Exogenous phytase for better utilization of parboiled rice polish based diet on the growth and meat yield of Japanese quail

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Abstract

For the abundant use of parboiled rice polish (PRP), dietary grains were replaced by 200g/kg and 400g/kg PRP with or without phytase supplementation. A total of 108 seven days old Japanese quails were fed *ad libitum* up to 35 days of age for better utilization of PRP. Increasing PRP with or without phytase supplementation did not influence live weight and feed intake. Supplementation of phytase improved feed conversion only in diet containing 200g/kg PRP ($p<0.05$). Feed cost/kg quail decreased with the addition of phytase at 200g/kg PRP diet, but increased on 400g/kg PRP diet. Dressing yield was improved ($p<0.05$) in 200g/kg PRP diet with phytase supplementation. There was an increase ($p<0.05$) in thigh meat for application of phytase in 400g/kg PRP diet. Heart weight increased ($p<0.05$) on 200g/kg PRP diet and decreased on 400g/kg PRP. It was concluded that substitution of costly grains by 200g/kg cheaper PRP with phytase might reduce the feed cost without affecting feed intake, live weight and meat yield of quails.

Key words: Japanese quail, parboiled rice polish, growth, meat yield

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Introduction

Japanese quail introduced in Bangladesh as an economic avian species suited for meat and egg under intensive management for their fast growth rate, high rate of egg production, shorter generation interval, shorter incubation period and fitness for high density rearing (Wahab 1990). The growing demand of animal protein could be met quickly by rearing quail commercially within a short period (Thomas and Ahuja 1989). Poultry farmers are in problem to formulate commercial diets for higher and fluctuated price of conventional ingredients with variable quality, non-availability and improper control of authority over feed market. The problem is severe with quails as they need diet having protein percent for faster growth.

The poultry feed alone accounts 65-70% of the total cost of production and it contains 50-60% grains (Banerjee 1992). Grain production is not sufficient in Bangladesh. Poultry compete directly with human and livestock for grains (wheat and maize). Consequently, every year huge amounts of grains are imported. It may be avoided through introduction of locally available cheaper feed and by introducing improved methods to increase utilization of quality feeds. Nutritionists are trying to utilize the efficiency of un-conventional cheaper feed using different additives including enzymes to reduce feed and production cost. Rice polish (RP), a byproduct of paddy processing constitutes 10% of paddy and available in major paddy growing areas of the world (Eshawaraiah et al. 1986). RP is much cheaper than that of grains.

There are 3 major types of RP; raw rice polish (RRP), deoiled rice polish (DRP) and parboiled rice polish (PRP). The RRP, produced in huller mills is not a good feed for poultry. It contains husk, saponin, pyridin, hemaglutinin, tannin, free fatty acids and phytin (Islam 1994). Now-a-days, RP is produced in automatic rice mills known as PRP. The number of automatic rice mills is increasing and the availability of PRP is also increasing. Eshawaraiah et al. (1986) reported that PRP contains l3% crude protein and 3150 kcal/kg ME which is almost comparable to wheat in chemical composition.

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Exogenous phytase and carbohydrase has been reported to improve feed utilization in broiler on PRP diet (Moshad 2001). Phytase used in poultry diet also helps in reducing environment pollution (Kies et al. 2001). Quails grow faster than chicken, if they are supplied adequate nutrients. They produce more meat than chicken at the same age. The PRP at higher level reduced feed intake, growth rate and feed conversion, but did not affect profitability (Islam 1994; Azam and Howlider 1998). The PRP is more stable to the oxidative hydrolysis and less susceptible to the development of free fatty acids oxidized during storage than that of RRP (Shaheen et al. 1975). The PRP has some demerits as its phytate phosphorus reduce phosphorus and calcium availability responsible for depressed performance of poultry on increasing levels of dietary PRP. The anti-nutritional effect of these substrates is manifested by poor growth accompanied by depressed nutrient utilization. Adverse effects can be overcome by dietary supplementation of exogenous phytase enzyme (Moshad et al. 2003) to increase utilization of PRP in formulating cheaper PRP based diets substituting costly grains.

Numerous studies and information are available on the effects of dietary PRP (Islam 1994) on broiler, layer and ducks, but there is lack of information on feeding PRP on growth and meat yield of Japanese quail. Therefore, the current study assessed effect of using different levels of phytase in Japanese quail diet with different levels of dietary PRP on growth and meat yield.

Materials and Methods

A total of 108 seven days old Japanese quails were allocated to 6 diets with 3 replications having 6 quails per replication. For the abundant use of parboiled rice polish (PRP), the grains were substituted by 0, 200 and 400g/kg PRP with (1g/kg feed) or without supplementation of phytase enzyme. Diet and drinking water were supplied *ad libitum* to quails. The recorded variables were live weight, feed intake, livability, temperature and relative humidity (six times daily) and meat yield characteristics and calculated variables were live weight gain and feed conversion on different replication of the diets. All recorded and calculated parameters were for a 3 (dietary PRP level) × 2 (phytase level) factorial experiments in a CRD. Analysis of variance was performed to partition variances into dietary PRP (DPRP), phytase level, DPRP × phytase and error to compare different parameters among different treatment combinations with the help of GENSTAT computer package. The significant differences were separated and compared by calculating LSD.

