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Research Article

EFFECT OF FEEDING DIFFERENT LEVELS OF SUNFLOWER OIL CAKE AND ENZYME SUPPLEMENTATION ON EGG QUALITY TRAITS OF BREEDER QUAILS

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ABSTRACT
The biological trial was carried out with 230 adult Japanese quails from 7-30 weeks of age. The birds were equally and randomly distributed into ten treatment groups of two replicates. All the quails were housed in multi-tier breeder cages up to thirty weeks of age. The quails in control group were fed corn-soya based diet with no multi-enzyme supplementation. Treatment groups were fed on diets containing 25, 50, 75 and 100 per cent levels of sunflower oil cake replacing the protein mix consisting of 60% groundnut cake and 40% DORB on an isolysine and isomethionine basis with no multi-enzyme supplementation and, similar treatment groups were fed with multi-enzyme supplementation. The egg quality traits were neither influenced by feeding different levels of SFOC nor by enzyme supplementation indicating that no significant statistical difference could be observed among the traits studied.

Key Words: *Japanese Quails, Sunflower Cake, Multi-Enzyme, Egg Quality Traits*

INTRODUCTION
Japanese quail a small domesticated avian species has assumed importance throughout the world as bird and is commercially exploited for egg production. The major constraint for the rapid development of quail industry is the escalating feed cost which accounts for nearly 75% of the total cost. Such an unparalleled escalation in the feed cost is threatening to the rapid development of quail industry. Sunflower oil cake is the cheaper source of vegetable protein than groundnut oil cake and soya and, is also rich in fiber which limits its utilization but could be enhanced through enzyme supplementation. Therefore, the present study was undertaken to analyze the influence of Sunflower oil cake on internal egg quality traits viz. shell thickness, albumen index, yolk index and yolk colour (Roche) in Japanese quails at different levels of its inclusion replacing the sunflower oil cake along with protein mix at various levels.

MATERIALS AND METHODS
The biological trial of twenty-four weeks duration (7-30 weeks) was carried out with 230 adult Japanese quails were equally and randomly distributed in to ten different treatment groups (T0, T1, T2, T3, T4, T5, T6, T7, T8 and T9) of two replicates belonging to the same age. All the quails were housed in multi-tier Japanese quail breeder cages and standard feeding and other management practices were followed. The per cent ingredient and nutrient composition of the diet for treatment groups are furnished (Table 1). A protein mixture consisting of 60% groundnut oil cake and 40% de-oiled rice bran was prepared and used as major protein source (31.4%) in the control diet (T0) which was replaced by sunflower oil cake at graded levels on isolysine (1.3%) and isomethionine (0.5 %) basis according to NRC standards (1977). The dietary treatments were control - T0 corn protein mix based diet T1, T2, T3, T4 were 25, 50, 75 and 100 per cent replacement of protein mix by SFOC T5 corn protein mix based diet with multi enzyme, T6, T7, T8, T9 were 25, 50, 75 and 100 per cent levels replacement of protein mix by SFOC with multi enzyme supplementation. Feeding was carried out up to thirty weeks of age. Data on internal egg quality traits viz. shell thickness, albumen index, yolk index and yolk colour (Roche) at four week intervals up to thirty weeks of age were recorded and subjected to analysis of variance as per Snedcor and Cochran (1989).

RESULTS AND DISCUSSION

Influence of feeding different levels of SFOC with or without enzyme supplementation on shell thickness (mm), albumen index, yolk index and Roche Yolk colour of quail eggs are presented in Table Numbers 2, 3, 4 and 5 respectively.

Shell Thickness

Irrespective of the level of inclusion, the mean shell thickness of Japanese quail eggs laid during 19-26 weeks was significantly increased with enzyme supplementation, but showed no significant variation in the eggs laid during the rest of the period. Irrespective of the enzyme supplementation, the level of inclusion of SFOC did not significantly influence the mean shell thickness of the eggs laid in the complete study period except during 15-18 weeks.

Albumen Index

Irrespective of the enzyme supplementation, the mean albumen index of the eggs collected from 7-18 weeks of age remained unaltered with different levels of inclusion of SFOC in the diet. In those eggs during rest of the period, the mean albumen index varied with various levels of inclusion of SFOC. Irrespective of the level of inclusion the mean albumen index in Japanese quail eggs laid between 11-18 and 27-30 weeks of age was significantly reduced with enzyme supplementation. On the other hand, the mean albumen index of the eggs laid during 19-26 weeks was increased significantly with enzyme supplementation.

