

*Original Research***Effect of Supplementation of Palm Kernel Meal with and without Enzyme on the Performance of Japanese Quail (*Coturnix Coturnix Japonica*)****M. Mahammad Ali, D. Narendra Nath, K. Nagaraja Kumari* and B. Eswara Rao**

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Abstract

A study was conducted to assess the influence of palm kernel meal (PKM) inclusion with and without enzyme supplementation on growth performance and production cost of Japanese quail. A total of 180 day-old Japanese quail chicks were individually weighed and randomly allotted into six treatment groups with three replicates containing ten birds each. Six experimental diets were prepared as 0 (control), 15 and 20% incorporation of PKM respectively with and without enzyme addition. Feed intake, body weight, body weight gain, feed conversion ratio (FCR) production economics were studied and analysed in a 3×2 factorial method. Body weight gain, feed intake were not influenced by either PKM or enzyme supplementation. Whereas better ($p < 0.01$) FCR was observed in diets with 15% PKM with addition of enzyme. Cost of production per Kg live gain was low ($p < 0.01$) in PKM included groups and lowest production cost was observed ($p > 0.01$) at 15% PKM with enzyme supplementation. It can be concluded that PKM supplemented with enzymes can be incorporated up to 15% in quail diets without any adverse effects on performance.

Key words: Enzyme, Japanese Quail, Palm Kernel Meal, Performance**How to cite:** Ali, M., Nath, D., Nagaraja, K., & Rao, B. (2019). Effect of Supplementation of Palm Kernel Meal with and without Enzyme on the Performance of Japanese Quail (*Coturnix Coturnix Japonica*). International Journal of Livestock Research, 9(7), 189-195. doi: 10.5455/ijlr.20190305085534**Introduction**

Japanese quail (*Coturnix coturnix japonica*) are the domesticated farm bird variety of quails. Taking up of quail entrepreneurship will be more profitable because of prolific egg production and meat yield. Adaptation of diversified poultry farming with quail is one of the best ways to meet the protein demand (Babangida and Ubosi, 2006). However, Japanese quail production has become more expensive because of more protein (22-25% CP) requirement (NRC, 1994). This has increased the demand for the conventional feed ingredients due to competition among the livestock species vis-a-vis with humans. To cater the

demands, inclusion of agro-industrial by-products in the livestock diets is needed; however, their enrichment is required to improve the nutritive value. The most promising one among the by-products is palm kernel meal (PKM) which can be incorporated in the diets of commercial birds potentially to reduce the cost of feeding.

Palm kernel meal contains moderate amounts of protein and carbohydrate. The chemical analysis of PKM showed that its nutrient content ranges widely, depending up on the oil extraction process, the species of the palm nut and the amount of the shell content remaining in the meal (Mara *et al.*, 1999). According to Sundu *et al.* (2006) the PKM is aflatoxin free, palatable and has considerable potential as an energy and protein source without having any anti nutritional factors. PKM contains high level of fibre with non-starch polysaccharides and β -mannan's which have similar properties to mannan from yeast to increase immunity. The high fibre content limits the use of PKM in monogastric animals particularly in poultry. The nutritive value of PKM can be improved through exogenous supplementation of enzymes as poultry do not produce endogenous enzymes to breakdown the non-starch polysaccharides (Shakila *et al.*, 2012). The research report on feeding PKM with enzymes has been shown to be beneficial in poultry diets (Soltan, 2009; Esuga *et al.*, 2008; Sundu *et al.*, 2006). The data (Shakila *et al.*, 2012) showing the incorporation of PKM in broiler diets up to 7.5% level without any adverse effects. But information regarding utilization of PKM in Japanese quail diets is very much scanty. Quail is a hardy bird and the fiber digestibility is more in quail when compared to chicken due to its wild nature, with this assumption this study was planned with incorporation of PKM at 15 and 20% levels. Hence, this study was conducted to observe the effect of PKM at higher levels with and without enzyme on performance and production cost of Japanese quail.

