommendation.

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References

Ahmed, F., Rahman, M.S., Ahmed, S.U., Miah, M.Y., 2004. Performance of broiler on phytase supplemented soybean meal-based diet. International Journal of Poultry Science, 3 (4), Pp. 266-271.

Assuena, V., Junqueira, O.M., Duarte, K.F., Laurentiz, A.C., Filardi, R.S., Sgavioli, S., 2009. Effect of dietary phytase supplementation on the performance, bone densitometry, and phosphorus and nitrogen excretion of broilers. Brazilian Journal of Poultry Science, 11 (1), Pp. 25-30.

Biehl, R.R., Baker, D.H., DeLuca, H.F. 1995. 1α-Hydroxylated cholecalciferol compounds act additively with microbial phytase to improve phosphorus, zinc and manganese utilization in chicks fed soy-based diets. J. Nutr., 125, Pp. 2407–2416.

Bradbury, E.J., Wilkinson, S.J., Cronin, G.M., Walk, C.L., Cowieson, A.J., 2018. Effects of phytase, calcium source, calcium concentration and particle size on broiler performance, nutrient digestibility and skeletal integrity. Animal Production Science, 58 (2), Pp. 271-283.

Cabahug, S., Ravindran, V., Selle, P.H., Bryden, W.L., 1999. Response of broiler chickens to microbial phytase supplementation as influenced by dietary phytic acid and non-phytate phosphorus contents. I. Effects on bird performance and toe ash. British Poultry Science, 40(5), Pp. 660-666.

Cabahug, S., Ravindran, V., Selle, P.H., Bryden, W.L., 1999. Response of broiler chickens to microbial phytase supplementation as influenced by dietary phytic acid and non-phytate phosphorus contents. I. Effects on bird performance and toe ash. British Poultry Science, 40 (5), Pp. 660-666.

Cardoso Júnior, A., Rodrigues, P.B., Bertechini, A.G., Freitas, R.T.F.D., Lima, R.R.D., Lima, G.F.R., 2010. Levels of available phosphorus and calcium for broilers from 8 to 35 days of age fed rations containing phytase. Revista Brasileira de Zootecnia, 39 (6), Pp. 1237-1245.

Choct, M., Annison, G., 1992. Anti-nutritive effect of wheat pentosans in broiler chickens: Roles of viscosity and gut microflora. British poultry science, 33 (4), Pp. 821-834.

Chung, T.K., Rutherfurd, S.M., Thomas, D.V., Moughan, P.J., 2013. Effect of two microbial phytases on mineral availability and retention and bone mineral density in low-phosphorus diets for broilers. British poultry science, 54 (3), Pp. 362-373.

Coppedge, J., Klein, J., Brown, B., Ratliff, B., Ruch, F., Lee, J.T., 2011. Effects of co-administration of phytase and nspase on broiler performance and bone ash. Int. J. Poult. Sci, 10, Pp. 933-939.

Cowieson, A.J., Acamovic, T., Bedford, M.R., 2006. Phytic acid and phytase: implications for protein utilization by poultry. Poultry Science, 85 (5), Pp. 878-885.

Denbow, D.M., Ravindran, V., Kornegay, E.T., Yi, Z., Hulet, R.M., 1995. Improving phosphorus availability in soybean meal for broilers by supplemental phytase. Poultry Science, 74 (11), Pp. 1831-1842.

Farrell, D.J., Martin, E., Du Preez, J.J., Bongarts, M., Betts, M., Sudaman, A., Thomson, E., 1993. The beneficial effects of a microbial feed phytase in diets of broiler chickens and ducklings. Journal of Animal Physiology and Animal Nutrition, 69 (1-5), Pp. 278-283.

Kiiskinen, T., Piironen, J., Hakonen, T., 1994. Effects of supplemental microbial phytase on performance of broiler chickens. Agric. Sci. Finland., 3, Pp. 457–466.

Kim, J.H., Han, G.P., Shin, J.E., Kil, D.Y., 2017. Effect of dietary calcium concentrations in phytase-containing diets on growth performance, bone mineralization, litter quality, and footpad dermatitis score in broiler chickens. Animal Feed Science and Technology, 229, Pp. 13-18.

Kwon, N., Han, K.I., Kim, S.W., Shin, S.I., Sohn, K.S., 1995. Effect of microbial phytase on performance nutrient utilization and phosphorus excretion of broiler chicks fed corn-soy diet. Korean J. Anim. Sci. 37, Pp. 539±555.

Lelis, G.R., Albino, L.F.T., Calderano, A.A., Tavernari, F.D.C., Rostagno, H.S., Campos, A. M.D.A., Ribeiro Junior, V., 2012. Diet supplementation with phytase on performance of broiler chickens. Revista Brasileira de Zootecnia, 41 (4), Pp. 929-933.

Mitchell, R.D., Edwards, H.M., 1996. Effects of phytase and 1,25 dihydroxy cholecalciferol on phytase utilization and the quantitative requirement for calcium and phosphorus in young broiler chickens. Poultry Science, 75, Pp. 95 - 110.

Morgan, N.K., Walk, C.L., Bedford, M.R., Burton, E.J., 2015. Contribution of intestinal-and cereal-derived phytase activity on phytate degradation in young broilers. Poultry science, 94 (7), Pp. 1577-1583.

National Research Council. 1994. Nutrient requirements of poultry. National Academy Press, Washington, DC.