Results

Growth Performance

The live weight and feed intake of quail were not influenced (Table 1) by phytase, parboiled rice polish (PRP) and their interaction ($p>0.05$). Supplementation of phytase did not influence ($p>0.05$) feed conversion when supplied without PRP. Feed conversion improved ($p<0.05$) on 200g/kg PRP diet with phytase but decreased by 23.79% on 400g/kg PRP. Fortification of phytase to a control diet did not change the feed cost/kg quail to any reasonable level. However, the feed cost/kg quail on control diet with phytase was increased ($p<0.05$) by 10.85%. Whereas, addition of phytase to diet with 200g/kg PRP decreased the feed cost by 18.82%, but it was depleted on a diet having 400g/kg PRP by 27.21% when fortified with phytase.

Meat yield

Dressing yield in control diet was higher (Table 2) than that with phytase ($p<0.05$). Phytase supplementation with 200g/kg PRP, improved ($p<0.05$) dressing yield by 5.96% and that was reversed in 400g/kg PRP diet. Dressing yield tended to be declined in 400g/kg PRP diet with phytase. Fortification of phytase in 400g/kg PRP diet increased ($p<0.05$) thigh meat by 1.32%. Heart weight increased on 200g/kg PRP and decreased on 400g/kg PRP in comparison with control diet ($p<0.05$). There was no difference ($p>0.05$) in breast meat, drumstick meat, wing meat, gizzard, head, liver, neck and shank weight among the different diets.

Table 1. Growth performance of Japanese quail fed diets containing different levels of parboiled rice polish (PRP) with or without phytase (Phy) from 7-35 days

Variable	Phy (g/kg feed)	PRP (g/kg feed)			Mean	SED and significance[+]		
		0	200	400		Phy	PRP	Phy×PRP
Initial body weight (g)	0	43.49	42.83	45.03	43.72			
	1	45.61	43.91	44.44	44.66	1.258^{NS}	1.027^{NS}	1.778^{NS}
	Mean	44.45	43.37	44.74	44.19			
Final body weight (g)	0	119.60	110.30	130.20	120.00			
	1	131.50	124.40	122.90	126.30	5.410^{NS}	4.420^{NS}	7.650^{NS}
	Mean	125.50	117.30	126.60	123.10			
Live weight gain (g)	0	56.10	54.90	68.90	60.00			
	1	61.60	64.60	61.20	62.50	4.740^{NS}	3.870^{NS}	6.710^{NS}
	Mean	58.90	59.80	65.00	61.20			
Feed intake (g)	0	318.40	319.90	317.30	318.50			
	1	386.10	393.70	382.30	354.00	20.300^{NS}	16.570^{NS}	28.710^{NS}
	Mean	352.20	306.80	349.80	336.30			
Feed conversion (Feed intake/ weight gain)	0	4.19	4.79	3.77	4.25			
	1	4.59	3.65	4.91	4.38	20.300^{NS}	0.326^{NS}	0.565*
	Mean	4.39	4.22	4.34	4.32			
Feed cost (Tk./quail)	0	9.67	9.72	9.64	9.67			
	1	11.72	8.92	11.61	10.75	0.616^{NS}	0.503^{NS}	0.872^{NS}
	Mean	10.70	9.32	10.62	10.21			
Feed cost (Tk./kg quail)	0	81.10	88.20	74.60	81.30			
	1	89.90	71.60	94.90	85.50	6.290^{NS}	5.140^{NS}	8.900*
	Mean	85.50	79.90	84.70	83.40			

[+]*NS, P>0.05; *, P<0.05; All SED's are against 6 error degrees of freedom*

Discussion

Growth Performance

Similar (p>0.05) live weights (Table 1) up to 40% dietary parboiled rice polish (PRP) recorded coincide with Tangendjaya (1984), Islam (1994) and Azam and Howlider (1998). The present findings did not agree with the result of Sanz (1987) who mentioned that live weight increased up to 48% dietary PRP. No difference in live weight gain among the various level of phytase coincide with the report of Richter et al. (1993), but contradict Piao et al. (1999), Moshad et al. (2003) and Rahman et al. (2009). They concluded that improved feed utilization may be obtained for exogenous phytase which could be responsible for increased live weight in broilers. Unaltered feed intake despite variation of dietary PRP level agree with the report of Hossain (2007), but contradict Chaturvedi (1967), Sayre et al. (1987), Mahbub (1989), Islam (1994) and Rahman et al. (2009). Hossain (2007) found no difference in feed intake for variation of PRP. The result of feed intake for phytase supplementation in PRP based diet not agree with the findings of Richter et al. (1994), Naher (2002), Moshad et al. (2003) and Rahman et al. (2009). Improved (p<0.05) feed conversion of quails at 200g/kg PRP with phytase supplementation agreed with the findings of Mahbub et al. (1989), Islam (1994), Azam and Howlider (1998), Naher, (2002), Moshad et al. (2003) and Rahman et al. (2009) but contradict Hossain (2007). They reported that addition of phytase on PRP based diet promoted feed conversion. Decreased feed cost/kg quail for phytase supplementation in 200g/kg PRP based diet coincide with the findings of Campbell et al. (1984), Eshwaraiah et al. (1986), Islam (1994), Augelovicova and Michalik (1997), Mikulski et al. (1998), Moshad et al. (2003), Naher (2003) and Rahman et al. (2009). Decreased feed cost on increasing level of dietary PRP was mainly due to lower cost of PRP in comparison with other grains.