Material and Methods

Management and Feeding of Birds

One hundred and eighty day-old Japanese quail chicks were weighed individually, wing banded and randomly divided into six treatment groups of three replicates each with ten chicks. Six experimental diets were prepared as 0 (control), 15 and 20% incorporation of PKM respectively with (cocktail enzyme) and without enzyme supplementation (Table 1). Diets with enzyme are prepared by adding a cocktail enzyme (Nutrikem™ XLP Plus Dry 137447) @ 50g/100kg to the respective diet as an additive. All the diets were prepared iso-caloric and iso-nitrogenous (NRC, 1994). The nutrient composition of the experimental diets was presented in Table 2. The birds were housed in a 5 tier battery cages during the experimental period of 5 weeks and maintained under uniform environment conditions thorough out the experiment. Feed and water were provided *adlibitum*.

Table 1: Ingredient composition of diets fed to Japanese quails (0-5 weeks of age)

Ingredients (kg)	Control (0 % PKM + Without enzyme)	Control + With enzyme	15% PKM + Without enzyme	15% PKM + With enzyme	20% PKM + Without enzyme	20% PKM + With enzyme	Cost/Kg (Rs)
Maize	60	60	46	46	41.5	41.5	14.67
Soybean meal	28	28	24	24	23	23	40.5
Fish meal	10	10	10	10	10	10	50
PKM	0	0	15	15	20	20	8
Animal fat	1	1	3.5	3.5	4.3	4.3	25
Stone grit	0.8	0.8	0.8	0.8	0.8	0.8	3
Salt	0.1	0.1	0.1	0.1	0.1	0.1	3.5
L-Lysine	0.12	0.12	0.12	0.12	0.12	0.12	110
DL-Methionine	0.12	0.12	0.12	0.12	0.12	0.12	246
Trace* minerals	0.01	0.01	0.01	0.01	0.01	0.01	60
Vitamins	0.03	0.03	0.03	0.03	0.03	0.03	880
Enzyme#	-	0.05	-	0.05	-	0.05	640
Total	100.18	100.23	99.68	99.73	99.98	100.03	
Feed cost/ 100kg (Rs)	2617	2649	2432	2464	2386	2418	
ME kcal/kg**	2900.3	2900.3	2900.19	2900.19	2900.09	2900.09	
Crude protein (%)\$	23.99	23.99	24.01	24.01	24	24	

*Trace minerals : Manganese sulphate 55000 mg, Ferrous sulphate 50000mg, zinc sulphate 50000mg, cobalt sulphate 500 mg, copper sulphate 3000mg, potassium Iodide 3000 mg, sodium selenite 500 mg/ Kg; #Enzyme (Nutrikem™ XLP Plus Dry 137447)- multi-protease, cellulose, alpha amylase, β-glucanase, mannanase, lipase and lysophospholipids/Kg; ** Calculated; \$ Analysed

Table 2: Nutrient composition of diets fed to Japanese quails (0-5 weeks of age)

Nutrient (%)	Control (0 % PKM + Without enzyme)	Control + With enzyme	15% PKM + Without enzyme	15% PKM + With enzyme	20% PKM + Without enzyme	20% PKM + With enzyme
Dry matter	89.69	89.75	89.73	89.69	89.75	89.73
Organic matter	91.34	91.93	92	91.34	91.93	92
Crude protein	23.99	24.01	24	23.99	24.01	24
Ether extract	1.19	1.21	1.23	1.19	1.21	1.23
Crude fibre	8.64	8.72	8.78	8.64	8.72	8.78
NFE	57.52	57.99	57.99	57.52	57.99	57.99
Total Ash	8.66	8.07	8	8.66	8.07	8
AIA	1.99	1.95	1.84	1.99	1.95	1.84
ME kcal/kg*	2900.3	2900.19	2900.09	2900.3	2900.19	2900.09
L-Lysine *	1.36	1.3	1.29	1.36	1.3	1.29
DL-Methionine *	0.53	0.53	0.53	0.53	0.53	0.53
Calcium	1.4	1.42	1.54	1.4	1.42	1.54
Phosphorus	0.76	0.76	0.78	0.76	0.76	0.78