Yolk Index

Irrespective of the enzyme supplementation, the mean yolk index of the eggs laid during 7-10, 15-18 and 23-26 weeks did not vary significantly with various levels of inclusion of SFOC. On the other hand the mean yolk index of the eggs laid during the rest of the period varied significantly. Irrespective of the level of inclusion, the mean yolk index in Japanese quail eggs laid between 11-14, 19-22 and 27-30 weeks of age significantly increased with enzyme supplementation.

Roche Yolk Colour

Irrespective of the enzyme supplementation, the different level of inclusion of SFOC did not influence the mean Roche yolk colour of the eggs. Irrespective of the level of inclusion the mean Roche yolk colour of the eggs laid during 11-14, 19-22 and 27-30 weeks of age did not vary significantly with enzyme supplementation. However, the mean Roche yolk colour of the eggs laid during 7-10 and 23-26 weeks of age increased significantly with enzyme supplementation.

Table 1: Composition of the ration

Sr. No.	Ingredients	Control	25%	50%	75%	100%
1	Maize	47	47	47	47	47
2	Protein Mix	34	25.5	17	8.5	0
3	SFOC	0	8.5	17	25.5	34
4	Soyabean meal	5	5	5	5	5
5	Fishmeal	8	8	8	8	8
6	Shell grit	4	4	4	4	4
7	Mineral mixture	2	2	2	2	2
8	Total	100	100	100	100	100
9	CP (%)	20.51	20.56	20.61	20.66	20.72
10	ME (Kcal/kg)	2612	2611	2611	2610	2609
11	Calcium (%)	2.62	2.64	2.65	2.67	2.69
12	Phosphorus (%)	0.37	0.38	0.40	0.42	0.44

The composition of T5 to T9 diets was similar to T0 to T4 respectively except for the addition of 500 gm of enzyme mix per tonne of feed. The enzyme contained cellulase 2000, hemicellulase 2500, glucosidase 245, pectinase 850, protease 48000 and amylase 11000 IU per gram.

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Table 2: Mean Shell thickness (in mm) of layer quails

Age Intervals (weeks)	T0	T5	Pooled	T1	T6	Pooled	T2	T7	Pooled	T3	T8	Pooled	T4	T9	Pooled
7-10	0.184± 0.004	0.19± 0.001	0.189± 0.003[a]	0.188± 0.007	0.191± 0.005	0.189± 0.006[a]	0.186± 0.001	0.238± 0.041	0.212± 0.002[a]	0.192± 0.004	0.191± 0.002	0.192± 0.003[a]	0.193± 0.001	0.181± 0.003	0.187± 0.002[a]
11-14	0.184± 0.007	0.19± 0.004	0.189± 0.006[a]	0.181± 0.015	0.197± 0.009	0.189± 0.012[a]	0.193± 0.001	0.179± 0.004	0.186± 0.003[a]	0.187± 0.002	0.190± 0.005	0.189± 0.004[a]	0.200± 0.005	0.189± 0.005	0.195± 0.004[a]
15-18	0.174± 0.007	0.19± 0.007	0.186± 0.007[a]	0.181± 0.001	0.191± 0.015	0.186± 0.008[a]	0.179± 0.002	0.199± 0.003	0.189± 0.003[a]	0.191± 0.002	0.198± 0.004	0.195± 0.003[a]	0.191± 0.007	0.191± 0.007	0.191± 0.007[a]
19-22	0.149± 0.001	0.17± 0.007	0.162± 0.004[a]	0.179± 0.007	0.166± 0.004	0.173± 0.006[ab]	0.185± 0.004	0.182± 0.010	0.184± 0.007[b]	0.175± 0.004	0.174± 0.001	0.175± 0.003[ab]	0.177± 0.005	0.193± 0.001	0.185± 0.003[b]
23-26	0.186± 0.001	0.17± 0.002	0.181± 0.002[a]	0.179± 0.004	0.185± 0.003	0.182± 0.004[ab]	0.188± 0.006	0.191± 0.009	0.189± 0.008[c]	0.191± 0.005	0.190± 0.005	0.191± 0.005[c]	0.192± 0.002	0.191± 0.001	0.192± 0.002[c]
27-30	0.197± 0.002	0.19± 0.002	0.197± 0.002[d]	0.184± 0.002	0.179± 0.007	0.182± 0.005[a]	0.185± 0.007	0.192± 0.008	0.189± 0.008[abcd]	0.179± 0.002	0.191± 0.003	0.185± 0.003[a]	0.188± 0.007	0.182± 0.006	0.185± 0.007[abc]