Newman S., Leeson, S., 1999. The effect of dietary supplementation with 1,25-dihydroxycholecalciferol or vitamin C on the characteristics of the tibia of older laying hens. Poultry Sci., 78, Pp. 85–90.

Petterson, D., Aman, P., 1989. Enzyme supplementation of a poultry diet containing rye and wheat. Brit. J. Nutr., 62, Pp. 139-149.

Pintar, J., Homen, B., Gazic, K., Grbesa, D., Sikiric, M., Cerny, T., 2004. Effects of supplemental phytase on performance and tibia ash of broilers fed different cereals-based diets. Czech J. Anim. Sci., 49, Pp.542-548.

Pirgozliev, V., Oduguwa, O., Acamovic, T., Bedford, M.R., 2008. Effects of dietary phytase on performance and nutrient metabolism in chickens. British Poultry Science, 49 (2), Pp. 144-154.

Powell, S., Johnston, S., Gaston, L., Southern, L.L., 2008. The effect of dietary phosphorus level and phytase supplementation on growth performance, bone-breaking strength, and litter phosphorus concentration in broilers. Poultry science, 87 (5), Pp.949-957.

Qian, H., Kornegay, E.T., Conner, D.E., 1996. Adverse effects of wide calcium: phosphorus ratios on supplemental phytase efficacy for weanling pigs fed two dietary phosphorus levels. J. Anim. Sci., 74, Pp. 1288-1297.

Richter, G., Lemsef, A., Cyriaci, G., Schwartze, J., 1993. Evaluation of microbial phytase in broiler feeding. Poult. Abst., 19, Pp. 70-78.

Rutherfurd, S.M., Chung, T.K., Thomas, D.V., Zou, M.L., Moughan, P.J., 2012. Effect of a novel phytase on growth performance, apparent metabolizable energy, and the availability of minerals and amino acids in a low-phosphorus corn-soybean meal diet for broilers. Poultry Science, 91 (5), Pp. 1118-1127.

Saima, M.Z., Khan, U., Jabbar, M.A., Ijaz, M., Qadeer, M.A., 2009. Efficacy of microbial phytase at different levels on growth performance and mineral availability in broiler chickens. Journal of Animal and Plant Sciences, 19, Pp. 58-62.

Scho¨ner, F.J., Hoppe, P.P., Schwarz, G., 1991. Comparative effects of microbial phytase and inorganic phosphorus on performance and on retention of phosphorus, calcium and crude ash in broilers. J. Anim. Physiol. Anim. Nutr., 66, Pp. 248–255.

Shirley, R.B., Edwards Jr, H.M., 2003. Graded levels of phytase past industry standards improves broiler performance. Poultry Science, 82 (4), Pp. 671-680.

Singh, P.K., Khatta, V.K., Thakur, R.S., Dey, S., Sangwan, M.L., 2003. Effects of phytase supplementation on the performance of broiler chickens fed maize and wheat-based diets with different levels of non-phytate phosphorus. Asian-australasian journal of animal sciences, 16 (11), Pp. 1642-1649.

Sohail, S.S., Bryant, M.M., Rao, S.K., Roland, D.A., 2001. Influence of cage density and prior dietary phosphorus level on phosphorus requirement of commercial Leghorns. Poultry science, 80 (6), Pp. 769-775.

Takemasa, M., Murakami, H., Yamazaki, M., 1996. Reduction of phosphorus excretion of chicks by addition of yeast phytase. Japanese Poultry Science, 33, Pp. 104-111.

Um, J.S., Lim, H.S., Ahn, S.H., Paik, I.K., 2000. Effects of microbial phytase supplementation to low phosphorus diets on the performance and utilization of nutrients in broiler chickens. Asian-Australasian Journal of Animal Sciences, 13 (6), Pp. 824-829.

Walk, C.L., Bedford, M.R., McElroy, A.P., 2012. Influence of limestone and phytase on broiler performance, gastrointestinal pH, and apparent ileal nutrient digestibility. Poultry Science, 91 (6), Pp. 1371-1378.

Wang, W., Wang, Z., Yang, H., Cao, Y., Zhu, X., 2013. Effects of phytase supplementation on growth performance, slaughter performance, growth of internal organs and small intestine, and serum biochemical parameters of broilers.

Watson, B.C., Matthews, J.O., Southern, L.L., Shelton, J.L., 2006. The effects of phytase on growth performance and intestinal transit time of broilers fed nutritionally adequate diets and diets deficient in calcium and phosphorus. Poultry science, 85 (3), Pp. 493-497.

Woyengo, T.A., Nyachoti, C.M., 2013. Anti-nutritional effects of phytic acid in diets for pigs and poultry–current knowledge and directions for future research. Canadian Journal of Animal Science, 93 (1), Pp. 9-21.

Wu, Y.B., Ravindran, V., Hendriks, W.H., 2003. Effects of microbial phytase, produced by solid-state fermentation, on the performance and nutrient utilization of broilers fed maize-and wheat-based diets. British poultry science, 44 (5), Pp. 710-718.

Zaefarian, F., Romero, L.F., Ravindran, V., 2013. Influence of a microbial phytase on the performance and the utilization of energy, crude protein and fatty acids of young broilers fed on phosphorus-adequate maize-and wheat-based diets. British poultry science, 54 (5), Pp.653-660.

Zhang, X., Roland, D.A., McDaniel, G.R., Rao, S.K., 1999. Effect of Natuphos phytase supplementation to feed on performance and ileal digestibility of protein and amino acids of broilers. Poultry Science, 78 (11), Pp. 1567-1572.