Table 2. Carcass characteristics of Japanese quail fed diets containing different levels of parboiled rice polish (PRP) with (1 kg) or without (0 kg) Phytase (Phy) from 7-35 days

Variable (%)	Phy (g/kg feed)	PRP (g/kg feed)			Mean	SED and Significance[+]		
		0	200	400		Phy	PRP	Phy×PRP
Dressed yield	0	59.99	57.21	60.94	59.38	1.826 ^{NS}	1.491^{NS}	2.582*
	1	55.78	63.17	60.40	59.79			
	Mean	57.89	60.19	60.67	59.58			
Breast meat	0	23.92	23.35	23.89	23.72	1.092^{NS}	0.891 ^{NS}	1.544 ^{NS}
	1	21.71	20.86	23.11	21.89			
	Mean	22.82	22.11	23.50	22.81			
Thigh meat	0	8.19	7.84	5.06	7.03	0.695*	0.567^{NS}	0.982^{NS}
	1	7.57	7.54	6.38	7.16			
	Mean	7.88	7.69	5.72	7.10			
Drumstick-meat	0	5.45	5.34	5.68	5.49	0.264 ^{NS}	0.215 ^{NS}	0.373 ^{NS}
	1	4.93	5.29	5.35	5.19			
	Mean	5.19	5.31	5.51	5.34			
Wing meat	0	4.91	3.92	3.58	4.14	0.472 ^{NS}	0.386 ^{NS}	0.668 ^{NS}
	1	5.25	5.00	3.96	4.73			
	Mean	5.08	4.46	3.77	4.44			
Gizzard	0	3.34	3.70	2.89	3.31	0.286 ^{NS}	0.234 ^{NS}	0.405 ^{NS}
	1	3.79	2.99	3.27	3.35			
	Mean	3.56	3.35	3.08	3.33			
Head	0	5.17	4.43	4.36	4.65	0.288 ^{NS}	0.235 ^{NS}	0.407 ^{NS}
	1	4.53	4.36	4.09	4.33			
	Mean	4.85	4.40	4.23	4.49			
Heart	0	0.93	1.28	0.81	1.01	0.121 ^{NS}	0.099*	0.171 ^{NS}
	1	0.82	0.67	0.77	0.75			
	Mean	0.88	0.97	0.79	0.88			
Liver	0	2.87	3.47	2.27	2.87	0.278 ^{NS}	0.227 ^{NS}	0.393 ^{NS}
	1	3.23	3.05	3.32	3.20			
	Mean	3.05	3.26	2.79	3.04			
Neck	0	2.77	2.90	2.87	2.82	0.182 ^{NS}	0.148 ^{NS}	0.182 ^{NS}
	1	2.81	2.22	2.70	2.57			
	Mean	2.79	2.56	2.74	2.70			
Shank	0	0.59	0.67	0.57	0.60	0.067 ^{NS}	0.055 ^{NS}	0.095^{NS}
	1	0.81	0.55	0.61	0.66			
	Mean	0.68	0.61	0.59	0.63			

[+]*NS, P>0.05; *, P<0.05; All SED's are against 6 error degrees of freedom*

Meat yield

The improved dressing yield (Table 2) on 200g/kg parboiled rice polish (PRP) diet with phytase supplementation agreed with Naher (2002) and Moshad et al. (2003), but contradict Carrion and Lopez (1989) and Rahman et al. (2009). The results obtained also coincide with Sanz (1987). He observed decreased carcass weight when RP replaced by more than 20% grain. There was an increased ($p<0.05$) thigh meat for application of phytase enzyme in 400g/kg diet. Heart weight increased ($p<0.05$) on 200g/kg PRP diet with phytase supplementation. There were no difference ($p>0.05$) for various levels of phytase on breast meat, drumstick meat, wing meat, liver, gizzard, head, neck and shank weight were noted. These results contradict Naher (2002) and Moshad et al. (2003). They stated that addition of phytase enzyme on PRP based diet increased muscle development, dressing yield and meat yield.

Conclusion

It was concluded that substitution of costly grains by 200g/kg cheaper parboiled rice polish with phytase might reduce the feed cost without affecting feed intake, live weight and meat yield of quails.

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