*Calculated values

Data Collection

Feed offered daily twice and feed residue was weighed once in a week to quantify the feed intake. Body weight of individual bird was recorded at weekly intervals up to 5 weeks of age, average weekly body weight and weight gain per bird were calculated for each replicate up to 5 weeks of age. Weekly feed

consumption was recorded replicate wise and the feed efficiency was calculated accordingly. The relative economics of rearing quails up to 5 weeks of age by incorporating palm kernel meal at varying levels in the diets was calculated based on the actual ingredient cost at the prevailing market.

Statistical Analysis

The data was statistically analysed by two-way ANOVA using SPSS for windows (SPSS Inc.2002). The significant difference seen among means was determined by Duncans multiple comparison test (Duncan, 1955).

Results and Discussion

The estimated values for chemical composition of PKM obtained from local oil mill are: dry matter-87.05%, organic matter-94.76%, crude protein 20.5%, ether extract 0.62%, crude fibre 18.82%, NFE-45.18%, total ash 5.23%, AIA-1.41%, Ca- 0.31% and phosphorous- 0.72%.

Body Weight

Decreased ($p < 0.05$) body weights of quails were observed with increase in incorporation of PKM in diet from 15 to 20%. Enzyme addition had no effect on body weight individually (Table 3).

Table 3: Effect of inclusion of various levels of PKM with or without enzyme in Japanese quail diet on performance and production cost/kg live weight gain (Rs)

PKM Inclusion	Enzyme Addition	Body Weight (g)*	Body Weight Gain(g)	Feed Intake (g)	FCR*	Production Cost/ kg Live Weight Gain (Rs)**
0% PKM	-	197.17 ^{ab}	188.93	591.37	3.13 ^{ab}	81.91 ^a
	+	205.47 ^a	191.03	590.4	3.09 ^{ab}	81.91 ^a
15% PKM	-	205.97 ^a	197.64	599.4	3.04 ^{ab}	73.84 ^b
	+	204.97 ^a	196.74	585.07	2.97 ^b	73.29 ^b
20% PKM	-	195.23 ^b	197.19	603	3.23 ^a	76.99 ^b
	+	200.40 ^{ab}	186.93	595.17	3.10 ^{ab}	74.87 ^b
SEM ¹		2.978	3.613	12.051	0.061	1.511
Main effects						
PKM inclusion						
0% PKM		201.32 ^{ab}	189.98	590.88	3.11	81.91 ^a
15% PKM		205.47 ^a	197.19	592.23	3.01	73.57 ^b
20% PKM		197.82 ^c	189.56	599.08	3.16	75.93 ^b
Enzyme addition						
-		199.46	191.17	597.92	3.13	77.58
+		203.61	193.32	590.21	3.05	76.69
P Value						
Effect of PKM		0.039	0.099	0.771	0.048	0
Effect of enzyme		0.089	0.481	0.448	0.148	0.484
PKM * Enzyme		0.285	0.703	0.859	0.736	0.77

¹pooled standard error mean; Means in a column sharing different letter (^{a,b,c}) are significantly different $p < 0.05$, $** (p < 0.01)$

Least ($p < 0.05$) body weights were observed in group fed with 20% PKM without enzyme supplementation. These results were in line with Makinde *et al.* (2013) in Japanese quail. Inclusion of 20% PKM in the current study, shown a marked depression in body weight, a finding does not support the implication from several researchers. Okeudo *et al.* (2005) observed non-significant effect of PKM upto 30% on body weight in broilers. Enzyme supplementation had no significant effect on body weight of Japanese quail which is in contrast with the observations of Iyayi and Davies (2005) and Soltan (2009).