Means bearing the same superscript within classes do not differ significantly.
**(P<0.05), **(P<0.01)*

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Table 3: Mean Albumen Index of layer quails

Age Intervals (weeks)	T0	T5	Pooled	T1	T6	Pooled	T2	T7	Pooled	T3	T8	Pooled	T4	T9	Pooled
7-10	0.088± 0.005	0.099± 0.007	0.094± 0.006^{a}	0.089± 0.001	0.098± 0.002	0.094± 0.002a	0.105± 0.007	0.093± 0.003	0.099± 0.005^{a}	0.093± 0.004	0.102± 0.002	0.098± 0.003^{a}	0.094± 0.004	0.097± 0.012	0.096± 0.008^{a}
11-14	0.082± 0.001	0.085± 0.007	0.084± 0.004^{a}	0.087± 0.001	0.089± 0.004	0.088± 0.003^{a}`	0.094± 0.011	0.079± 0.001	0.087± 0.006^{a}	0.093± 0.007	0.078± 0.008	0.086± 0.008^{a}	0.091± 0.002	0.081± 0.002	0.086± 0.002^{a}
15-18	0.081± 0.001	0.411± 0.003	0.246± 0.002^{d}	0.076± 0.005	0.075± 0.008	0.076± 0.007^{ab}	0.072± 0.001	0.075± 0.005	0.074± 0.003^{a}	0.077± 0.004	0.075± 0.005	0.076± 0.005^{abc}	0.081± 0.003	0.076± 0.001	0.079± 0.002^{cd}
19-22	0.070± 0.005	0.085± 0.006	0.078± 0.006^{ab}	0.077± 0.006	0.077± 0.001	0.077± 0.004^{ab}	0.078± 0.001	0.087± 0.004	0.083± 0.003^{b}	0.073± 0.003	0.084± 0.001	0.079± 0.002^{ab}	0.072± 0.006	0.078± 0.001	0.075± 0.003^{a}
23-26	0.068± 0.007	0.077± 0.005	0.073± 0.006^{a}	0.072± 0.007	0.082± 0.007	0.077± 0.007^{c}	0.074± 0.001	0.085± 0.002	0.079± 0.002^{d}	0.075± 0.002	0.083± 0.001	0.079± 0.002^{cd}	0.073± 0.003	0.078± 0.001	0.076± 0.002^{b}
27-30	0.091± 0.001	0.086± 0.001	0.089± 0.001^{c}	0.087± 0.003	0.083± 0.002	0.085± 0.003^{ab}	0.088± 0.001	0.079± 0.005	0.084± 0.003^{a}	0.090± 0.011	0.079± 0.005	0.085± 0.008^{bc}	0.086± 0.003	0.086± 0.006	0.086± 0.005^{abc}

Means bearing the same superscript within classes do not differ significantly.
(P<0.05),(P<0.01)*

Table 4: Mean Yolk Index of layer quails

Age Intervals (weeks)	T0	T5	Pooled	T1	T6	Pooled	T2	T7	Pooled	T3	T8	Pooled	T4	T9	Pooled
7-10	0.466± 0.183	0.435± 0.033	0.450± 0.108^{a}	0.407± 0.037	0.428± 0.005	0.417± 0.021^{a}	0.461± 0.013	0.408± 0.031	0.434± 0.022^{a}	0.450± 0.009	0.441± 0.016	0.450± 0.012^{a}	0.424± 0.038	0.450± 0.019	0.437± 0.028^{a}
11-14	0.361± 0.001	0.389± 0.009	0.375± 0.005^{abc}	0.384± 0.002	0.386± 0.008	0.385± 0.005^{c}	0.369± 0.018	0.375± 0.005	0.372± 0.011^{a}	0.375± 0.007	0.393± 0.017	0.384± 0.012^{abc}	0.373± 0.002	0.375± 0.011	0.374± 0.006^{ab}
15-18	0.471± 0.008	0.434± 0.006	0.452± 0.007^{a}	0.455± 0.004	0.467± 0.016	0.461± 0.001^{a}	0.465± 0.001	0.443± 0.012	0.465± 0.001^{a}	0.449± 0.001	0.465± 0.001	0.457± 0.001^{a}	0.459± 0.023	0.460± 0.006	0.460± 0.014^{a}
19-22	0.374± 0.029	0.436± 0.005	0.405± 0.017^{a}	0.422± 0.010	0.452± 0.005	0.437± 0.007^{b}	0.429± 0.007	0.442± 0.006	0.435± 0.007^{b}	0.420± 0.008	0.443± 0.007	0.431± 0.008^{b}	0.437± 0.009	0.452± 0.002	0.444± 0.005^{b}
23-26	0.375± 0.004	0.415± 0.002	0.395± 0.003^{a}	0.407± 0.015	0.426± 0.007	0.416± 0.011^{a}	0.434± 0.027	0.402± 0.018	0.418± 0.023^{a}	0.423± 0.012	0.411± 0.019	0.417$^{\pm}$ 0.015^{a}	0.403± 0.003	0.410± 0.020	0.406± 0.012^{a}
27-30	0.396± 0.050	0.429± 0.003	0.412± 0.026^{ab}	0.394± 0.002	0.423± 0.006	0.408± 0.004^{ab}	0.426± 0.029	0.411± 0.010	0.418± 0.019^{b}	0.427± 0.004	0.426± 0.006	0.427± 0.005^{b}	0.378± 0.020	0.406± 0.004	0.392± 0.012^{a}

Means bearing the same superscript within classes do not differ significantly.
(P<0.05),(P<0.01)*

Table 5: Mean Roche Yolk Colour of layer quails

Age Intervals (weeks)	T0	T5	Pooled	T1	T6	Pooled	T2	T7	Pooled	T3	T8	Pooled	T4	T9	Pooled
7-10	4.45±0.35	4.30± 0.30	4.38± 0.33[a]	3.40± 0.10	4.75± 0.15	4.08± 0.13[a]	3.95± 0.65	4.15± 0.15	4.05± 0.40[a]	3.60± 0.50	4.30± 0.30	3.95± 0.40[a]	3.45± 0.15	4.05± 0.05	3.75± 0.10[a]
11-14	5.70 ±0.89	6.25± 0.25	5.98± 0.57[a]	6.80± 0.20	6.40± 0.40	6.60± 0.30[a]	6.65± 0.35	6.85± 0.25	6.75± 0.30[a]	6.55± 0.25	6.90± 0.10	6.73± 0.18	6.85± 0.25	6.55± 0.25	6.70± 0.25[a]
15-18	6.65± 0.35	6.80± 0.70	6.73± 0.53[a]	6.30± 0.20	6.55± 0.45	6.43± 0.33[a]	7.15± 0.15	6.20± 0.10	6.68± 0.13[a]	6.75± 0.75	6.55± 0.45	6.65± 0.60[a]	7.05± 0.05	6.35± 0.25	6.70± 0.15[a]
19-22	6.25± 0.42	5.20± 0.10	5.73± 0.26[a]	5.90± 0.40	6.00± 0.25	5.95± 0.33[a]	4.95± 0.35	5.30± 0.25	5.13± 0.30[a]	5.60± 0.10	5.80± 0.50	5.70± 0.30[a]	5.22± 0.40	6.25± 0.12	5.74± 0.26[a]
23-26	6.35± 0.25	7.05± 0.25	6.70± 0.25[a]	6.35± 0.15	6.75± 0.25	6.55± 0.20[a]	6.70± 0.10	6.35± 0.25	6.53± 0.20[a]	6.37± 0.12	6.80± 0.10	6.59± 0.11[a]	6.55± 0.45	6.50± 0.40	6.53± 0.43[a]
27-30	7.50± 0.18	6.08± 0.08	6.79± 0.13[a]	6.24± 0.41	6.25± 0.75	6.25± 0.58[a]	6.58± 0.08	6.91± 0.58	6.75± 0.33[a]	6.66± 0.08	6.41± 0.41	6.54± 0.25[a]	6.58± 0.25	7.33± 0.67	6.96± 0.46[a]

Means bearing the same superscript within classes do not differ significantly.
**(P<0.05), **(P<0.01)*

In general, the egg quality traits were neither influenced by feeding graded levels of SFOC nor by enzyme supplementation indicating that no significant statistical difference could be observed among the traits studied. Similar observations were reported by Mirza *et al.*, (1993) and contrary findings were furnished by Karunajeew *et al.*, (1987) with respect to albumen height in White Leghorns.

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