Body Weight Gain

Body weight gains were not influenced ($p > 0.05$) either by the level of PKM or enzyme supplementation in diet of Japanese quail (Table 3). This observation was in consonance with those of Sundu and Dingle (2003) in broilers. Similarly Makinde *et al.* (2013) observed no significant difference in body weight gain of Japanese quail when fed with PKM up to 15%. Yaophakdee *et al.* (2018) also found same results in broilers. In contrary, Soltan (2009), Abdollahi *et al.* (2016), Abidah and Nooraida (2017) observed significantly lower body weight gains in broilers at 15, 24 and 20% PKM respectively in diet. Though the results of this study revealed no significant difference in body weight gains, the body weight gain was numerically low at 0% PKM. Enzyme addition didn't show any significant influence on body weight gain of Japanese quail, but numerically higher body weight gains were noticed in enzyme supplemented group than non-enzyme group. These observations were inconsonance with observations of Sundu and Dingle (2003) and Esuga *et al.* (2008), Abdollahi *et al.* (2016) in broilers. Whereas, Soltan (2009) found significantly improved body weight gains with enzyme supplementation.

Feed Intake

Inclusion of PKM with or without enzyme supplementation showed non-significant effect on feed intake (Table 3). These observations were in line with the observations of Sundu and Dingle (2003), Anaeto *et al.* (2009), Soltan (2009), Hossain and Soleimani, (2017) and Yaophakdee *et al.* (2018) in broilers. In contrary, Abdollahi *et al.* (2016), Abidah and Nooraida (2017) observed significantly higher feed consumption at 20% PKM in broiler diets. Though the results of this study revealed no significant difference among feed consumption, the feed consumption was numerically high at 20% PKM. This might be due to lower the availability of energy in diet due to more fibre content (Shakila *et al.*, 2012). Enzyme supplementation had no effect on the feed consumption of Japanese quail. This observation was inconsonance with the observations of Sundu and Dingle (2003), Soltan (2009) and Shakila *et al.* (2012) in broilers.

Feed Efficiency

Significantly ($p < 0.05$) better FCR values were observed in group fed with 15% PKM supplemented with enzymes when compared with the group with 20% PKM without enzymes (Table 3). Either PKM or enzyme

supplementation had no influence on FCR individually. These observations were in agreement with the observations of Makinde *et al.* (2013) in Japanese quail and Abdollahi *et al.* (2016) in broilers. However, Abidah and Nooraida (2017), Hossain and Soleimani, (2017) and Yaophakdee *et al.* (2018) observed significantly poor feed efficiency in broilers at 20% and above PKM incorporation. Though the results of this study revealed no significant difference among feed efficiency, the feed efficiency was numerically poor at 20% PKM without enzymes. These results were in consonance with the observations of Soltan (2009), Abdollahi *et al.* (2016) in broilers. In contrary Esuga *et al.* (2008) find that significantly better feed efficiency in enzyme supplemented group than raw PKM group. Though the results of this study revealed no significant difference in feed efficiency with and without enzyme supplementation to the PKM dietary groups, the values were numerically better in dietary groups fed with enzyme.

Cost Economics

The results in this study showed that production cost/ kg live body weight gain was significantly ($P < 0.01$) decreased with the increase in inclusion of PKM in diet (Table 3). Similar findings were reported by Esuga *et al.* (2008), Anaeto *et al.* (2009) in broilers and Makinde *et al.* (2013) in Japanese quail. Enzyme supplementation in diets of Japanese quail didn't show any significant effect on production cost/kg live weight gain. These observations were inconsonance with those of Shakila *et al.* (2012) in broilers. In contrary Esuga *et al.* (2008) reported that enzyme supplementation decreases feed cost/kg live weight gain in broilers. But numerically low feed cost/kg live weight gain was observed in PKM with enzyme supplementation than PKM without enzyme. Numerically lowest production cost was noticed in the group fed with 15% PKM supplemented with enzymes.

Conclusion

Overall, the PKM at different levels with and without enzyme did not influence the body weights, weight gains, feed consumption and feed efficiency. The inclusion of 15 and 20% PKM with enzyme supplementation in Japanese quail diets showed better economic returns. Based on the production cost/kg live weight gain in the present study, inclusion of 15% PKM along with enzyme in the rations can be recommended for commercial Japanese quail rearing.

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